EFFECT OF SOME MINERAL AND BIO FERTILIZATION TREATMENTS ON YIELD AND YIELD COMPONENTS OF BREAD WHEAT UNDER TWO SEEDING RATES

By

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ABSTRACT

Two field experiments were carried out during 2013/2014 and 2014/2015 winter seasons at Agric. Res. Stat., Giza, Fac. Agric., Cairo Univ., Egypt to study the effect of two seeding rates (50 and 65 kg wheat grains feddan^{-1}) and seven combination treatments of NPK fertilizer with Cerealein inoculation (T_1: Control, T_2: 50kg N +30kg P+24kg K; T_3: 65kg N +37.5kg P+36kg K ; T_4: 80kg N +45kg P+48kg K; T_5: T_2 + 0.6 kg Cerealein ; T_6: T_3 + 0.6 kg Cerealein and T_7: T_4 + 0.6 kg Cerealein) and their interaction on wheat growth , grain yield and its components**.** A split plot arrangement in a Randomized Complete Blocks Design with three replications was used. Seeding rates were randomly assigned for main plots while, fertilizer treatments were randomly arranged for sub plots. Results showed that seeding rate had not significant effect on all yield attributes except, no. of shoots m^{-2}and number of grains /spick in 2013/2014 season, number of shoots/ m^2, number of spikes m^{-2},straw yield feddan^{-1} and harvest index (%) in 2014/2015 season. Chemical fertilizers (NPK) with bio-fertilizer (Cerealein) combinationhad significanteffect on yield and its components in both seasons except, spike length were no significant affected in both seasons. Grain yield and its components i.e. plant height, number of tillers m^{-2}, number of spikes m^{-2}, number of grains spike^{-1},grains weight spike^{-1}, 1000-grain weight, grain, straw and biological yields were significantly ***increased*** by adding bio-fertilizer compared to control.T_3 + 0.6 kg Cerealeinresulted in significant increment in plant height, number of tillers m^{-2}, number of spikes m^{-2}, number of grains spike^{-1},grains weight spike^{-1}, 1000-grain weight, grain, straw and biological yields and harvest index compared with other combination treatments. The interaction between seeding rate and fertilizers treatments was significant for all characters under study. The highest grain yield was recorded by sowing 50 kg wheat grains feddan^{-1} with adding 65kg N + 37.5 kg P + 36 kg K + 0.6 kg cerealein).

Key words:Wheat, bio-fertilizer, chemical fertilization, Cerealein , seeding rates, grain yield and heat use efficiency

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دكتور : ربيع محمد عبدالسلام
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المستخلص العربي

أجريت تجربتان حقليتان خلال موسمى الزراعة ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥ فى محطة التجارب والبحوث الزراعية بالجيزة ، كلية الزراعة ، جامعة القاهرة لدراسة تأثير معدلين تقاوى (٥٠ و ٦٥ كجم /فدان) و سبعة معدلات من الآسمدة المعدنية والحيوية على محصول الحبوب ومكوناته بيانها كالتالى :

١) بدون تسميد (معاملة مقارنة)
٢) ٥٠ كجم نيتروجين+ ٣٠ كجم فوسفور + ٢٤ كجم بوتاسيوم
٣) ٦٥ كجم نيتروجين + ٣٧,٥ كجم فوسفور + ٣٦ كجم بوتاسيوم
٤) ٨٠ كجم نيتروجين + ٤٥ كجم فوسفور + ٤٨ كجم بوتاسيوم
٥) ٥٠كجم نيتروجين + ٣٠ كجم فوسفور + ٢٤ كجم بوتاسيوم + ٠،٦ كجم سيريالين
٦) ٦٥ كجم نيتروجين + ٣٧,٥ كجم فوسفور + ٣٦ كجم بوتاسيوم + ٠،٦ كجم سيريالين
٧) ٨٠ كجم نيتروجين + ٤٥ كجم فوسفور + ٤٨ كجم بوتاسيوم + ٠،٦ كجم سيريالين

النتائج المتحصل أظهرت بأن معدلى التقاوى (٥٠ كجم ، ٦٥ كجم حبوب قمح للفدان) تحت الإختبار لم تختلف معنويا فى تأثيرها على صفات طول النبات عند الحصاد وعدد السنابل /م٢ وطول السنبلة ووزن الحبوب فى السنبلة وزن الآلف حبة ومحصول الحبوب ومحصول القش والمحصول البيولوجى ودليل الحصاد فى الموسم الأول ٢٠١٣/٢٠١٤ بينما فى الموسم الثانى ٢٠١٤/٢٠١٥ تأثرت صفات المحصول ومكوناته عدا صفة ارتفاع النبات وعدد الحبوب فى السنبلة وطول السنبلة عدد الحبوب فى السنبلة ووزن حبوب السنبلة ووزن الألف حبة ومحصول الحبوب للفدان والمحصول البيولوجى . ومن هذه النتائج يمكن التوصية بأن أنسب معدل تقاوى هو ٥٠ كجم حبوب للفدان.

