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COMBINED EFFECT OF BIO-ORGANO-FERTILIZATION AT DIFFERENT N-LEVELS ON:
1- YIELD, GRAINS QUALITY, VIABILITY AND ACTIVITY OF α-AMYLASE OF TWO WHEAT VARIETIES

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ABSTRACT

Combined effect of bio-organo-fertilization; Azotobacter inoculation and/or farmyard manure (0.5% by weight) at N-levels; 20% (N_1), 60% (N_2) and 100% (N_3) of recommended dose (70 kg N/fed) on yield, grains quality, viability and activity of α-amylase of two wheat varieties; Sakha 8 (V_1) and Sakha 92 (V_2) on field were studied. Two field experiments were carried out at Sakha Agric. Res. Station during 1997/98 and 1998/99 winter seasons.

The obtained results showed that:

- Increasing nitrogen fertilizer levels from N_1 to N_2 or N_3 significantly increased grain, straw and total yields at the first season while increased grain yield only at the second season. Also, there were no detectable difference in grain yield between N_2 and N_3 treatments in both seasons.
- Bio-organo treatments highly significantly increased grain, straw and total yields for the two studied wheat varieties.
- Combination of Azotobacter inoculation with farmyard manure was, generally the most efficient treatment in increasing grain, straw and total yields under all studies nitrogen levels.
- Increasing nitrogen fertilizer levels with using bio-organo-fertilization significantly increased protein and decreased nitrogen free extract content of the grains while ash and crude fiber contents did not differ significantly.
- Using different levels of nitrogen with the tested kind of bio-organo-fertilization had highly significant effect on α-amylase activity, grains produced under Azotobacter treatment recorded the highest value of α-amylase activity.
- Neither variety nor bio-organo-fertilization and their interactions do not affected on seed germination. While their were highly significant differences in seed germination with using N levels.
- The radical and shoot length of the two tested varieties were highly significant different between nitrogen levels and bio-organo-treatments, while no differences were observed on seedling dry weight between treatments.
- The results indicated, under the studied conditions, the possibility of saving 28/kg of nitrogen/fed of N-fertilizers, without affecting grains yield, germination, seedling vigour and α-amylase activity of the grains.

Keywords: Bio-organo-fertilization, wheat, Azotobacter, farmyard manure, viability α-amylase.

INTRODUCTION

Nitrogen fertilizers have been applied in very large amounts to field crops since 1950's in many countries. Their application, in the last decade, raised up to ten folds, while no considerable increase in organic manure application have been recorded in the same period. This leads to increase of residual components like biuret from urea fertilizer generating serious complications on the environment. It has been found that biuret is toxic for plant growth when its concentration in urea exceeds 1% (Cooke, 1978). Also, nitrates and nitrites are other hazardous residues normally originating from application of N-fertilizers. Hallberg (1989) and Puckett (1995) stated that nitrate is a wide spread pollutant of ground and surface waters world wide. They added that, this ion is a potential human health threat especially to infants, causing methomoglobinemia. Also, the reduction of nitrate, in the body, to nitrite and reaction of nitrite with amino acids leads to formation of nitroseamines, which are serious carcinogenic compounds.

Considerable attention, therefore, was focused on the decrease of chemical N-fertilizers and to substitute them by organic and biological fertilizer. Therefore, there is a widespread interest in the use of combination of mineral and bio-fertilizers as an alternative and cheap sources than chemical fertilizers (Boddey and Dobereiner, 1988 and Jagnow, 1990).

Biological nitrogen fixation occurred by seed inoculation with nonsymbiotic nitrogen-fixers play an important role in increasing yield and/or decreasing chemical nitrogen fertilizer requirements (Kennedy and Tchan, 1992). In this respect, Meshram and Shende, 1982a and b) showed that grain yield increased by inoculation with Azotobacter combined with moderate application of nitrogen fertilizer and farmyard manure.

Metwally and Khamis (1998) found that the application of organic and/or inorganic N to sandy soil had a significant positive effect on wheat grain and straw yields. They also found that the addition of 50% of entire requirements of wheat crop in organic form and the rest in mineral form produce the same yield as in the case of 100% chemical N source. They concluded that the beneficial effects of crop residue-N incorporation on physiological efficiency must be attributed to more regular supply of N to the plant, and also by the effect of phenolic, physiologically active substances formed by organic material degradation, which could be taken up by plants.

Khamis and Metwally (1998) found that the incorporation of organic materials inoculated with microbial decomposers and Azotobacter improved the decomposing effects in the soil and hence favourable increased the grain and straw yields of wheat.

Negm *et al*. (1998) reported that, the use of symbionts is more economical and much better than the use of chemical fertilizers which had already raized serious objection and real concern about the pollution of the environment.

To attain a sustainable fertility for soil, production of save plant foods free from chemical pollutants, and protecting the environment from pollution. This work aimed at studying the effect of organic and bio-fertilization in comparison to chemical N-fertilization on yield, quality, viability and total activity of α-amylase in grains between two wheat varieties.

MATERIALS AND METHODS

Two field experiments were carried out at Sakha Agric. Res. Station during 1997/98 and 1998/99 seasons. They aimed at studying the combined effect of biological fertilization: Azotobacter inoculation (of grains) and/or farmyard manure (FYM) treatments (0.5% by weight), added at the first season 1997/98 only, at three levels of nitrogen fertilizer (20, 60 and 100% of recommended N dose; 70 kg N/fed) on grain, straw and total yields, grains quality, viability and α-amylase activity.

