WHEAT PRODUCTIVITY AS AFFECTED BY VARIETIES, NITROGEN, ORGANIC AND BIO-FERTILIZERS UNDER NEW RECLAIMED SOIL CONDITION.

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ABSTRACT

Two field experiments were carried out in the Experimental Farm, of the Faculty of Agriculture, Fayoum University on Sandy Loam soil during 2011 / 2012 and 2012 / 2013 seasons to study the effects of two organic manure levels i.e. (15 and 30 m³ / fed.), bio-fertilizer (Azotobacter who was inoculation the seeds) and three levels of nitrogen fertilizer .[100% (75 kg N / fed.) & 50 % (37.5 kg N / fed.) and 25 % (18.75 kg N / fed.) ] of Urea ( 46 % N) and their combinations on productivity of two wheat cultivars i.e. (Sakha 93 (V1) &Sakha 94 (v2)).The treatments were set in Randomized Complete Block Design (RCBD) in factorial arrangement with three replications.

Significant effect for wheat varieties were obtained on plant height (cm), in the 1st season and on total protein percentage in both seasons but was insignificantly on other traits .The superiority was for Sakha 94 in most characters .

Fertilizer treatments was significantly effect on all traits in both season except plant height , number of spike / plant,1000-grain weight in second season and harvest index% in first season .F3 ( 30 m³ / fed. organic manure + bio – fertilizer + 50 % ( 37.5 kg N / fed.)) treatment gave the highest values followed by F4 (30 m³ / fed. organic manure + bio – fertilizer + 25 % (18.75 kg N / fed.)) or F5 (30 m³ / fed. organic manure + 50 % (37.5 kg N / fed.)) treatments .

Interaction between varieties and fertilizer treatments was significantly effect on number of spike / plant and weight of grains / spike in both seasons and on grain yield (ton / fed.) and total protein (%) in 1st and number of grains / spike in second season only but was insignificantly on plant height (cm), 1000-grain weight, and harvest index (%) in both seasons .

Results of stepwise regression revealed that both the harvest index, 1000 grains weight, number of grains/ spike and plant height were causes high grains yield genotypes in wheat programs.

By using organic fertilizer and / or bio-fertilizer with half dose of mineral fertilizer it could be increased in plant growth and yield . Besides, using bio-fertilizers that contain different microbial strains had led to decrease in the use of chemical fertilizers and had provided height products free of harmful agrochemicals for human safety.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops in Egypt. Nowadays, major efforts have been made to minimize the gap between production and consumption. Production of wheat grains in Egypt is not enough to achieve self-sufficiency due to the high consumption rate per capita and high increasing rate in population every year, its cultivated area is about 3.1 million feddan. The local production is about 9.5 million ton however; it covers less than 60% of local consumption (FAO, 2013).

Wheat is one of the cheapest sources of carbohydrate and also contains a considerable amount of protein, minerals and vitamins.

There are many factors, which can help to increase wheat production of which the use modern varieties and judicious fertilization are important. It is well recognized that crop productivity depends on adequate plant nutrient and organic matter content of the soil.

Manure play an important role in improving physical, chemical and biological properties of soils.

Due to low nutrient content and slow acting nature, organic manure alone may fail to meet the high nutritional requirements of crops.

Some of the plant nutrients, when added to the soil in inorganic form, have low efficiency as compared with the effect of the same nutrients applied along with organic manure.

Thus, organic manure reduce the application rate of chemical fertilizers and also help to solve the problem of micro – nutrient deficiency in the soil.

Azotobacter is a heterotrophic, aerobic micro-organism, fixing nitrogen as non-symbiotix which is a good source of bio-fertilizer to improve the growth and yield of cereals and many other crops.

Fertilizer N and organic N have their own merits and demerits and the drawbacks associated with either sources of these plant nutrients are often overcome when these are mixed in judicious combinations.

In additional, stepwise regression is a method that is used to estimate the value of a quantitative variable regarding its relation with one or some other quantitative variables. This relation is such that it is possible to predict other changes using one variable. Many investigators have used this technique on wheat such as Mohamed (1999), Pržulj and Momcilovic (2011), Soleymanifard et al. (2012).

The objective of the present investigation was to study the effect of mineral (urea), organic N and bio-fertilizer (Azotobacter) applied alone and in various combinations on productivity for two wheat cultivars, so as to select the most appropriate combinations doses of these fertilizers in wheat production saving as much fertilizer N as possible and to determine effective traits on yield under newly reclaimed soil.

