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Response of Two Barley Cultivars to Partial Substitution of Mineral Fertilizers by Biofertilizers under New Valley Conditions

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Abstract

A field experiments was carried out during of 2014/15 and 2015/16 seasons in the Experimental Farm, Agricultural Research Station of El-Kharga, New Valley Government to study the effects of partially substitution of chemical NPK fertilizers by biofertilizers on two barley cultivars production under New Valley conditions. Seven fertilizers combinations were tested as follows: F_1: 100% of recommended NPK fertilizers, F_2: 75% of recommended NPK fertilizers + Microbein, F_3: 50% of recommended NPK fertilizers + Microbein, F_4: 75% of recommended NPK fertilizers + Algae extract, F_5: 50% of recommended NPK fertilizers + Algae extract, F_6: 75% of recommended NPK fertilizers + Algae extract + Microbein, and F_7: 50% of recommended NPK fertilizers + Algae extract + Microbein. Number of spikes m^{-2}, number of grains $spike^{-1}$, weight of 1000-grains, weight of grains $spike^{-1}$, biological yield fed^{-1}, grain yield fed^{-1}, straw yield fed^{-1}, and harvest index (%) were recorded at harvest.

Results indicated that the superiority of Giza 134 cultivar over Giza 132 cultivar was confirmed for most studied traits in both seasons.

Double-inoculation of Algae extract and Microbein plus 75% of recommended mineral NPK fertilizers represents 10.14, 18.50 and 16.19% increases in grain, straw and biological yields of barley in the first season; 8.91, 29.42 and 22.15% in the second season, respectively; compared to the application of 100% of recommended mineral NPK fertilizers alone.

Giza 134 cultivar fertilized with 75% chemical NPK + Algae extract + Microbein (F_6) gave the highest grain yield (2.69 and 2.97 ton fed^{-1}) and biological yield (8.38 and 9.43 ton fed^{-1}) followed by 50% chemical NPK + Algae extract + Microbein (F_7) with the same cultivar (2.53 and 2.88 ton fed^{-1}) and (8.16 and 8.95 ton fed^{-1}), respectively.

It can be concluded that replacing 25 or 50% of chemical fertilizers by double-inoculation of Algae extract + Microbein as biofertilizers to improved yield and its components of Giza 132 and Giza 134 cultivars as well as saving about 25 to 50% of recommended dose of NPK.

***Keyword*:** NPK fertilization, bio-fertilizers, barley, yield and partial substitution

Introduction

Barley (*Hordeum vulgare* L.) is multipurpose winter crop. In Egypt, the major use of barley is for animal feeding, however, there is a recent interest in using the crop in human food. The cultivated area of barley is limited in Nile Valley and Delta due to the competition with other important winter crops. However, it could be cultivated in the Northern Coast of Egypt under rainfed and newly reclaimed soil in the desert area.

Many investigators revealed that yield and its components were

significantly influenced by various barley cultivars (Ali, 2011 and Mariey *et al*., 2016). In this regard, Mariey and Khedr (2017) revealed that the maximum values of grain yield were found for the cultivars Giza 2000, Giza 126 and Giza 131 were (14.13,13.16 and 11.53 t ha^{-1}), respectively.

Recently, there has been an increasing awareness of the undesirable impact of chemical fertilizers on the environment, as well as increasing fertilizers costs led to the strong belief in biological N_2-fixation and the use of biofertilizers. Therefore, several works showed that the integrated use of bio and inorganic sources of plant nutrients was enhanced barley productivity. El-Sayed *et al*. (2000) found that Microbein and Azottein caused significant increases in grain yield reached about 24.8 and 27.2% in the first season and 18.4 and 22.0% in the second season respectively compared to the un-inoculation. El-Shahat *et al*. (2014) stated that all the bio-fertilizers (symbiotic N_2- fixers and Azolla) treatments recorded significant increases for grains and straw yields as compared with un-inoculated treatments control.

So, this work was initiated to find out the best NPK fertilization combination with bio-fertilizers and mineral NPK source to reduce the amount of mineral NPK used in fertilization of two barley cultivars.

Materials and Methods

A field experiment was carried out at the Experimental Farm of El-Kharga Research, Station, New Valley, Egypt, during 2014/15 and 2015/16, seasons to study the effects of partially substitution of chemical NPK fertilizers by bio-fertilizers on two barley cultivars production under New Valley conditions.