Split-split plot design with four replications was used. The main plots were randomly assigned to three nitrogen levels i.e. N_1=20%, N_2=60% and N_3=100% of recommended dose (70 kg N/fed). Two sub-plots were assigned to wheat varieties i.e. V_1 = Sakha 8 and V_2 = Sakha 92 with four sub-sub plots (2 x 2 m for each) for Bio-organo treatments i.e. without (B_1)/Azotobacter grain inoculation in each season (B_2)/farmyard manure (0.5% by weight) for one time and mixed with the surface (0-20 cm) soil layer before planting of the first season (B_3)/Azotobacter inoculation + farmyard manure addition (B_4). All other field practices were as recommended for Nile Delta Area.

All experimental units were dressed with P by 30 kg P_2O_5/fed as superphosphate and K by 15 kg of K_2O as potassium sulphate. Nitrogen fertilizer was dressed with N by 14 kg N/fed (20% of recommended; at planting for all plots, the second dose by 28 kg N/fed; 40% of recommended, at tellering for plots of N_2 and N_3 treatments and the rest of recommended; 28 kg N/fed was dressed at potting stage for plots of N_3 treatment only.

Initial soil samples of experimental location were collected. Chemical and physical properties of the soil surface layer (0-30 cm) are presented in Table 1 and some chemical characteristics of applied farmyard manure were analysed according to the methods of Black (1965) and illustrated in Table 2.

The planting was on December 5th 1997 and December 8th 1998 and the harvesting was on May 18th 1998 and May 23rd 1999 on the first and second seasons, respectively. The total grains and straw yields of wheat were recorded after maturity and weighed at about 15% moisture content.

Chemical analysis:

After wheat harvesting, at the first year of study, the grains were taken randomizly from every treatment and cleaned by excluding foreign grains, the grains were ground to fine powder, to pass through 2 mm sieves for the following chemical analysis: crude protein (CP); ether extract (EE); ash, crude fiber (CF) and nitrogen free extract (NFE), which were determined according to procedures outlined in AOAC (1990).

1

Table 2: Some chemical characteristics of applied farmyard manure.

EC (dS/m) 1: 10 ext.	pH in 1: 10 ext.	Organic carbon	Total N (%)	Total P (%)	Total K (%)	Available P (ppm)	C/N ratio
1.85	7.6	32.68	1.65	0.69	1.49	389	19.81

Alpha-amylase activity:

Alpha-amylase activity of wheat grains was determined after harvesting according to the method described by Reddy *et al*. (1984). The enzymes was extracted from the endosperm of grains according to method of Briggs, (1967). The enzyme reaction was done at 22-24ºC for 10 min. using calcium acetate buffer at pH of 4.8. Total α-amylase activity was calculated as micrograms of starch hydrolyzed per minute.

Viability tests:

Germination was carried out under optimum conditions according to international rules (ISTA, 1993). Radical, shoot length and seedling dry weight were also measured according to the procedures reported in the seed vigor testing hand book (AOSA, 1991).

All collected data were subjected to the statistical analysis as the usual technique of analysis of variance (ANOVA) as mentioned by Steel and Torrie (1980) and was carried out using IRRI STAT software version 3/93 (Biometric Unit. International Rice Research Institute, Manila, Philippine. Duncan's (1955) multiple range test was used to compare means at 0.05 level of probability.

RESULTS AND DISCUSSION

1.Grain, straw and total yields (ton/fed):

Grain, straw and total yields (ton/fed) of the two studied varieties Sakha 8 (V_1) and Sakha 92 (V_2) as affected by addition of different levels of nitrogen fertilizer: 20% (N_1), 60% (N_2) or 100% (N_3) of recommended dose (70 kg N/feddan) and bio-organo treatments; without (B_1), Azotobacter inoculation (B_2), farmyard manure addition (0.5% by weight) (B_3) and Azotobacter inoculation + farmyard manure (B_4) are shown in Table 3 and Figure 1. Data showed that increasing nitrogen fertilizer levels from N_1 to N_2 or N_3 increased grain, straw and total yields significantly at the first season and grain yield at second season. But their were no detectable difference in grain yield between N_2 and N_3 in both seasons.

Regarding to bio-organo treatments; organic and/or microbial inoculation, results of Table (3) showed that these treatments highly significantly increased grain, straw and total yields of the two studied wheat varieties.

Inoculation of seeds or seedling of various plants with associative N_2-fixing bacteria led to change in plant growth and yield (Dobereiner and Day 1975 and Pohlman and McColl, 1982).

Table 3: Grain, straw and total yields (ton/fed) of the tested wheat varieties for two seasons as affected by N levels and bio-organic treatments.

