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Behavior of some Bread Wheat Genotypes under Different Planting Dates and Nitrogen Fertilizer Levels in Sohag Governorate

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Abstract

Two field experiments were conducted in two successive seasons of 2015/2016 and 2016/2017 at the Research Farm Al-Kawthar, Faculty of Agriculture, Sohag University, to determine the effect of two planting dates (15 November and10 December) and three nitrogen fertilizer levels (50, 75 and 100 kg N/fed.) on yield and its components of four bread wheat genotypes (Sids 12, Giza 168, NGB 6404 and NGB 10893). A randomized complete block design (RCBD) in split- split plot with four replications was used. Data indicated that the planting dates were significantly effects on all studied traits except spike length and straw yield in both seasons, as well as nitrogen fertilizer levels and genotypes had significantly effect on the all studied traits; plant height (cm), spike length (cm), 1000-grain weight (g), grain yield (ard./fed.), biological yield (ton/fed.), straw yield (ton/fed.) and harvest index(%) in the both seasons. Increasing N up to 100 kg/fed increased yield and its attributes of wheat in both growing seasons except plant height (cm), spike length (cm) and harvest index (%). Sids 12 and NGB 10893 genotypes produced the highest values of grain yield compared to other genotypes in both seasons. Moreover, NGB 10893 accession produced the maximum values of spike length (cm) and1000-grain weight (g) in both seasons, while NGB 6404 accession produced the tallest plants. Late planting (10 December) increased significantly plant height (cm), spike length (cm), 1000-grain weight, grain yield (ard./fed.), biological and straw yields (ton/fed.).In general the highest grain yields (21.59 and 21.04 ard./fed.) were obtained by Sids 12 genotype when planted in 10 December and application of 100 kg N/fed., and NGB 10893 genotype when planted in 10 December and fertilized with 75kg N/fed. interaction treatments, respectively.

Keywords: *Wheat genotypes, plantingdates, nitrogen fertilizer levels and grain yield.*

Introduction

Wheat is the most important strategic commodity for the populations all over the world and comes at the first order in Egypt, not only for human food but also for animal feeding. Wheat is the main winter cereal crop in Egypt and is widely distributed all over the country. The cultivated area (3.47 million feddans) in 2014/2015 season with an average grain yield of 18.46 (ard./fed). Although, there was a good progress towards increasing the total wheat yield in Egypt in last year's still there is a big gap between the consumption and local production (32 %). The local production is about 9.61 million tons.

Nitrogen fertilizer plays a direct effect on growth behavior and yield quality, since nitrogen is the element which stimulates above-ground growth and produces the rich, green color characteristic of healthy plant and increases the protein percentage.

Ali, Amal *et al* (2016) reported that increasing N fertilization level from 95.2 to 190.4 kg N/ha significantly increased all phonological traits, grain yield and its components and grain protein content of some durum and bread wheat varieties.

Sowing date is an important factor that affects phenophases and grain yield and its components of wheat (Kiss *et al.,* 2013). Longer vegetative growth period due to sowing at optimal date, resulted in higher radiation use efficiency and better dry matter mobilization and higher values for grain yield and its components (Sun *et al*., 2013; Eslami *et al.,* 2014 and Anwar *et al*., 2015). Sowing date may, alsohave an impact on quality characters of wheat especially protein content. Gheith *et al*.(2013) studied the response of some bread wheat genotypes during 2011/2013 years and he concluded that all studied genotypes have been superior in early sowing dates (25 Nov.), while late sowing dates (10 and 25 Dec.) and low nitrogen application had significantly declined yielding capacity of wheat genotypes. Rising temperatures in recent years due to global climate change affect the growth and productivity of grain crops, especially wheat crop. This study aimed to determine the optimal planting dates and nitrogen fertilizer levels of some bread wheat genotypes.

Materials and Methods

To examine the response of wheat grain yield and its attributes to planting dates and nitrogen fertilization on four bread wheat genotypes Sids 12 and Giza 168 (Egyptian varieties) in addition NGB 6404 and NGB 10893 accessions (their seeds were imported in 2010 from Nordic Genetic Resource Center (Nord Gen) then, after adapted under Sohag conditions) were sown in two planting dates (15thNovember and10th December).Three nitrogen levels 50, 75 and 100 kg N/fed., were used during 2015/2016 and 2016/2017 winter seasons.

A randomized complete block design (RCBD) in split-split-plot with four replications was used. The bread wheat genotypes and the treatments were distributed randomly as following: 1) Planting dates were placed in the main plots. 2) The genotypes were laid out in the sub-plots. 3) The nitrogen fertilizer levels were fixed in the smallest plots, where the plots area was 10.5 m^2 (3.5 m length x 3.0 m width), includingof15 rows with 20 cm apart between them.