The experimental design was randomizing complete block design (RCBD) using split plot design with four replications. The experimental treatments can be described as follows:

Main plots: Barley cultivars

1. Giza 132 2. Giza 134

Sub plots: Fertilization combinations

F_1 = 100% of recommended NPK fertilizers.

F_2 = 75% of recommended NPK fertilizers + Microbein

F_3 = 50% of recommended NPK fertilizers + Microbein

F_4 = 75% of recommended NPK fertilizers + Algae extract

F_5 = 50% of recommended NPK fertilizers + Algae extract

F_6 = 75% of recommended NPK fertilizers + Algae extract + Microbein

F_7 = 50% of recommended NPK fertilizers + Algae extract + Microbein

Some physical and chemical properties of experimental soil is shown in Table 1. Jackson, M.L. (1973).

Table 1. Some physical and chemical characteristics of the experimental soil.

Soil Characteristics	Season	
	2014/15	**2015/16**
Sand %	71.00	70.25
Silt %	9.75	9.00
Clay %	19.25	20.25
Soil texture	Loamy Sand	Loamy Sand
$CaCO_3$ %	1.93	1.95
pH (1:1 suspension)	7.5	7.5
EC (1:1 extract) dS m^{-1}	0.56	0.57
OM%	0.11	0.13
Total N %	0.005	0.006
$NaHCO_3$ – P (mg kg^{-1})	6.74	6.64
Exch-K (mg kg^{-1} soil)	0.21	0.23

Microbin is a commercial multi-strains biofertilizer produced by the General Organization for Agricultural Equalization Fund, Ministry of Agriculture and Land Reclamation. It is constituted of a mixture of P-dissolving and N_2-fixing bacteria (*Azospirillum sp., Bacillus sp. and Pseudomonas sp.*). Arabic gum was melted in amount of warm water and was added to the Microbin. Barley grains were added to the mixture of Microbein and the gum and mixed carefully and spread over plastic sheet in shadowed place for a short time before sowing.

Algae extract (*Ascophyllum nodosum*) is a commercial component. It was applied at rate 2 L fed^{-1} with irrigation water at sowing.

Barley grains were hand drilled at the rate of 40 kg fed^{-1} on 21 and 15 November in 2014/15 and 2015/16 seasons, respectively. The experimental unit area was 10.5 m^2 (3.0m X 3.5 m). It included 17 rows, 300 cm long and 20 cm apart. The experimental plots were irrigated by underground water using flooding irrigation system.

The recommended dose of NPK was 45, 30 and 24 kg fed^{-1}. N as ammonium nitrate (33.5% N), 30 kg P_2O_5 fed^{-1} as super phosphate (15% P_2O_5) was applied before sowing and 24 kg K_2O fed^{-1} as potassium sulphate (48% K_2O) was applied at 20 days after sowing. Nitrogen fertilizer was added in three doses, 20% were added at sowing time, 40% added at 20 days after sowing and the third dose 40% were applied at 50 days after sowing.

At harvest one square meter was taken randomly from each sub plot to determine yield and its components:

1. Number of spikes m^{-2}.
2. Number of grains $spike^{-1}$ (average of 10 stem).
3. Weight of grains $spike^{-1}$ g (average of 10 stem).
4. Weight of 1000-grains (g).
5. Biological yield (ton fed^{-1}).
6. Grain yield (ton fed^{-1}).
7. Straw yield (ton fed^{-1}).
8. Harvest index (%) was calculated as follows:

$$Harvest\ index = \frac{Grain\ yield\ (ton\ fed^{-1})}{Biological\ yield\ (ton\ fed^{-1})} \times 100$$

The obtained data were subjected to standard analysis of variance and the means of treatments were tested for significant differences using the least significant difference method (LSD) at $P = 0.05$. The MSTATC (version 2.10) computer program written by Freed *et al*. (1987) was used to perform all the analysis of variance.

Results and Discussion

1. Yield components

1.1. Effect of barley cultivars

The effects of cultivars on number of spikes m^{-2}, number of grains $spike^{-1}$, weight of grains $spike^{-1}$ and weight of 1000-grains of barley are shown in Table 2. The superiority of Giza 134 cultivar over Giza 132 cultivar was confirmed for most studied traits in the both seasons. However, results reveal the superiority of Giza 132 cultivar in weight of 1000-grains in the second season.