Characteristics		1997/98			1998/99		
Treatments		**Grain**	**Straw**	**Total yield**	**Grain**	**Straw**	**Total yield**
Nitrogen levels (N)	N_1	1.30 b	1.91 b	3.21c	1.50 b	2.81 ab	4.31 ab
	N_2	2.51 a	2.40 a	4.91 b	1.73 a	2.55 b	4.28 b
	N_3	2.23 a	3.59 a	5.82 a	1.65 a	2.91 a	4.56 a
Varieties (V)	V_1	1.93 a	2.57 a	4.50 a	1.68 a	2.53 a	4.21 b
	V_2	2.10 a	2.69 a	4.79 a	1.58 a	2.99 a	4.57 a
Biological (B)	B_1	1.70 b	2.03 b	3.73 b	1.58 b	2.61 bc	4.19 bc
	B_2	1.83 b	2.69 a	4.52 b	1.47 b	2.52 c	3.99 c
	B_3	2.20 a	2.82 a	5.02 a	1.71 a	2.89 ab	4.60 ab
	B_4	2.33 a	2.96 a	5.29 a	1.74 a	3.01 a	4.75 a
F-test	N	**	**	**	**	*	*
	V	NS	NS	NS	NS	NS	**
	B	**	**	**	**	**	**
Interactions (N x V x B)	$N_1V_1B_1$	1.09 a	1.70 a	2.79 a	1.61 a	2.25 b	3.86 b
	$N_1V_1B_2$	1.23 a	2.15 a	3.38 a	1.32 b	2.36 ab	3.68 b
	$N_1V_1B_3$	1.36 a	2.04 a	3.40 a	1.82 a	3.06 a	4.88 a
	$N_1V_1B_4$	1.45 a	1.80 a	3.25 a	1.74 a	3.16 a	4.90 a
	N1V2B1	1.16 a	1.52 b	2.68 b	1.53 a	2.29 b	3.82 b
	N1V2B2	1.14 a	1.56 b	2.70 b	1.08 b	2.88 ab	3.96 b
	N1V2B3	1.45 a	2.18 a	3.63 a	1.49 a	2.95 ab	4.44 b
	N1V2B4	1.52 a	2.27 a	3.79 a	1.41 a	3.53 a	4.94 a
	N2V1B1	1.91 b	1.73 b	3.64 c	1.64 b	2.33 a	3.97 a
	N2V1B2	2.57 a	2.15 b	4.72 b	1.71 ab	2.23 a	3.94 a
	N2V1B3	2.56 a	2.07 b	4.63 b	1.65 b	2.16 a	3.81 a
	N2V1B4	2.66 a	3.35 a	6.01 a	1.91 a	2.49 a	4.40 a
	N2V2B1	2.31 b	1.77 b	4.08 b	1.67 b	2.55 b	4.22 b
	N2V2B2	2.21 b	2.76 a	4.97 a	1.46 b	2.23 b	3.69 b
	N2V2B3	2.93 a	2.87 a	5.80 a	2.20 a	3.44 a	5.64 a
	N2V2B4	2.92 a	2.67 a	5.59 a	2.39 a	3.00 ab	5.39 a
	N3V1B1	1.56 b	2.45 b	4.01 c	1.57 c	2.91 a	4.48 a
	N3V1B2	1.81 b	3.83 a	5.64 b	1.71 ab	2.52 a	4.23 a
	N3V1B3	2.34 a	3.63 a	5.97 ab	1.65 bc	2.27 a	4.92 a
	N3V1B4	2.59 a	3.89 a	6.48 a	1.89 a	2.58 a	4.47 a
	N3V2B1	2.16 bc	3.03 b	5.19 b	1.59 ab	3.32 a	4.91 a
	N3V2B2	2.03 c	3.45 b	5.48 b	1.50 b	2.89 a	4.39 b
	N3V2B3	2.53 ab	4.17 a	6.70 a	1.61 ab	3.46 a	5.07 a
	N3V2B4	2.83 a	4.19 a	7.02 a	1.79 a	3.31 a	5.10 a
F-test	N x V	NS	NS	NS	NS	NS	NS
	N x B	NS	NS	NS	**	NS	NS
	V x B	NS	NS	*	**	NS	NS
	N x V x B	NS	**	NS	*	NS	NS

Grain yield given in Table (3) and indicated that farmyard manure (FYM); B_3 alone or in combination with Azotobacter inoculation, B_4 increased the grain yield significantly to 2.20 & 2.33 ton/fed and 1.71 & 1.74 ton/fed than that of N-fertilizer treatment alone, (B_1) 1.7 & 1.83 ton/fed and that of

Azotobacter inoculated (B_2), 1.58 & 1.47 ton/fed for the first and second seasons, respectively. Biological treatments increased straw yield significantly at the first season, while at the second season Azotobacter inoculation in combination with farmyard manure, B_4 was the superior treatment with significantly difference than B_1 and B_2 treatments. Data of total yield, at each season, had similar trend as grain and straw yield.

These results stand in harmony with those obtained by Sakr *et al*. (1992) and El-Sersawy *et al*. (1997). The beneficial effects of organic manuring on yield may be attributed to their influence on the quality and quantity of the root exudates which in turn improve the biological activities in the vicinity of plant rhizosphere (Zohdy and Abd El-Aziz 1983 and Abdalla *et al.,* 1991).

Data of interaction between nitrogen fertilizer levels (N), wheat varieties (V) and bio-organo-treatments (N x V x B) recorded in Table (3) and illustrated in Fig. 1. These data showed that at lower level of nitrogen fertilizer, N_1 there were no significant differences between the effect of biological treatments or that of corresponding chemical fertilizer alone, B_1 on grain yield of the two studied varieties for the two seasons. Straw yield of Sakha 8 wheat variety had the same trend as the first season. While farmyard manure treatment, B_3 and that in combination with Azotobacter inoculation, B_4 significantly increased straw yield of Sakha 92 wheat variety than B_1 and B_2 treatments in the first season and than B_1 only in the second season.