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MATERIALS AND METHODS

Experimental Procedures. Two field experiments were conducted at the Experimental Farm of the Faculty of Agriculture Fayoum, University in Demo Farm, during 2011/2012 and 2012/2013 seasons. The experiments were carried out to study the effect of two organic manure and bio-fertilizer as a total or partial replacement of nitrogen fertilizer under new reclaimed soil conditions in two bread wheat cultivars. A factorial experiment based on completely randomized design with three replications was used. The studied factors were two bread wheat varieties i.e. Sakha 93 (V1) and Sakha 94 (V2) were obtained from Field Crop Research Institute, Agricultural Research Center, Giza, Egypt, and Seven different combination of fertilizer treatments between organic manure, mineral and bio-fertilizer (Azotobacter was inoculated the seeds). The combination treatments were Control= 75 kg N/fed (F1), 30 m³/fed organic manure + bio-fertilizer (F2), 30 m³/fed organic manure + bio-fertilizer + 37.5 kg N/fed. (F3), 30 m³/fed organic manure + bio-fertilizer + 18.75 kg N/fed. (F4), 30 m³/fed organic manure + 37.5 kg N/fed. (F5) and bio-fertilizer + 37.5 kg N/fed (F7). A Randomized complete block design in factorial arrangement with three replications was used. The size of each plot was 10.5 m² (3.5 m long and 3.0 m wide).

Agronomic Traits. Plant height, number of spike/plant, number of grains/spike, Weight of grains/spike, 1000-grain weight, Harvest index, grain yield/fed. and protein percentage (Pro.%) were determined after the plants were harvested. protein percentage measured by near infrared analyzer according to Granland and Zimmerman (1975).

Statistical Analysis. All the data collected of wheat at the two seasons were statistically analyzed according to the procedures cut lined by Snedecor and Cochran (1980). To compare treatment means, LSD at 5 % level of significance was used according to Stell and Torrie (1960). The stepwise regression analysis was also carried out for the data obtained to test the significance of the independent variables affecting the grain yield.

RESULTS AND DISCUSSION

Effect of varieties

The data illustrated in table (1) show the effect of wheat varieties and treatments of fertilizer. Plant height was significantly in first season only and protein percentage was significantly in both seasons, whereas, there was no significant effect of varieties on other studied traits in both seasons. Sakha 94 variety superiority on Sakha 93 for all studied traits except for 1000-grain weight in both seasons and harvest index and grain yield in 2nd season. This may be due to the differences in genetic construction, these results are in generally agreement with those obtained by, Ali et al (2004), Badran (2009), Mattas et al (2011), Woyema et al (2012), Zaki et al (2012), Abd El-Razek and El-Sheshtawy (2013), Bithy (2014), Radwan et al (2014), Lemma

Effect of treatments of fertilizer:

The results presented in Table 1, clearly, indicated that there were significant on all studied traits in both seasons except plant height, number of spike/plant and 1000-grains weight in the 1st season and harvest index in the 2nd season. The tallest plants were obtained from F3 treatment, and F4 treatment followed by F2 treatment gave the largest number of spike/plant (5.17 and 5.00, respectively). The two treatments F3 and F4 gave higher number of grains per spike (63.67, 63.33) in 1st season and (68.67, 68.50) in 2nd season and weight of grains/spike in the second season (3.53,3.17) respectively, also F7 and F3 followed by F3 treatment (in 1st season) gave higher weight of grains per spike than the other fertilizer treatments. F3 treatment alone gave higher weight for 1000-weight (48.03g), grains yield/fed (2.23 and 2.59t in 1st and 2nd seasons, respectively) and high percentage for harvest index (44.90% in 2nd season) and protein percentage (14.38 and 14.79% in 1st and 2nd seasons, respectively) than the other fertilizer treatments. It's may be due to the organic manure, bio-fertilizer and nitrogen fertilizer increased mineral contents of soil and adjusted physical characters of soil to good conditions, this finding are conceded with those obtained by Abraham and Lal (2004), El Gizawy (2009), Shah et al (2010), Hammad et al (2011), Agamy et al (2012), Mohammed et al (2012), Zaki et al (2012), El-Nady and Borham (2013) and Esmailpour et al (2013).