The higher mean values of the previous traits indicate the suitable genetic behavior of Giza 134 cultivar with environment factors which may lead to an increasing in number of spikes m^{-2} and number of grains $spike^{-1}$. Similar trend was obtained by Alam *et al*. (2007), Zeidan (2007) and Ali (2011) who recoded significant differences between barley genotypes in yield components.

Table. 2. Effect of cultivars on yield components of barley in two growing seasons.

cultivars	Number of spikes m^{-2}		Number of grains $spike^{-1}$		Weight of grains $spike^{-1}$ (g)		Weight of 1000-grains (g)	
	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
Giza 132	333.09	329.01	35.25	40.35	1.21	1.47	34.46	36.26
Giza 134	371.09	375.61	41.18	48.33	1.57	1.69	38.4	34.91
F Test	**	*	*	*	**	*	*	ns

* and ** indicated significant at 5% and 1% levels of probability, respectively.
ns = non- significant

1.2. Effect of fertilization combinations

Data in Table 3 indicate that number of spikes m^{-2}, number of grains $spike^{-1}$ and weight of grains $spike^{-1}$ as well as weight of 1000-grains of barley were highly significantly affected by partial replacement of chemical NPK by bio-fertilizers (Microbin and Algae extract). Application of the 75% mineral NPK + Algae extract + Microbein combination (F_6) records the highest mean values of number of spikes m^{-2}, weight of grains $spike^{-1}$ of barley followed by the 50% chemical NPK + Algae extract + Microbein combination (F_7) without significant differences. F_6 treatment increased number of spikes m^{-2} by 15.97, 21.97, 29.80, 18.71 and 24.08% as compared to F_1, F_2, F_3, F_4 and F_5, respectively in the first season, being 16.31, 25.40, 27.12, 22.20 and 25.78% in the second season in the same order.

Fertilized barley plants with F_6 and F_7 gave the highest mean values of number of grains $spike^{-1}$ without significant variations in the first season only. The increment percentages of number of grains $spike^{-1}$ due to F_6 and F_7 fertilizing compared with F_1 recommended

NPK fertilization (F_1) were 14.13 and 14.48%, respectively in the first season. Meanwhile, applied F_6 combination recoded significant differences compared with the rest fertilization combinations. F_6 treatment increased number of grains spike^{-1} by 29.89% compared with recommended chemical fertilization F_1 in the second season.

Table 3. Effect of fertilization combinations on yield components of barley in the two growing seasons.

Treat.	Number of spikes m^{-2}		Number of grains spike^{-1}		Weight of 1000-grains (g)		Weight of grains spike^{-1} (g)	
	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
F_1	349.06	351.50	35.38	40.85	1.40	1.49	39.27	36.65
F_2	332.38	326.03	40.00	38.47	1.32	1.35	33.14	35.36
F_3	311.88	321.60	34.50	39.67	1.19	1.24	34.32	31.63
F_4	341.00	334.55	38.88	46.29	1.36	1.63	35.03	35.21
F_5	326.25	325.03	37.75	44.17	1.38	1.44	36.56	32.75
F_6	404.81	408.83	40.38	53.06	1.68	2.10	41.65	39.61
F_7	399.25	398.65	40.63	47.88	1.43	1.81	35.04	37.90
F-Test	**	**	**	**	**	**	**	**
LSD 0.05	25.84	28.67	3.16	4.82	3.98	2.77	0.14	0.17

* and ** indicated significant at 5% and 1% levels of probability, respectively.

Also, F_6 combination gave the maximum mean values of 1000-grains weight followed by F_7 and F_1 in the second seasons.

The present results cleared that the positive effect of application of Microbin and Algae extract with 75 or 50% chemical NPK fertilization may be due to the enhancing plant growth which increased plant metabolites which encouraged the growth of microorganisms through the save of chemical NPK fertilizers. These results are confirmed with those reported by Abd El-Lattief (2012) and Zaki *et al*. (2012).

1.3. Effect of interaction

The effect of interaction on number of spikes m^{-2}, number of grains spike^{-1} and weight of grains spike^{-1} as well as weight of 1000-grains are shown in Table, 4. Data reveal that there no significant differences were observed between treatments on the studied traits. Fertilized Giza 134 cultivar fertilized with the 75% of recommended mineral NPK + Algae extract + Microbein combination (F_6) gave the highest mean values of the most studied traits. Meanwhile, Giza 132 cultivar supplied with 75% of recommended mineral NPK + Microbein combination (F_3) recoded the lowest mean values of the most studied traits.