Data of the interaction, also, revealed that bio-organo-treatments (farmyard manure in combination with Azotobacter inoculation, B_4) was, generally the most efficient treatment in increasing grain, straw and total yields of studied wheat varieties under each studied nitrogen level. This trend was more pronounced for Sakha 8 variety at N_2 level at the first season where the averages were 2.66, 2.56, 2.57 and 1.91 ton/fed, for grains yield, 3.35, 2.07, 2.15 and 1.73 ton/fed for straw yield and 6.01, 4.63, 4.72 and 3.64 ton/fed, total yield at the treatments for $N_2V_1B_4$, $N_2V_1B_3$, $N_2V_1B_2$ and $N_2V_1B_1$ respectively.

The beneficial effects of Azotobacter on plant development can be attributed not only to N_2-fixation process, but also to the production of growth promoting substances like gibberellins and other compounds of auxine type which gave a positive effect on plant growth. The beneficial effect on such organisms may be also due to their successful competition against antagonists of plant growth. El-Sersawy *et al*. (1997) came to similar conclusions.

The data presented in Table 3 indicated that the residual effect of farmyard manure treatment (second season) alone, B_3 or in combination with the inoculation of seeds with Azotobacter, B_4, generally increased grain and straw yields of the studied wheat varieties than bio-organic untreated ones, B_1. This trend was more pronounced in grain and total yields of Sakha 92 wheat variety at N_2 (42 kg N/feddan) treatment where the averages were significantly varied. They were 2.39, 2.20 and 1.67 ton/fed for grains and 5.39, 5.64 and 4.22 ton/fed for total yield at treatments $N_2V_2B_4$, $N_2V_2B_3$ and $N_2V_2B_1$, respectively.

These results were supported by the data obtained by El-Yamani *et al*. (1997) who found that residual effect of farmyard manure in addition with 45 kg N-fertilizer per feddan obtained the highest values of grain and straw yields.

The data in Table (3) indicate that grain and straw yields of the studied wheat varieties, when biologically treated, B_2, B_3 or B_4 in combination with 42 kg N/fed were generally, higher than or equal to that of treatment N_3; 70 kg N/fed (B_1). These results indicated the possibility of saving nitrogen fertilizer by about 28 kg N/feddan without affecting grain yield, by using bio-organo treatments. These results are in harmony with that obtained by Hammouda *et al*. (1991).

2.Chemical composition of grains:

The chemical composition of the tested grain varieties as affected by the chemical and bio-organo-fertilizers are shown in Table (4). The present results indicted that Sakha 92 had the highest content of crude protein (CP), ether extract (EE) and crude fiber (CF) than Sakha 8, while the content of ash and nitrogen free extract (NFE) were the highest in Sakha 8, but the differences among both varieties were insignificant. In the case of EE, ash and NFE, the values obtained in the present study for chemical composition investigated of wheat grain, were within the range of values reported by El-Aidy and Abd El-Shafi (1995) and El-Emery *et al*. (1994).

Increasing the rate of nitrogen fertilizer (Table 4) led to significant ($P < 0.05$) increase crude protein content of the grains, while nitrogen free extract was significantly ($P < 0.05$) decreased.

Data indicated also that the differences in ether extract, crude fiber and ash content of the grain were insignificant as the result of using the three nitrogen levels of fertilizer.

Bio-organo-fertilizer significantly increased ($P < 0.05$) crude protein and ether extract contents of grain, but the nitrogen free extract content was decreased, while ash and crude fiber contents did not differ significantly.

Under experimental condition either nitrogen and bio-organo-fertilizer or cultivars and their interaction constantly affected chemical composition of the tested wheat grains. The interaction between N_2 treatment and each of B_3 or B_4; N_2B_3 and N_2B_4 significantly increased, the percentage of protein content in Sakha 8 cultivar (8.29 and 8.95%, respectively). Compared with grains produced under N_1 and other kinds of bio-fertilizer (B_1, B_2 B_3 or B_4). Also, in Sakha 8 cultivar, treatment with N_3 and B_2, B_3 or B_4 produced grains contained higher crude protein content 10.96, 10.08 and 10.51% for N_3B_2, N_3B_3 and N_3B_4, respectively. The same trend was investigated with Sakha 92 wheat cultivar. The protein content was significantly increased in the grains produced under N_2B_3 and N_2 B_4 (10.15 and 10.98%, respectively). While the highest percentage of protein content was recorded by N_3 level and the different kinds of bio-organo treatments B_1, B_2, B_3 and B_4, the values ranged between 10.20 to 11.31%.

Table 4: Chemical composition and α-amylase activity of the tested wheat varieties as affected by N level and bio-organic treatments.