Effect of the interaction:

The interaction between wheat varieties and fertilizer treatments in table (2) was significant in 2011/2012 season only in grain yield (two varieties Sakha 93 and Sakha 94 remained at par under F3 treatment gave highest yield per feddan) and in total protein (%) (Sakha 94 variety (V2) when treated by F3 treatment gave the highest grain protein percentage) and significant in two seasons in number of spike/plant and weight of grains / spike , the highest number of spike/plant resulted from the variety Sakha 93(V1) when fertilized with F2 treatment in first season and Sakha 94(V2) when fertilized with F5 or f4 treatment in second season ,while,v1f1 interaction gave the highest weight of grains / spike in first season also the same variety followed by v2 under f5 treatment gave the highest weight in second season. On the other hand number of grains/spike was significant in the second season only, v1f5 and v2f4 interaction gave largest number (70.33,69.33) respectively. But was not significant in both seasons in 1000 – grains weight (g) and harvest index %, this finding are conceded with those obtained by Ali et al (2004), Woyema et al (2012), Zaki et al (2012), Abd El – Razek and El – Sheshtawy (2013), Bithy (2014) and Radwan et al (2014).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>plant height (cm)</th>
<th>No. of spike/plant</th>
<th>No. of grains/spike</th>
<th>Weight of 1000-grains (g)</th>
<th>Harvest index (%)</th>
<th>Grain yield (ton/fed.)</th>
<th>Protein %</th>
</tr>
</thead>
<tbody>
<tr>
<td>V$_n$Sakha94</td>
<td>77.19</td>
<td>85.95</td>
<td>4.62</td>
<td>5.10</td>
<td>59.76</td>
<td>63.90</td>
<td>2.93</td>
</tr>
<tr>
<td>V$_n$Sakha94</td>
<td>84.48</td>
<td>87.29</td>
<td>4.81</td>
<td>5.19</td>
<td>59.71</td>
<td>64.24</td>
<td>3.02</td>
</tr>
<tr>
<td>LSD$_{df}$ for V</td>
<td>3.99</td>
<td>n.s</td>
<td>n.s</td>
<td>n.s</td>
<td>n.s</td>
<td>n.s</td>
<td>n.s</td>
</tr>
</tbody>
</table>

Table (2): Effect of the interaction between wheat varieties and fertilizer treatments on yield and some yield traits in 2011/2012 and 2012/2013 seasons.

<table>
<thead>
<tr>
<th>Fertilizer (F)</th>
<th>plant height (cm)</th>
<th>No. of spike/plant</th>
<th>No. of grains/spike</th>
<th>Weight of 1000-grains (g)</th>
<th>Harvest index (%)</th>
<th>Grain yield (ton/fed.)</th>
<th>Protein %</th>
</tr>
</thead>
<tbody>
<tr>
<td>F$_1$</td>
<td>76.00</td>
<td>84.67</td>
<td>4.83</td>
<td>4.83</td>
<td>60.67</td>
<td>62.00</td>
<td>3.18</td>
</tr>
</tbody>
</table>

LSD$_{df}$ for F$_1$ | 3.44 | n.s | 0.58 | n.s | 2.49 | 3.03 | 0.209 | 0.220 | 2.01 | n.s | 2.80 | 0.31 | 0.26 | 0.40 | 0.41 |

F$_2$=Mineral fertilizer 75 N (Control), F$_3$=Organic 30 m + Bio-fertilizer, F$_4$=Organic 30 m + Bio-fertilizer + 37.5 N, F$_5$=Organic 30 m + Bio-fertilizer + 18.75 N, F$_6$=Organic 30 m + 37.5 N, F$_7$=Organic 15 m + 37.5 N, F$_8$=Bio-fertilizer + 37.5 N, I$^1$ = 1st season (2011/2012), I$^2$ = 2nd season (2012/2013) and n.s= no significant.

Stepwise regression

Stepwise regression is a semi-automated process of building a model by successively adding or removing variables based solely on the t-statistics of their estimated coefficients. In order to remove effect of non-effective characteristics in regression model on grain yield, stepwise regression was used. Results of stepwise regression (Table 3) showed that the harvest index Fayoum J. Agric. Res. & Dev., Vol. 31, No.2, July, 2017
Abd El-Samie, F.S., (HI). 1000 grains weight (SI), number of grains/ spike (NGS) and plant height (PLH) with R square of 69.35%, had justified the maximum of yield changes. Therefore the following equation can be obtained:

\[
\text{Grain yield (GY)} = -2.049 + 0.071\text{HI} + 0.029\text{SI} - 0.012\text{NG} + \text{0.008PLH}
\]

Existence of significant R square in a successful regression equation indicates the effectiveness of these traits to increase grain yield. Leilah and Al-Khateeb (2005), Ahmadizadeh et al. (2011) and Zarei et al. (2011) reported importance of Harvest index to grain yield. However, obtained results were in the opposite of those of Soleymanifard et al. (2012), who found that 75% of variation in grain yield is explained by 1000 grain weight and plant height traits. With respect to the positive and significant regression coefficients of harvest index, it could be stated that increasing the amount of these traits will cause an increase in the yield. Thus, in this study, harvest index trait had the most effect on the grain performance in newly reclaimed soil.