كان لمعدلات التسميد المعدنى مع إضافة السماد الحيوى تأثيرا معنويا على صفات المحصول ومكوناته فى موسمى الدراسة ٢٠١٣/٢٠١٤ و ٢٠١٤/٢٠١٥ حيث أدت زيادة معدلات التسميد المعدنى مع إضافة السماد الحيوى "السريالين بمعدل ٠،٦ كجم للفدان " إلى زيادة معنوية فى طول النبات وعدد الأفرع وعدد السنابل /م٢ وعدد حبوب السنبلة ووزن حبوب السنبلة ووزن الألف حبة ومحصول الحبوب ومحصول القش والمحصول البيووجى *ودليل* الحصاد. كان أفضل معدل تسميد هو ٦٥ كجم نيتروجين+ ٣٧,٥ كجم فوسفور + ٣٦ كجم بوتاسيوم + ٠،٦ كجم للفدان سيريالين أعطى أعلى محصول حبوب وأعلى محصول قش وأعلى محصول بيولوجى للفدان فى كلا موسمى الدراسة مقارنة بباقى معدلات التسميد المعدنى و الحيوي.

ويمكن الإستنتاج من هذه الدراسة أنه بزراعة الصنف سدس ١٣ بمعدل ٥٠ كجم /فدان وإضافة السماد المعدنى بمعدل ٦٥ كجم نيتروجين + ٣٧,٥ كجم فوسفور + ٣٦ كجم بوتاسيوم مع إضافة اللقاح البكتيرى سيريالين بمعدل ٠،٦ كجم للفدان أمكن الحصول على أعلى محصول من الحبوب تحت ظروف التجربه.

الكلمات الدالة : القمح، التسميد الحيوى، التسميد المعدنى، معدلات التقاوى ، معدل النمو النسبى محصول الحبوب.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is the important cereal crops as the main food stable for the Egyptian public. In Egypt, wheat provides 37%of the total calories for the people and 40% of protein in the Egyptian diet. Wheat straws represent a major source of animal feeding. The area under wheat cultivation in Egypt during 2015/2016 season was 3.258 million faddan (4200m^2) produced 9 million tons. The yield per faddan was 2.763 kg (FAOSTAT, 2017). Moreover, Egypt is also the world's first wheat importer, because the local production of wheat does not fill the gap with the local consumption. It's not facility possible to increase the agricultural area of wheat, subsequently efforts are focused on increasing the yield per unit area.

Improving the productivity of this crop in Egypt is a main task due to its short supply which mandated importing about 50%of the needed wheat grains from outside the country. Plant density is one of the major factors determining the ability of the crop to take full advantage of resources. Optimum plant density varies greatly according to climatic conditions, soil, sowing time and varieties. Optimum seed rate is an important requirement for economic yield from an area. Greater plant population is attained by higher seed rate but it gives poor growth and development of that crop. Use of low seed rate does not produce required number of plants in the field that could efficiently utilize light, water and nutrients and thus resulted in low yield. Use of extensive seed rate may cause lodging, exhaustion of nutrients and water before maturity and may provide a favorable

condition for insects and diseases. Thus planting of wheat at optimum seed rate is very important for economic yield (Tanveer *et al*., 2009).

N, P and K are required in enhancing the natural ability of plants to resist stress from drought and cold, pests and diseases (Tsai *et al.*, 2007).

Beneficial role of bio fertilizers are evident to rationalize the use of mineral fertilizers and add an effective mean for sustainable cultivation of the land, less environmental pollution, diminishing farming expenses, enhancing crop productivity by providing them with a readily nutritive elements and growth promoting substances. Among the micro-organisms used for wheat is *Azotobacter* spp. (*Azotobacter* is a heterotrophic free living nitrogen fixing bacterium). Besides N fixation, *Azotobacter* spp. synthesis and secret considerable amounts of biological active substances like B vitamins, biotin and phytohormons. In addition, *Azotobacter* spp. can also produce antifungal compounds to fight against many plant pathogens and decrease growth and yield.

The objectives of this study was to study growth, productivity of Seds 13 wheat cultivar sowed with two seeding rate under integrated mineral fertilization (nitrogen, phosphorus and potassium) levels with or without bio-fertilizer (Cerealein).

REVIEW OF LITERATURE

The literature of this study will be reviewed under the following topics:

1. Effect of seeding rate

Increasing the productivity of field crops could be achieved by maximizing the amount of radiation they intercept. Interception of radiation on leaf surface can be manipulated for their maximum by many factors one of them number of sown seeds per square meter. Seeding rate influence the number of spikes per unite area, number of grains per spike, individual grain weight and consequently grain yield of wheat per unite area. Optimum seeding rate varies from environment to environment and responses to seeding rate depend on wheat variety, fertility of soil, sowing date and other growing factors. Yield potential per unite area of any wheat variety can be improved by optimizing the seeding rate.