Treatments	Percentage on dry matter basis (%)	Total* activity of

		CP	EE	Ash	CF	NFE	α-amylase
Nitrogen levels (N)	N_1	7.81 c	1.66 a	1.91 a	2.75 a	73.93 a	60.88 a
	N_2	9.83 b	1.65 a	1.86 a	2.77 a	72.18 b	45.98 c
	N_3	10.42 a	1.63 a	1.90 a	2.70 a	71.25 c	56.66 b
Varieties (V)	V_1	8.85 b	1.63 a	1.92 a	2.69 a	72.92 a	50.30 b
	V_2	9.56 a	1.67 a	1.87 a	2.79 a	71.98 b	58.73 a
Biological (B)	B_1	8.82 a	1.38 b	1.83 a	2.69 a	73.09 a	47.42 b
	B_2	9.33 a	1.74 a	1.93a	3.03 a	72.11 a	61.19 a
	B_3	9.29 a	1.74 a	1.89a	2.73 a	72.39 a	54.09 b
	B_4	9.38 a	1.75 a	1.91a	2.35 a	72.20 a	55.34 b
F-test	N	**	NS	NS	NS	**	**
	V	**	NS	NS	NS	**	**
	B	NS	**	NS	NS	NS	**
Interactions	N1V1B1	7.95 a	1.31 b	1.87 b	2.85 a	74.90 a	50.97 b
(N x V x B)	N1V1B2	7.32 b	1.70 a	2.03 a	2.52 b	74.35 ab	63.75 a
	N1V1B3	7.96 a	1.73 a	1.98 ab	2.44 b	73.66 b	75.36 a
	N1V1B4	7.30 b	1.75 a	1.87 b	2.85 a	73.95 b	41.70 b
	N1V2B1	8.29 b	1.45 b	1.80 a	2.50 b	74.60 a	46.69 c
	N1V2B2	8.95 a	.63 b	1.91 a	2.86 a	72.31 b	62.61 b
	N1V2B3	7.98 b	1.84 a	1.94 a	3.03 a	73.10 b	61.81 b
	N1V2B4	6.73 c	1.90 a	1.90 a	2.95 a	74.58 a	84.17 a
	N2V1B1	8.33 c	1.32 b	2.09 a	2.52 b	73.24 ab	44.08 b
	N2V1B2	7.68 a	1.78 a	1.90 b	2.65 ab	74.06 a	68.47 a
	N2V1B3	9.37 b	1.92 a	1.78 b	2.94 a	73.04 bc	39.86 b
	N2V1B4	9.90 a	1.72 a	1.78 b	2.69 ab	72.25 c	33.53 b
	N2V2B1	8.90 c	1.50 b	1.74 b	2.63 b	71.26 b	45.36 a
	N2V2B2	9.73 b	1.44 b	1.80 b	2.77 b	72.30 a	49.31 a
	N2V2B3	10.15 b	1.93 a	1.81 b	2.60 b	71.53 ab	48.93 a
	N2V2B4	10.98 a	1.61 b	2.01 a	3.37 a	69.76 c	38.33 a
	N3V1B1	8.84 c	1.27 b	1.78 b	2.45 b	73.16 a	49.19 a
	N3V1B2	10.96 a	1.91 a	2.01 a	3.12 a	69.78 c	46.90 a
	N3V1B3	10.08 b	1.45 b	1.90 ab	2.71 b	71.48 b	48.75 a
	N3V1B4	10.51 ab	1.74 a	2.01 a	2.49 b	71.26 b	40.98 a
	N3V2B1	10.63 b	1.41 b	1.71 b	2.93 a	71.40 a	48.21 c
	N3V2B2	11.31 a	1.96 a	1.95 a	2.94 a	69.90 b	76.11 b
	N3V2B3	10.20 c	1.56 b	1.95 a	2.75 a	71.54 a	49.82 c
	N3V2B4	10.87 ab	1.77 a	1.93 a	2.22 b	71.45 a	93.34 a
F-test	N x V	**	NS	NS	NS	**	*
	N x B	**	**	**	**	**	**
	V x B	**	*	**	NS	NS	**
	N x V x B	**	**	**	**	**	**

*** Micrograms of starch hydrolyzed per minutes per grain.**
CP-crude protein, EE-ether extract, CF-crude fiber and NFE-nitrogen free extract.
Means within the column by the same letter are not significantly different (P < 0.05)

Concerning ether extract, crude fiber, nitrogen free extract and ash content of the two tested varieties, data of interaction between nitrogen fertilizer levels (N), wheat varieties (V) and bio-organo treatments (N x V x B) (Table 4) indicated highly significant differences between all treatments.

The differences of nutrient contents of tested grains may be attributed to the variations of biochemical process occurring in the grains during maturations as the results of these interactions.

3.Alpha-amylase activity of grains:

Because alpha-amylase is an important starch-degrading enzyme in the endosperm of cereal grains, and its reaction products provide substrates and an energy source for embryo during germination (Reddy *et al.,* 1984). On the other hand, the information on α-amylase activity in the grains of wheat produced under different levels and kind of fertilizer is limited, the activity of α-amylase during germination in the grains of the two tested varieties produced under chemical and bio-fertilizer were investigated.

Obtained data of α-amylase activity (Table 4) showed significant-variation between and within the two kind of fertilizers. The highest value of α-amylase activity was recorded in the grains produced under Azotobacter fertilizer B_2 (61.19), followed by 60.88 with using 20% of recommended nitrogen dose (N_1) while the grains produced under 60% of recommended nitrogen level (N_2) showed the lowest value (45.98). The differences between the two tested varieties were not significant and the average values of α-amylase activity were 50.30 and 58.73 with Sakha 8 and Sakha 92, respectively.