**Table (3):** Regression coefficient, standard error, t-value and probability of the accepted variables by the stepwise procedure to predict grain yield.

<table>
<thead>
<tr>
<th>Traits or variable</th>
<th>B</th>
<th>SE</th>
<th>t</th>
<th>Sig</th>
<th>VIF</th>
<th>R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plant height</td>
<td>0.008</td>
<td>0.004</td>
<td>1.880</td>
<td>0.064</td>
<td>1.200</td>
<td>1.37%</td>
</tr>
<tr>
<td>No. of grains /spike</td>
<td>-0.012</td>
<td>0.006</td>
<td>-2.020</td>
<td>0.047</td>
<td>1.230</td>
<td>0.91%</td>
</tr>
<tr>
<td>1000-grains weight</td>
<td>0.029</td>
<td>0.011</td>
<td>2.590</td>
<td>0.011</td>
<td>1.070</td>
<td>3.20%</td>
</tr>
<tr>
<td>Harvest index</td>
<td>0.071</td>
<td>0.006</td>
<td>11.110</td>
<td>0.000</td>
<td>1.230</td>
<td>63.87%</td>
</tr>
</tbody>
</table>

B: Regression coefficient, SE: Standard error, t: Student t-value and Sig: Probability. \( R^2 = 69.35\% \), Adj \( R^2 = 67.80\% \), Predicted \( R^2 = 65.83\% \) and Constant = -2.049.

**REFERENCES**


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تأثير الأصناف والتمسيد المعدني والعضوي على التتابع محصول الفولع تحت ظروف الأراضي الجديدة

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أقيمت تجربتان بحثيتان بمزرعة كلية الزراعة - جامعة الفيوم - منطقة دمياط - محافظة الفيوم خلال موسمين 2011 / 2013 وذلك لدراسة تأثير مستويات من السماد العضوي (5 و 20 و 40%) والسماد الحيوي (1% من التسميات ببكتريا الأتروباكتر) قبل الزراعة وثلاث مستويات للسماد المعدني (50% (10 مجم/نفadan) و 5% (7.5 مجم/نفadan) و 2.5%) (5 كجم/نفadan) من سماد البوريدا 4% N على انتاجية صنفين من الفول (سما 93 وسماء 94) تحت ظروف الأراضي حديثة الاستصلاح، وتم ترتيب المعاملات في تجربة عاملية في تصميم قطعات كاملة عشوائية في ثلاث مكررات.

أثرت الأصناف تأثيرًا معرفيًا على صفة محصول النبات (صم) في الموسم الأول ونسبة الزيوت في الفول في كل المعاملات، وذلك غير معنويًا تأثيرًا على باقي الصنفين في الموسم الأول.

وظهرت معاملة السماد الطبيعي تأثيرًا معرفيًا على كل الصنفين في المعاملات، وكم عدا صفة ارتفاع النباتات (صم) وعدد السناب على النبات وزن الألف حبة في الموسم الثاني ودليل الحصاد للمؤسسة.

وتوزع تأثير المعاملة الثالثة (45% عضوي + 45% حيوي + 10% مزخري) الموصى بها أعلى القيم في جميع المعاملات، ودائمًا، وصلت معاملة الفوائض المذكورة (30% عضوي + 30% حيوي + 25% مزخري) الموصى بها في جميع الصنفين في المعاملات.

وأظهرت نتائج تحليل الانحدار متعدد المراحل ان صفات دليل الحصاد ودليل الحجاب وزن 1000 حبة وعدد سنابات وطول النباتات بالتزابغ هي الاصناف مساويا في المحصول العالمي للفول.

وفي النهاية، باستخدام السماد العضوي مع أو بدون السماد الحيوي مع نصف الكمية الموصى بها من السماد المعدني أو بعدة المراحل من سماد النبات، يظهر زواج ذلك في نمو النباتات، ويعيين زاد المحمولة، وذات كفاءة المحمولة، ويسهم المنتج الذي يكون آخر الحياة الأنسان، وأيضًا إذا محد من تلوث البيئة بقليل التكاليف المستخدمة.