الملخص العربي

"تأثير الازوسبرليم ومعدلات السماد النيتروجينى على المحصول ومكوناته لقمح الخبز تحت ظروف مدينة سرت"

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أجريت تجربتان حقليتان بمشروع القرطابية بمدينة سرت – ليبيا خلال موسمى الزراعة ٢٠٠٩/٢٠١٠ و٢٠١٠/٢٠١١م لدراسة تأثير سبع معاملات سمادية ما بين السماد الحيوى و معدل السماد النيتروجينى منفردا أو مختلطا على الناتج ومكوناته ونسبة البروتين فى حبوب قمح الخبز (اكاسيا سى فى).

المعاملات السمادية:

١-كنترول (بدون اضافة).

٢-١٠٠% من المعدل الموصى به من السماد النيتروجينى .

٣-السماد الحيوى (الازوسبرليم).

٤-١/٤ الموصى به من معدل السماد النيتروجينى + الازوسبرليم .

٥-١/٢ الموصى به من معدل السماد النيتروجينى + الازوسبرليم.

٦-٣/٤ الموصى به من معدل السماد النيتروجينى + الازوسبرليم .

٧-١٠٠% الموصى به من معدل السماد النيتروجينى + الازوسبرليم .

تم استخدام تصميم القطاعات كاملة العشوائية فى ثلاثة مكررات. ويمكن تلخيص أهم النتائج :

-أظهرت النتائج اختلافات معنوية بين المعاملات السمادية المستخدمة على صفات طول النبات وطول السنبلة وعدد السنابل فى المتر المربع وعدد سبيبلات السنبلة ووزن حبوب السنبلة ووزن الالف حبة ومحصول القش وكذلك محتوى الحبوب من البروتين فى كلا الموسمين ، حيث اعطت المعاملة السمادية السابقة(١٠٠% من السماد النيتروجينى الموصى به+ الازوسبروليم) أعلى القيم لهذه الصفات مقارنة بالمعاملات السمادية الاخرى المدروسة فى كلا الموسمين ، فيما أعطت المعاملة السمادية الاولى (كنترول) أقل القيم لهذه الصفات المدروسة مقارنة بجميع المعاملات السمادية تحت الدراسة فى كلا الموسمين .

وبناء على ذلك، فإضافة ١٠٠ % او ٧٥ % من السماد النيتروجينى الموصى به مع التلقيح ببكتريا الازوسبرليم يمكن التوصية به لزيادة إنتاجية القمح تحت ظروف هذه الدراسة.

effective and economical alternate of chemical fertilizers with lesser input of capital and energy (Hafeez et al. 2002). Free-living nitrogen-fixing bacteria *eg Azotobacter chroococcum* and *Azospirillum lipoferum*, were found to have not only the ability to fix nitrogen but also the ability to release phytohormones similar to gibberellic acid and indole acetic acid, which could stimulate plant growth, absorption of nutrients, and photosynthesis (Fayez et al. 1985).

Many authors have shown the positive effect inoculation of wheat with biofertilizers (Tilak 1992 ,Tawfik and Gomaa 2005; Abbasdokht 2008; Badr et al. 2009; Bahrani et al. 2010). reported positive effects of double-inoculation of *Azotobacter* and *Azospirillum* on dry matter of maize and sorghum. Rai and Caur (1998) studied the effects of *Azotobacter* and *Azospirillum* as double-inoculation or alone on wheat growth and yield.They found that double-inoculation of *Azotobacter* and *Azospirillum* had positive effects on plant height, spike length, grain yield, biological yield and harvest index in various wheat genotypes. Ozturk et al (2003) found that grain protein content was increased by the application of chemical nutrients and biofertilizers, compared with untreated plants.

Present study aims to evaluate the importance of bio-fertilization with *Azospirillum* in the improvement growth and productivity wheat crop under Sert conditions.

Materials and methods

The field experiments were conducted at the El-Kortabia Project, Sert during 2009-2010 and 2010-2011 seasons. The soil of the experimental site is silty throughout its profile (5.7. % sand, 81.3. % silt and 13.0% clay). Its pH value of 8.2, 0.56 EC (dSm^{-1}), and available N, P and K of 258, 18 and 158 ppm, respectively.