Alpha amylase activity in the wheat grains of two tested varieties as affected by the interaction of the different levels and kind of fertilizer were highly significant different (Table 4). The grains of Sakha 92 (V_2) produced under 100% of recommended nitrogen dose (N_3) along with Azotobacter and FYM ($N_3V_2B_4$) recorded the highest value of α-amylase activity (93.34) while the seed of the Sakha 8 variety (V_1) produced under the same condition of bio-fertilizer and the 60% of recommended nitrogen dose ($N_2V_2B_4$) showed the lowest value (33.53). The various values of α-amylase activity recorded in the tested varieties, could be attributed to the biochemical variations occurring in the seeds during maturations as the result of using the different tested levels and kind of chemical and bio-fertilizer.

4.Viability and vigor of grains:

Germination percentage and seedling characters of the two tested varieties as affected by chemical and bio-organo fertilizer (Table 5) indicated that, neither variety nor biofertilizer and their interactions not affected on seed germination. In contrast, there were highly significant differences of seeds germination as the result of using different levels of nitrogen fertilizer. This may be attributed to the variation of nutrient contents of the tested seeds (crude protein % and nitrogen free extract) as affected by nitrogen levels and bio-organo fertilizer as shown in Table (4).

Under experimental conditions , it is clear as could be seen in Table (5) that the percentage of germination of seeds produced under all treatments were above recommended level (85%) which was mentioned by the Ministry of Agriculture . Concerning of seedling vigor characters of the tested seeds, the differences between the two tested varieties were not significant, while radical length was significantly varied with using different levels of nitrogen fertilizer. On the other hand, bio-fertilizer showed significant effect on radical and shoot length, meanwhile no variations were observed concerning, seedling dry weight when different levels of N and the different kinds of bio-organic treatments were used.

It is clear as could be seen in Table (5) that, the radical and shoot length of the two tested varieties as affected by the interaction of N levels and the different kinds of bio-organic treatments were highly significantly different, it is worth to mention that the differences in the chemical composition of the tested seeds (Table 4) produced under different levels and kinds of experimental of chemical and bio-organic treatments may be consider as the major factor caused the significant variations of seedling vigor values in this study.

Table 5: Germination percentage and seedling vigor of the tested wheat varieties as affected by levels and bio-organic treatments.

Treatments		Lab. germination %	Seedling vigor		
			Radical length (cm)	Shoot length (cm)	Seedling dry weight (mg)
Nitrogen levels (N)	N_1	97.17 a	13.88 b	15.00 a	30.54 a
	N_2	92.33 b	14.56 a	15.15 a	30.54 a
	N_3	96.17 a	14.33 a	15.18 a	29.33 a
Varieties (V)	V_1	96.00 a	13.71 a	14.95 a	31.22 a
	V_2	93.11 a	14.80 a	15.26 a	29.86 a
Biological (B)	B_1	96.00 a	13.82 b	15.76 a.	29.61 a
	B_2	92.33 a	14.41 a	15.17 b	29.78 a
	B_3	95.67 a	14.49 a	15.18 b	30.39 a
	B_4	94.22 a	14.30 a	14.32 c	30.78 a
F-test	N	**	*	NS	NS
	V	NS	NS	NS	NS
	B	NS	**	**	NS
Interactions (N x V x B)	$N_1V_1B_1$	98.00 a	13.23 a	15.37 a	30.67 a
	$N_1V_1B_2$	95.33 a	13.23 a	15.17 ab	30.67 a
	$N_1V_1B_3$	98.00 a	13.30 a	14.63 bc	32.00 a
	$N_1V_1B_4$	100.00 a	13.40 a	14.30 c	32.00 a
	$N_1V_2B_1$	95.33 a	14.30 a	15.80 a	27.33 a
	$N_1V_2B_2$	96.00 a	14.37 a	14.80 bc	27.67 a
	$N_1V_2B_3$	96.67 a	14.87 a	15.33 ab	31.33a
	$N_1V_2B_4$	98.00 a	14.30 a	14.57 c	32.67a
	$N_2V_1B_1$	96.00 a	13.33 c	15.70 a	31.00 a
	$N_2V_1B_2$	98.67 a	14.27 ab	15.40 a	31.00 a
	$N_2V_1B_3$	93.33 a	13.72 bc	15.13 a	31.00 a
	$N_2V_1B_4$	89.33 a	14.87 a	13.43 b	31.33 a
	$N_2V_2B_1$	90.00 a	14.50 b	16.27 a	30.00 a
	$N_2V_2B_2$	92.00 a	15.03 ab	15.30 b	30.67 a
	$N_2V_2B_3$	91.33 a	15.23 ab	15.57 b	29.33 a
	$N_2V_2B_4$	88.00 a	15.57 a	14.37 c	30.00 a
	$N_3V_1B_1$	99.33 a	13.20 c	15.43 a	31.00 a
	$N_3V_1B_2$	94.00 a	14.37 a	15.17 ab	31.33 a
	$N_3V_1B_3$	97.33 a	14.17 ab	15.07 ab	31.33 a
	$N_3V_1B_4$	92.67 a	13.43 bc	14.63 b	31.33 a
	$N_3V_2B_1$	97.33 a	14.33 bc	15.97 a	27.67 a
	$N_3V_2B_2$	94.67 a	15.20 ab	15.17 b	27.33 a
	$N_3V_2B_3$	97.33 a	15.67 a	15.37 b	27.33 a
	$N_3V_2B_4$	97.33 a	14.23 c	14.83 b	27.33 a
F-test	N x V x B	NS	**	**	NS

Mean within the column followed by the same letter are not significantly different ($P < 0.05$)

From this study, it could be concluded that the grains of wheat varieties produced under high level of nitrogen along with different kinds of bio-orgno fertilizer accompanied with high protein content.