Table 4. Effect of fertilization combinations on yield components of barley in two growing seasons.

Cultivar	Fert. comb.	Number of spikes m^{-2}		Number of grains $spike^{-1}$		Weight of 1000-grains (g)		Weight of grains $spike^{-1}$ (g)	
		2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
Giza 132	F1	329.88	324.00	33.75	35.65	34.60	37.10	1.17	1.31
	F2	307.38	305.55	35.25	33.20	33.21	36.18	1.17	1.20
	F3	278.50	304.20	33.00	36.60	31.73	31.83	1.05	1.15
	F4	322.50	318.60	34.75	42.80	35.16	36.68	1.22	1.58
	F5	302.50	305.55	35.00	38.05	35.48	33.68	1.24	1.28
	F6	400.13	378.90	37.25	49.95	38.94	40.00	1.45	2.00
	F7	390.75	366.30	37.75	46.20	32.08	38.40	1.21	1.78
Giza 134	F1	368.25	379.00	37.00	46.04	43.94	36.20	1.63	1.68
	F2	357.38	346.50	44.75	43.73	33.07	34.55	1.48	1.50
	F3	345.25	339.00	36.00	42.74	36.90	31.43	1.33	1.33
	F4	359.50	350.50	43.00	49.77	34.91	33.75	1.50	1.68
	F5	350.00	344.50	40.50	50.30	37.65	31.83	1.53	1.60
	F6	409.50	438.75	43.50	56.18	44.35	39.23	1.92	2.20
	F7	407.75	431.00	43.50	49.56	38.01	37.40	1.66	1.85
F Test		ns	ns	ns	ns	ns	ns	ns	ns
LSD 0.05		-	-	-	-	-	-	-	-

ns = non- significant.

2. Yield

2.1. Effect of barley cultivars

Presented data in Table 5 show the effect of cultivars on biological, grain, straw and yields as well as harvest index of barley.

Data illustrate significant differences between the two cultivars in all the abovementioned traits, except straw yield in the second season and biological yield in the first season. Giza 134 cultivar gave the highest mean values for all studied traits in both growing seasons.

The superiority of Giza 134 cultivar than Giza 132 cultivar because it is giving the highest average of weight of grain $spike^{-1}$, number of spikes m^{-2} (Table, 2) in both seasons. These results are in agreement with those reported by El-Banna *et al*. (2011) and Mariey and Khedr (2017).

Table. 5. Effect of cultivars on yield of barley in two growing seasons.

cultivars	Biological yield (ton fed^{-1})		Straw yield (ton fed^{-1})		Grain yield (ton fed^{-1})		Harvest index (%)	
	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
Giza 132	6.54	6.96	4.87	4.75	1.67	2.21	26.2	31.65
Giza 134	7.41	7.71	5.00	5.07	2.41	2.64	33.23	34.67
F Test	ns	*	*	ns	*	**	*	*

* and ** indicated significant at 5% 1% levels of probability, respectively.
ns = non- significant.

2.2. Effect of fertilization combinations

It is clear from data in Table 6 that the effects of partial replacement of chemical fertilizers by bio fertilizers on the biological, grain and straw yields were highly significant, while, fertilization combinations have insignificant effect on harvest index.

Application of double-inoculation of Algae extract and Microbein + 75% chemical NPK (F6) surpassed other fertilization combinations on grain, straw and

biological yields. This combination represents 10.14, 18.50 and 16.19% increases in grain, straw and biological yields of barley in the first season being 8.91, 29.42 and 22.15% in the second season, respectively; compared to the application of 100% chemical NPK (F_1).

Partial substitution of 50% of chemical NPK by Algae extract and Microbein (F_7) came in the second rank without significant differences compared to F6 combination. The F_7 combination increased abovementioned traits by 3.38, 15.04 and 11.75% in the first season; 5.04, 20.90 and 15.27% in the second season, respectively; compared to the application of 100% chemical NPK (F_1).

This is logic since the same fertilizer combination gave the highest mean values with resend to yield component studied traits as mention before.

A similar conclusion had been achieved by Salantur *et al*. (2006) and Mohammed *et al*. (2012).

Table 6. Effect of fertilization combinations on yield of barley in two growing seasons.