The dose of nitrogen (120 kg N ha^{-1}) was manipulated at various levels in combination with different biofertilizers as per the treatment schedule. The different treatment combination as follows:

T_1- Control (without nitrogen and uninoculated).T_2- 100% mineral N (MN), T_3- Azospirillum , T_4- 1/4 mineral N + Azospirillum, T_5- 1/2 mineral N + Azospirillum, T_6- 3/4 mineral N + Azospirillum, and T_7- 100% mineral N + Azospirillum. The seeds were inoculated by liquid culture of locally isolated strain of Azospirillum lipoferum (108 CFU/ml). The experiment was carried out in a randomized complete block design with three replications. Experimental unit measured 4.0 m in width and 5 m in length.

Bread wheat Acasia cv. was sown (130 kg/ha) on the 10th of November in each season. P and K fertilizers were applied at the level of 36 and 50 kg ha^{-1}, respectively, were applied basally before sowing in all treatments. The other cultural practices were carried out as recommended for the crop.

At harvest time, ten plants were taken at random from each plot for measuring plant height, spike length, number of spikelets/spike, kernel weight /spike and 1000-kerenl weight was estimated for each plot. Meanwhile, number of spike/m^2, grain, straw and biological yields were estimated at plot basis. Grain protein content was determined on dry matter basis, according to AOAC (1995).

The data were analyzed by analysis of variance (ANOVA) using MSTAT-C statistical software. Treatment means were compared using Duncan's multiple tests (Steel and Torrie 1980). Since data followed the homogeneity test, pooling was carried out over the seasons and mean data are given.

Results and discussion

Yield components:

Results presented in Table 1 showed that means over two seasons for plant height and yield components for various studied treatments . Significant effect were observed on plant height, spike length, number of spike / m^2, number of spikelets/spike, kernel weight /spike and 1000-kernel weight. The greatest values of such traits were T_7 (100% mineral N + *Azospirillum*). However, T_6 (3/4 mineral N + biofertilizer with *Azospirillum*) resulted also higher values for the above mentioned yield components comparing with T_2 (100% nitrogen and uninoculated) but the differences among the two treatments almost did not attain the statistical differences. Inoculation with *Azospirillum* alone (T_3) produced significantly higher plant height (97.8 cm), spike length (11.00 cm), number of spike / m^2 (245), number of spikelets/spike (16.14), kernel weight /spike (2.330 g) and 1000-kernel weight (36.00 g) than those of uninoculated and without mineral N (T_1).These results are agreement with El-Garhi et al. (2007), Badr et al. (2009) and Bahrani et al. (2010) who found positive effect on yield components of wheat when inoculated with biofertilizer.

Grain, straw and biological yields:

It is evident from the results in Table 2 showed that grain, straw and biological yields varied, according to various proportions of mineral and biofertilizers. The maximum grain straw yields and biological(5.390, 6.885 and 12.275 tons / ha, respectively), were obtained from the treatment of T_7 (100% mineral N + *Azospirillum*). Like yield components, T_6 (3/4 mineral N + biofertilizer with *Azospirillum*) resulted also higher values for the grain, straw and biological yields comparing with T_2 (100% nitrogen and uninoculated) but the differences among the two treatments almost did not attain the statistical differences. The minimum grain, straw and biological yields (3.150, 4.200 and 7.350 tons / ha, respectively) were resulted by the T_1 (control) treatment.

Such increase in yields (grain, straw and biological) and yield components, due to application of T_7, might be due to the role of biofertilizer (*Azospirillum*) in enhancing soil biological activity, which improved nutrient mobilization from organic and chemical sources. Also, the biofertilizer plays a significant role in regulating the dynamics of organic matter decomposition and the availability of plant nutrients and in increasing nitrogen fixer. These results are in concordance with most similar previous studies (Sharief et al. 1998; El-sayed et al. 2005; El-Garhi et al. 2007; Badr et al. 2009; Bahrani et al. 2010).

Grain protein concentration (%):

It is noticed from Table 2 results indicate that grain protein content significantly varied, according to various proportions of mineral and biofertilizers. The maximum grain protein content was observed from T_7, (12.35%) T_6 (12.22%) and T_2 (12.25%) compared with others treatments. In this case, Ozturk et al (2003) found that grain protein content was increased by application of chemical and biofertilizers, compared with untreated plants .