The results of the present work revealed also, the importance of bio-organic and should be taken in consideration during cultivated crops to decrease chemical fertilizer and its side effects. However, there is a great need to carry out more studies to study the effect of different levels and kinds of bio-fertilizer on yield production along with quality and viability of the grain produced.

REFERENCES

Abdalla, F.M.; G.G. Antoun, and S.A.M. Attia, (1991). Residual effect of organic manures on N-fixation in two peanut cultivars. Egypt. J. Agric. Res. 69(2): 473-480.

AOAC (1990). Official methods of analysis. 15^{th} ed. Horwitz, W., ed. association of Official Agricultural Methods, Washington, D.C.

AOSA (1991). Association of official seed analysis. Rules for testing seed. J.of Seed Technol., 12(3): 1-125.

Black, C.A. (1965). Methods of soil analysis. Part 1, Physical and Mineralogical properties including a statistics of measurement and sampling. American Society of Agronomy. Inc. Publisher, Wisconsin, USA.

Boddey, R.M. and J. Dobereiner, (1988). Nitrogen fixation associated with grasses and cereals: recent results and perspective for future research. Plant & Soil 108, 53-65.

Briggs, D.E. (1967). Modified assay for α-amylase in germinating barley. J. Inst. Brew., 73: 361.

Cooke, G.W. (1976). Fertilizing for maximum yield. 2^{nd} Edition Fletcher & Son Ltd., Norwich, Great Britain, 38-51.

Dobereiner, J. and J. Day, (1975). Nitrogen fixation in rhizosphere of tropical grasses. In "Nitrogen fixation by living micro-organisms" Ed. W.D.P. Steward, Cambridge Univ. Press, 39-56.

Duncan, D.B. (1955). Multiple Range and Multiple F-test. Biometrics, 11: 1-24.

El-Aidy, A. Nadia and A.M. Abdel-Shafi, (1995). Effect of pesticide concentration and storage period on pesticide residue, chemical composition, viability and vigour of wheat seed. J. Agric. Sci. Mansoura Univ., 20(7): 3173-3179.

El-Emery, M.I.; Nadia, A. El-Aidy and A.M. Abd El-Shafi, (1994). Effect of water supply on viability, chemical composition of grain and yield and its components of wheat. Annals Agric. Sci., Ain Shams Univ., Cairo 39(1): 137-157.

El-Sersawy, M.M.; Bouthaina F. Abd El-Ghany; K.W. Khalil, and S.Y. Awadalla (1997). Interaction between organic manure mixtures, applied N-level and biofertilization on calcareous soil properties and wheat production in Wadi Sudr, south Sinai. Egypt. J. Soil Sci., 37(3):367-397.

El-Yamani, M.S.; K.M. Sayed, and F.I. Zein, (1997). Residual effect of farmyard manure, gypsum and N-fertilizer applied to sugar beet in salt affected soil on subsequent soybean and wheat crops. J. Agric. Sci. Mansoura Univ., 22(9): 3005-3013.

Hallberg, G.R. (1989). Nitrate in ground water in the United States. In: Nitrogen Management of ground water protection, R.F. Follet, ed. Elsevien Amsterdam, pp. 35-74.

Hammouda, F.M.; M.I. Zidan, and M.I. Amer, (1991). Response of lentil (*Lens esculenta,* L.) to Rhizobium inoculation and N-fertilization. Egypt. J. Agric. Res. 69(2): 511-520.

ISTA (1993). International seed testing Association. International rules for seed testing. Seed Sci. and Technol., 21: 25-46.

Jagnow, G. (1990). Differences between cereal crop cultivars in root-associated nitrogen fixation, possible causes of variable yield responses to seed inoculation. Plant and Soil., 123: 255-259.

Kennedy, Ivan, R. and Yao, Tseng Tchan (1992). Biological nitrogen fixation in non-leguminous field crops: Recent Advances. Plant and Soil., 141: 93-118.

Khamis, M.A. and Sh.M. Metwally (1998). Utilization of organic materials inoculated with microbial decomposers as a nitrogen source for wheat in represennce of Azotobacter in a sandy soil. Egypt. J. Soil Sci., 38(1-4)

Meshram, S.U. and S.T. Shende (1982a). Response of maize to azotobacter chroococcum. Plant and Soil., 69: 265-269.

Meshram, S.U. and S.T. Shende (1982b). Total nitrogen uptake by maize with Azotobacter inoculation. Plant and Soil., 69: 275-280.

Negm, M.A.; R.G. Kerlous, and Y.B. Besada, (1998). Different sources of nitrogen and rhizobium inoculation effect on peas growing on a calcareous soil. Egypt. J. Soil Sci., 38(1-4): 69-79.

Metwally, Sh.M. and M.A. Khamis (1998). Comparative effects of organic and inorganic nitrogen sources applied to a sandy soil on availability of N and wheat yield. Egypt. J. Soil Sci., 38(1-4): 35-54.

Pohlman, A.A. and G. McColl (1982). Nitrogen fixation in the rhizosphere of barley. Plant and Soil, 69: 341-352.