Donaldson *et al.* (2001) at Lind, Washington stated that for both grain and straw of winter wheat production, the effects of sowing rate was depended on the year in which the crop was grown, as indicated by the significant year × sowing rate interaction. In all years, the low sowing rate resulted in the lowest straw production. Maximum grain yield was obtained from the low and medium sowing rate in the first season and from the medium and high rate in the second and the third seasons.

Gooding *et al.*(2002) in United Kingdom studied that the effect of five seeding rate (50, 100, 200, 350 and 600 grains/m^2) on spikes

number/plant, grains number/plant, 1000-grain weight, grain yield/ha, straw yield/ha and above ground harvest index (%) of two spring wheat varieties. They found that grain yield followed a parabolic response seed rate with apparent reductions in yield at very high seed rate (600 grains/m^2). Effects of seed rate on 1000-grain weight were small and inconsistent. Harvest index decreased linearly with seeding rate. Plants compensated for low population densities by increased production and survival of tillers and, to a lesser extent and increased grain numbers per spike.

Wajid *et al.* (2004) at semi-arid condition in Pakistan found that highly significantly differences between three seeding rate (200, 300 and 400 plants m^{-2}) were recorded in its effect on dry matter production and wheat grain yield/ha. Results showed that the highest yields were obtained from plant density of 300 plants m^{-2}.

LIoveras *et al.* (2004) at Ebro valley, Spain found that environment (site - year) significantly influenced wheat grain yield. Plant density affected grain yield and yield components, but its effects varied according to the environment. The results also show that, in the irrigated Mediterranean conditions of the experiments, the average response curves for all wheat varieties in each environment fit significantly well to straight lines in three of the four trials. Only in one environment with an excellent growing season the yield response to plant density show a quadratic response which is frequently reported in high-producing areas. The plant densities giving the highest wheat yields are at least 400 to 500 plants m^{-2} for the most studied varieties.

Number of spikes per square meter increased linearly with increasing seeding rate for all tested varieties. Number of grains per spike significantly decreased with increasing plant density, which is a production of 24% more grains per spike at the lowest densities. The plant densities giving the highest grain yields are at least 400 to 500 plants m^{-2}.

Oztrurk *et al.*(2006) at Erzurum, Turkey reported that increasing seeding rate up to 625 seeds m^{-2} for winter sowing and 575 seeds m^{-2} for freezing and spring sowing increased spikes per square meter and wheat grain yield/ha. The highest seeding rate produced grain yields that were 49.3% and 35.4 % higher than the lowest rate (325 seeds m^{-2}). The higher grain yield of higher seeding rate was associated with higher spike number per square meter

Chengci *et al.* (2008) studied the effect of four seeding rate (108, 215, 323 and 430 seeds/m^2) on grain yield of hard red spring wheat (*Triticum aestivum* L.). They reported that grain yield was significantly affected by seeding rate. Grain yield increased with increasing seeding rate from 108 to 215 grains/m^2 No further yield increase was observed at seeding rate above 215 seeds /m^2.

Malik *et al.* (2009) evaluated the effect of different seeding rates, i.e. 125, 150 and 175 kg grains/ha on productivity of wheat. They found that there was significant variation in number of tillers/m^2 among seeding rates. The maximum number of tillers/m^2 and 1000-grain weight was recorded at sowing 175 kg grains/ha compared with other seeding rates. On the other hand, there was no significant

differences between seeding rate in number of grains/spike and grain yield/ha.

Tanveer *et al.* (2009) at Park Road in Islamabad under rained conditions studied the effect of different seeding rates (80,100, 120 and 140 kg seeds/ha) on performance of different wheat varieties and lines. They reported that no significant differences in grain yields/ha were recorded due to the different seed rates.

Soomoro *et al.* (2009) at Balochistan in Pakistan found that sowing wheat with 175 kg seeds/ha had significant effect and produced greatest plant height, number of tillers/m^2, number of spikes/m^2, number of grains/spike, 1000-grain weight , straw yield/ha and grain yield/ha followed by 150 kg grain/ha and 125kg grain/ha, respectively.

Ali *et al.* (2010) studied the impact of various seed rates (125,150,175 and 200 kg grains/ha) on wheat crop. They found that seeding rate had a significant effect on all yield attributes, except straw yield. Moreover, sowing wheat with 150 kg grains/ha produced the greatest grain yield (4.13 t/ha) compared with other seeding rates.

Iqtidar *et al.* (2010) reported that the higher wheat seeding rate (200 kg grains/ha) produced the highest values of all studied wheat traits compared with other seeding rates (50, 100 and 150 kg grains/ha).

Jammati *et al.* (2010) found that increasing wheat plant density from 300 plants/m^2 to 400 plants/m^2 caused an increase in spikes no./m^2 and grain yield/ha of wheat crop.

Kivi *et al.* (2010) at Ardabil, Iran tested that the effect of three plant densities (300, 350 and 400 grains/m^2) on durum wheat yield and