Conclusion

From these results, it could be conduced that high nitrogen fertilizer rate and Azospirillium (T_7 treatment) were added to wheat plants increased filling of grains by increasing photosynthetic productivity of the plants and increasing the rate of dry matter translocation to the grains, leading in a significant increase in the total grains weight . Also , it

could be attributed to the role of nitrogen and Azospirillium elements in enhancing the vegetative growth of wheat plants which were reflected in plant height, spike length, 1000-grain weight, grain weight /spike and grain and straw yields/fad.

Table 1: Effect of fertilization treatments on yield components of wheat (data over two seasons).

Treatments	Plant height (cm)	Spike length (cm)	No. of spike/m^2	No. of spikelets/ spike (g)	Kernel weight/ spike (g)	1000-kernel weight (g)
T_1- Control (without N)	92.5 e	9.22 d	230 e	14.55 f	2.006 e	33.00 e
T_2- 100% mineral N	110.0 b	13.21 b	278 bc	20.45 bc	2.695 b	40.85 bc
T_3- *Azospirillum*	97.8 d	11.00 c	245 d	16.14 e	2.330 d	36.00 d
T_4- 1/4 mineral N + *Azospirillum*	98.2 d	11.50 c	250 d	18.45 d	2.432 cd	38.19 cd
T_5- 1/2 mineral N + *Azospirillum*	105.0 c	12.85 b	270 c	20.00 c	2.588 bc	39.30 bc
T_6- 3/4 mineral N + *Azospirillum*	111.4 b	13.23 b	280 b	21.15 b	2.711 b	41.22 b
T_7- 100% mineral N + *Azospirillum*	118.7 a	14.50 a	295 a	23.18 a	3.044 a	44.30 a

The same letters within columns means not significant differences at 5% level.

Table 2: Effect of fertilization treatments *on* yield of wheat (data over two seasons).

Treatments	Grain yield (t/ha)	Straw yield (t/ha)	Biological yield (t/ha)	Grain protein content (%)
T_1- Control (without N)	3.150 e	4.200 e	7.350 e	10.00 c
T_2- 100% mineral N	4.800 b	6.205 b	11.005 b	12.25 a
T_3- *Azospirillum*	3.775 d	4.800 d	8.575 d	11.03 b
T_4- 1/4 mineral N + *Azospirillum*	3.985 d	5.480 c	9.465 c	11.05 b
T_5- 1/2 mineral N + *Azospirillum*	4.400 c	5.665 c	10.065 c	11.25 b
T_6- 3/4 mineral N + *Azospirillum*	4.855 b	6.281 b	11.136 b	12.22 a
T_7- 100% mineral N + *Azospirillum*	5.390 a	6.885 a	12.275 a	12.35 a

The same letters within columns means not significant differences at 5% level.

References:

Abbasdokht, H. 2008. The study of Azotobacter chroococcum inoculation on yield and post harvest quality of wheat. International Meeting on Soil Land Management and Agroclimatology, Turkey, 885-889.

AOAC, 1995. Official Methods of Analysis. 12th ed. Association of Official Analysis Chemists, Washington, DC, USA.

Badr, A., Elham, O.M., Ibrahim, El-Kramany, M.F. 2009. Interaction effect of biological and organic fertilizers on yield and yield components of two wheat cultivars. Egypt. J. Agron., 31(1): 17-27.

Bahrani, A.J., Pourreza, Hagh Joo M. 2010. Response of Winter Wheat to Co-Inoculation with Azotobacter and Arbescular Mycorrhizal Fungi (AMF) under Different Sources of Nitrogen Fertilizer. American-Eurasian J. Agric. & Environ. Sci., 8 (1): 95-103.

Choudhury, A.T.M.A., Kennedy, I.R. 2004. Prospects and potentials for systems of biological nitrogen fixation in sustainable rice production. Biology and Fertility of Soils 39, 219–227.

El-Garhi, A.S., Atia, N.A., Sara Fouda, E.E. 2007. Effect of inoculating N-fixing bacteria (Cerealine) on wheat (*Triticum aestivum*, L) growth and nutrient content. Zagazig J. Agric. Res., 34(2): 249-273.