Puckett, I.J. (1995). Identifying the Major Sources of Nutrient Water Pollution Environmental Science & Technology, 408 A-414 A.

Reddy, L.V.; T.M. Ching and R.J. Metzger (1984). Alpha-Amylase activity in wheat kernels matured and germinated under different temperature conditions. Cereal Chem., 61(3): 228-231.

Sakr, A.A.; S.A. Rizk, and A.S. El-Sebaay (1992). Effect of organic manures on plant growth and NPK uptake by wheat and maize plants. Egypt. J. Soil Sci., 32(2): 249-264.

Steel, R.G.D. and J.H. Torrie, (1980). Principles and procedures of statistics. McGraw-Hill, (Publ.) New York, NY.

Zohdy, L.I. and R.A. Abd El-Aziz (1983). Soil conditioners II- Effect of microbiological and chemical properties on sandy and calcareous soil under broad bean plants. Egypt. J. Microbiol., 18(1): 47-58.

التـأثير المشـترك للتسـميد الحيـوى والعضـوى عنـد مسـتويات مختلفـة مـن التسـميد النتروجينى على
١- المحصول وجودة الحبوب والحيوية ونشاط أنزيم الفا-اميليز لصنفين من القمح

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**** قسم بحوث تكنولوجيا البذور - معهد المحاصيل الحقلية - مركز البحوث الزراعية - الجيزة - مصر**

أجريت دراسة عن التأثير المشترك للتسميد الحيوى والعضوى (تلقيح الحبوب بالأزوتوباكتر والمادة العضوية ٠,٥% بالوزن وكل منهما على حدة عند مستويات مختلفة من التسميد النيتروجينى ٢٠% N_1 ، ٦٠% N_2 ، ١٠٠% N_3 من معدل التسميد الموصى به وهو ٧٠ كجم نيتروجين/فدان). وذلك على المحصول ونوعية الحبوب والحيوية ونشاط إنزيم الفا أميليز على صنفين من القمح هما سخا ٨ و سخا ٩٢ فى دراسة حقلية. حيث أقيمت تجربتين حقليتين خلال موسمى شتاء ٩٨/١٩٩٧ ، ٩٩/١٩٩٨. وأوضحت النتائج المتخصل عليها أن:

- زيادة التسميد النيتروجينى أدت إلى زيادة معنوية فى محصول الحبوب والقش والمحصول الكلى فى السنة الأولى بينما كانت الزيادة معنوية فى محصول الحبوب فقط فى الموسم الثانى. أيضا لم يكن بين الاصناف أى فروق معنوية فى محصول الحبوب والقش والمحصول الكلى الا فى الموسم الثانى فقط لصفة المحصول الكلى.
- لم يكن هناك فروق معنوية لمحصول الحبوب تحت ظروف التجربة بين معاملتى المستوى الثانى والثالث للتسميد النيتروجينى.
- زادت المعاملات الحيوية العضوية من محصول الحبوب والقش للصنفين من القمح.
- كانت التوليفة من التلقيح بالأزوتوباكتر مع التسميد العضوى هى بصفة عامة أكثر المعاملات كفاءة فى زيادة محصول الحبوب والقش والمحصول الكلى زيادة معنوية تحت جميع مستويات التسميد النيتروجينى.
- زيادة التسميد النيتروجينى مع المعاملات الحيوية العضوية أدت إلى زيادة معنوية فى محتوى الحبوب من البروتين وإنخفاض معنوى فى نسبة الكربوهيدرات الذائبة بينما نسبة الرماد والألياف لم تتأثر.
- إستخدام مستويات من التسميد الآزوتى مع المعاملات الحيوية العضوية كان له تأثير معنوى فى نشاط إنزيم الالفا-أميليز وقد سجلت الحبوب المنتجة نتيجة المعاملة بالأزتوباكتر أعلى قيمة لنشاط إنزيم الفا أميليز.
- لم يتأثر إنبات البذور فى كلا الصنفين وكذلك بإستخدام المعاملات الحيوية والعضوية بينما كانت الإختلافات معنوية فى نسبة الإنبات نتيجة لإستخدام المستويات المختلفة من التسميد الآزوتى.
- كانت الإختلافات فى طول الريشة والجذير فى كلا الصنفين معنوية بين المعاملات بينما لم يكن هناك فروق معنوية بين المعاملات فى الوزن الجاف للبادرة.
- أوضحت النتائج أنه يمكن توفير ٢٨ وحدة نيتروجينية/فدان بدون النقص فى محصول الحبوب ونسبة الإنبات عن المستوى المسموح به وقوة البادرات وكذلك نشاط إنزيم الألفا أميليز.

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Table 1:Some initial chemical and physical properties of the surface soil layer (0-30 cm) under study.

Ece (dS/m)	Soluble cations me/L				Soluble anions me/L				SAR	Soil pH ,	OM,	Total $CaCO_3$	Available nutrients mg/kg			Clay , %	Silt, %	Sand, %	Texture grade
	Na^+	K^+	Ca^{++}	Mg^{++}	$CO^=_3$	HCO^-_3	Cl^-	$SO^=_4$		1: 2.5	%	%	N	P	K				
4.65	26.2	1.0	16.7	7.3	0.6	4.1	21.6	24.9	7.57	8.1	1.86	2.29	48.9	28.3	197	57.8	21.8	20.4	Clay