Treat.	Grain yield (ton fed^{-1})		Straw yield (ton fed^{-1})		Biological yield (ton fed^{-1})		Harvest index (%)	
	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
F_1	2.07	2.58	4.92	4.69	6.98	7.27	29.73	35.72
F_2	2.04	2.22	4.54	4.58	6.58	6.80	31.12	32.41
F_3	1.84	2.01	3.80	4.09	5.64	6.11	32.63	33.13
F_4	2.08	2.60	5.48	4.79	7.56	7.39	28.28	35.11
F_5	1.84	2.05	4.33	4.46	6.17	6.52	30.21	31.69
F_6	2.28	2.81	5.83	6.07	8.11	8.88	28.25	31.74
F_7	2.14	2.71	5.66	5.67	7.80	8.38	27.79	32.29
F-Test	**	**	*	**	*	**	ns	ns
LSD 0.05	0.23	0.32	1.30	0.53	1.48	0.58	-	-

* and ** indicated significant at 5% and 1% levels of probability, respectively. ns = non- significant.

Data in Table 6 show that harvest index was insignificant influenced by various studied fertilization combinations. Fertilized barley plants with F_3 combination gave the highest mean value of harvest index (32.63%) followed by F_2 (31.12%) and F_5 (30.21%) in the first season. Meanwhile, the highest mean value of harvest index (35.72%) was obtained by F_1 in the second season. Thus, it is indicated that using bio-fertilizers caused an increase in harvest index due to effect on dry weight and allocating more photosynthetic matters to grain. These results are in harmony with those reported by Zaki *et al*. (2012) and Abd El-Razek and El-Sheshtawy (2013).

2.3. Effect of interaction

The effects of interactions on biological, grain and straw yields as well as harvest index in both seasons are shown in Table 7. The interactions between barley cultivars and fertilization combinations have insignificant effects on the studied traits, except straw yield in the first season and biological yield in the second season.

Giza 134 fertilized with 75% of recommended NPK + Algae extract + Microbein (F_6) gave the highest grain

yield (2.69 and 2.97 ton fed^{-1}) and biological yield (8.38 and 9.43 ton fed^{-1}) followed by 50% chemical NPK + Algae extract + Microbein (F_7) with the same cultivar (2.53 and 2.88 ton fed^{-1}) and (8.16 and 8.95 ton fed^{-1}), respectively.

Table 7. Effect of cultivars and NPK fertilization combinations on yield components of barley in two growing seasons.

Cultivar	NPK fert.	Grain yield (ton fed^{-1})		Straw yield (ton fed^{-1})		Biological yield (ton fed^{-1})		Harvest index (%)	
		2014/15	2015/16	2014/15	2015/16	2014/15	2015/16	2014/15	2015/16
Giza 132	F_1	1.70	2.46	4.83	4.58	6.52	7.03	26.22	34.89
	F_2	1.68	1.87	4.41	4.44	6.09	6.31	27.72	29.65
	F_3	1.51	1.80	3.73	4.50	5.24	6.30	28.97	28.70
	F_4	1.71	2.35	5.40	4.88	7.10	7.23	24.76	32.28
	F_5	1.51	1.83	4.07	3.88	5.58	5.72	27.55	31.71
	F_6	1.86	2.66	5.98	5.69	7.84	8.34	24.01	31.92
	F_7	1.76	2.53	5.68	5.27	7.44	7.81	24.16	32.38
Giza 134	F_1	2.45	2.70	5.00	4.80	7.45	7.51	33.24	36.55
	F_2	2.41	2.57	4.66	4.73	7.07	7.30	34.52	35.18
	F_3	2.17	2.23	3.87	3.69	6.04	5.93	36.29	37.55
	F_4	2.46	2.86	5.56	4.70	8.01	7.55	31.79	37.94
	F_5	2.18	2.27	4.59	5.05	6.76	7.32	32.87	31.68
	F_6	2.69	2.97	5.69	6.46	8.38	9.43	32.48	31.56
	F7	2.53	2.88	5.63	6.07	8.16	8.95	31.42	32.20
F Test		ns	ns	ns	*	ns	*	ns	ns
LSD 0.05		-	-	-	0.75	-	0.82	-	-

* and ** indicated significant at 5% and 1% levels of probability, respectively. ns = non- significant.

Straw yield of barley hadn't clear response trend to the interaction effects between barley cultivars and fertilization combinations. Giza 132 cultivar was surpassed Giza 134 cultivar with 75% of recommended NPK + Algae extract + Microbein (F_6) in the first season meanwhile, Giza 134 cultivar was the best in the second season with the same fertilization combination.