El-Sayed, M.Z., Abd El-Sattar, A.E., Basha, H.A., Abd El-Hammeed, I.M. 2005. Improvement of wheat productivity in newly reclaimed soil in Egypt. Annals UMCS, Sec. E. 60:113-121

Fayez, M., Emam, N.F., Makboul, H.E. 1985. The possible use of nitrogen fixing *Azospirilum* as biofertilizer for wheat plants. Egypt. J. Microbiol., 20 (2), 199-206.

Hafeez, F.Y., Hameed, S., Zaidi, A.H., Malik, K.A. 2002. Biofertilizers for Sustainable Agriculture. In: Techniques for Sustainable Agriculture (Azam, F., Iqbal. M.M., Inayatullah, C. and Malik, K.A., Editors), pp. 67-73. ISBN, NIAB, Faisalabad, Pakistan.

Kennedy, I.R., Choudhury, A.T.M.A., Kecskés, M.L. 2004. Non-symbiotic bacterial diazotrophs in cropfarming systems: can their potential for plant growth promotion be better exploited? Soil Biology and Biochemistry 36, 1229–1244.

Ozturk, A., Caglar, O. and Sahin, F. 2003. Yield response of wheat and barley to inoculation of plant growth promoting rhizobacteria at various levels of nitrogen fertilization. J. Plant Nutrition and Soil Sci. 166 (2): 262-266.

Rai, S.N., Caur, A.C. 1998. Characterization of *Azotobacter* Spp. And effect of *Azospirilum lipoferum* on the yield and N-Uptake of wheat crop, Plant and Soil, 109: 131-134.

Sharief, A.E., El-Kalla, S.E., Leilah, A.A., Mostafa, H.E.M. 1998. Response of wheat cultivars to nitrogen fertilizer levels and biological fertilization. J. Agric. Sci., 23(12):5807-5816. Mansoura Univ., Egypt.

Steel, R.G.D., Torrie, J.H. 1980. Principles and procedures of statistics, 2nd ed McGraw-Hill, New York.

Tawfik, M.M., Gomaa, A.M. 2005. Effect of organic and biofertilizers on the growth and yield of wheat plants Egypt. J. Agrci. Res., 2(2): 711-725.

Tilak, K.V.B.R. 1992. *Azospirillum brasilense* and *Azotobacter chrooccocum* inoculum effect of mayze and sorghum. Soil Bio. Biochem., 14: 417-418.

Effect of *Azospirillum* and nitrogen fertilizer rates on yield and yield components of bread wheat (Triticum astivium) under Sert conditions.

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Abstract

This investigation was conducted at El-Kortabia Project, Sert during two seasons 2009-2010 and 2010-2011 to study the effect of fertilization treatments as (T_1-Control(without nitrogen and uninoculated).T_2-100%mineral N (MN),T_3-Azospirillum,T_4-1/4 mineral N+Azospirillum,T_5-1/2mineral N+Azospirillum,T_6-3/4mineral N+Azospirillum,and T_7-100% mineral N+Azospirillum) on yield,and its components as well as grain protein content of bread wheat under Sert conditions. A randomized complete block design, with three replications, was used in this study.

All traits yield, yield components and grain protein content atwere significantly affected over the two seasons. T_7 (100% mineral N + *Azospirillum*) gave highest values of plant height, spike length, number of spike / m^2, number of spikelets/spike, kernel weight /spike, 1000-kernel weight, and grain, straw and biological yields as well as grain protein content. However, T_6 (3/4 mineral N + biofertilizer with *Azospirillum*) resulted also higher values for the grain, straw and biological yields and yield components comparing with T_2 (100% nitrogen and uninoculated) but the differences among the two treatments almost did not attain the statistical differences.

Accordingly, application of 100% or 75% from recommended mineral nitrogen with inoculation by *Azospirillum lipoferum* might be recommended for increasing the productivity of wheat under the conditions of this study .

Key words: biofertilizers; *Azospirillum;* grain yield, grain protein content.

Introduction

The utilization of biological nitrogen fixation technology can decrease the use of mineral N, prevent the depletion of soil organic matter and reduce environmental pollution to a considerable extent (Choudhury and Kennedy 2004 and Kennedy et al. 2004). Also, Use of biofertilizers on the soils has decreased the pH, which had led to increased availability of trace elements that enhance plant growth. Bio-fertilizers are eco-friendly and have been proved to be