The interaction effect between barley cultivars and fertilization combinations was insignificant with regard to harvest index in the both studied seasons (Table, 7). Generally, Giza 134 cultivar was superior to Giza 132 cultivar under most fertilization combinations. In this regard, fertilized Giza 134 cultivar plants with F_3 and F_4 gave the highest mean values of harvest index in the first season and second season, respectively.

Conclusion

Using bio-fertilizers is necessary to rationalize the consumption of the chemical fertilizers minimize the environmental pollution and improve soil quality. So, it can be replaced 25 or 50% of chemical fertilizers by double-inoculation of Algae extract + Microbein as bio-fertilizers to improved barley yield and its components as well as saving about 25 to 50% of recommended dose of NPK.

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استجابة صنفين من الشعير للإحلال الجزئي للأسمدة المعدنية بالأسمدة الحيوية تحت ظروف الوادي الجديد

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الملخص

أجريت تجربة حقلية خلال موسمي ٢٠١٤/٢٠١٥ و٢٠١٥/٢٠١٦ في المزرعة التجريبية بمحطة البحوث الزراعية بالخارجة، الوادي الجديد لدراسة تأثير الإحلال الجزئي للأسمدة المعدنية بالسماد الحيوي على إنتاجية صنفين من الشعير تحت ظروف الوادي الجديد. اختبرت ٧ توليفات سماديه من الأسمدة المعدنية والحيوية كالتالي:

١. ١٠٠% من الكمية الموصي بها من سماد NPK المعدني
٢. ٧٥% من الكمية الموصي بها من سماد NPK المعدني + ميكروبين
٣. ٥٠% من الكمية الموصي بها من سماد NPK المعدني + ميكروبين
٤. ٧٥% من الكمية الموصي بها من سماد NPK المعدني + مستخلص طحالب
٥. ٥٠% من الكمية الموصي بها من سماد NPK المعدني + مستخلص طحالب
٦. ٧٥% من الكمية الموصي بها من سماد NPK المعدني + ميكروبين + مستخلص طحالب
٧. ٥٠% من الكمية الموصي بها من سماد NPK المعدني + ميكروبين + مستخلص طحالب

عند الحصاد تم تقدير عدد السنابل في المتر المربع، عدد حبوب السنبلة، وزن ١٠٠٠ حبة، وزن حبوب السنبلة، محصول الحبوب والقش والمحصول البيولوجي للفدان وكذلك دليل الحصاد.

أوضحت النتائج تفوق الصنف جيزة ١٣٤ على الصنف ١٣٢ في معظم الصفات المدروسة في موسمي النمو.

١- التلقيح المزدوج بكل من الميكروبين ومستخلص الطحالب مع إضافة ٧٥% من الكمية الموصي بها من سماد NPK المعدني أدى لزيادة محصول الحبوب والقش والمحصول البيولوجي بنسبة ١٠,١٤، ١٨,٥٠ و١٦,١٩% في الموسم الأول و٨,٩١، ٢٩,٤٢ و٢٢,١٥% في الموسم الثاني، على التوالي مقارنة بالمعاملة ١٠٠% من السماد المعدني الموصي به.

٢- تسميد صنف جيزة ١٣٤ بمعاملة التسميد ٧٥% سماد NPK معدني + ميكروبين + مستخلص طحالب أعطى أعلى محصول حبوب (٢,٦٩ و٢,٩٧ طن للفدان) والمحصول البيولوجي (٨,٣٨ و٩,٤٣ طن للفدان). في حين جاءت معاملة التسميد ٥٠% سماد NPK معدني + ميكروبين + مستخلص طحالب مع نفس الصنف في المرتبة الثانية، حيث أعطت ٢,٥٣ و٢,٨٨ طن حبوب للفدان و٨,١٦ و٨,٩٥ طن محصول بيولوجي للموسمين الاول والثانى على التوالي.

مما سبق يمكن التوصية باستبدال ٥٠% من الأسمدة الكيماوية (NPK) عن طريق التلقيح المزدوج بكل من الميكروبين ومستخلص الطحالب كأسمدة حيوية لتحسين المحصول ومكوناته لصنفي الشعير جيزة ١٣٢ و١٣٤ بالإضافة إلى توفير حولي ٥٠% من الأسمدة الكيميائية الموصي بها.