Seeding rate was used as recommended (60 kg/fed.). Ammonium nitrate (33.5% N) was used as source of nitrogen fertilizer, and the treatments applied in three splits each, 20, 40 and 40% at sowing, first irrigation and 30 days later, respectively. The experiment soil was sandy-clay texture, with pH 7.6, electrical conductivity 0.60 dS m^{-1}, total nitrogen 1.68 g/kg and organic matter 2.61%.All other agriculture practices were carried out as recommended.

Data recorded:

Plant height and yield components (spike length, 1000-grain weight and harvest index) were recorded as recommended procedure. Biological and grain yields were recorded by weighing all above ground dry matter of each plot, then grain separating and weighing in kilograms and converted into ton and ard./fed., respectively.

Statistical analysis:

The data was statistically analyzed each season separately by Proc GLM procedure (SAS Version 9.1, SAS Institute 2003) described by CO-Stat (2004) as well as the least significant differences (LSD) test among the means of factor levels and their interactions at probability level at 5% was used according to Gomez and Gomez 1984.

Results and discussion

The grain yield and its component of wheat genotypes are dramatically affected not only by alteration of sowing dates according to the region temperature, but also by mineral nitrogen fertilizer levels depending on the broad genetic makeup of the wheat genotype. Kiss *et al*., 2013 and Sun *et al.,* 2013 confirmed that wheat genotypes responded significantly by sowing dates. Ali *et al*. (2011), Eslami *et al*. (2014) and Anwar *et al*. (2015) studied the effect of nitrogen fertilizers on growth, yield and components of wheat genotypes and summarized that physiological, growth traits and grain yield enhanced by N fertilizer.

In the present investigation, the most studied traits were responded significantly to genotypes, planting dates, nitrogen fertilizer levels, and their first and second order interactions effect.

1- Planting Dates:

Planting date had the significantly affected by sowing dates for all studied traits were found in Table (1),except spike length and straw yield had insignificantly effected by this trial in both seasons. These results may be due to the genetic effects on spike length and straw yields more than environmental effects.

Performance the highest most studied traits of wheat plants were resulted from the late sowing (10^{th} Dec.), since the tallest plants (92.19 and 97.67 cm), the maximum1000-kernel weight (46.99 and 48.18 g), grain yields (17.03 and 17.95 ard./fed.), biological yields (5.36 and 5.76 ton/fed.) and harvest index (48.10 and 47.06 %) in the first and second seasons, respectively. These results due to rising air temperature during November more than December, caused decline the growth characters such as number of tillers and elongation more than the agronomic traits. The results of Malik *et al.* (2009) sustained our dissections, where he observed decline the number of tillers at 15^{th} Nov. (247.3 tillers/m^2) compared to sowing at 30^{th} Nov. (285.8 tillers/m^2). Abdel nour, Nadia and Fateh (2011) in their study at El-Sharkia Governorate stated that the date at 25^{th} of November produced the highest number of spikes/m^2, number of kernels /spike, 1000-kernel weight, biological yield and grain yield. Moreover, Said *et al.* (2012) found that increasing the number of grains (50.1) $spike^{-1}$, 1000 grain weight (32.1gm), biological yield (6824 kg ha^{-1}) and grain yield (2336 kg ha^{-1}) were obtained from late sowing (15^{th} December).

2-Genotypes:

Data in Table (1) showed that the imported genotypes (G2 and G3) differed significantly and were taller than the Egyptian cultivars (G1 and G4) in both seasons, and this may be due to the morphological and genetically differences between the studied genotypes. The genotype G3 was superior for other genotypes in spike length (12.77 and 14.14cm) and1000-grain weight (52.17and 53.36 g) in the first and second seasons, respectively, since, this genotypes characterized by longer spike and wider dimensions of grains. The highest grain yields were obtained from Genotypes G1 (18.38 and 19.17 ard./fed.) followed by G3 (17.81 and 18.74 ard./fed.), without significant differences between them in the both seasons, while the G2 was the lowest one (13.10 and 14.04 ard./fed.). The genotype G2 differed significantly for the others with the lowest values for biological and straw yields in both seasons. Also the minimum grain yield was observed in the genotype G2, exhibited the highest harvest index values in both seasons, this due to the increasing of its straw yield (1.97 and 2.21 ton/fed.) further than grain increased in the 1st and 2nd seasons, respectively. These results are in agreements with those obtained by Tahir *et al*. (2009), Gul *et al*. (2012), Lak *et al*. (2013) and Upadhyay *et al*. (2015).

3-Nitrogen fertilizer levels:

The presented data in Table (1) regarded that, the first level of nitrogen fertilizer (50 kg N/fed.) differed significantly than the other highest two N levels, and exhibited the lowest values of all traits, except the harvest index values (49.24 and 47.89 %) were the highest values were produced by the lowest N level in both seasons, this due to decreasing the grain weight more than straw yield reduced, meanwhile without significant differences were found between N fertilizer level (75 and 100 kg N/fed.) for all studied traits in 1st and 2nd seasons, that is means any further in increasing N fertilizer than 75 kg/fed., without any economic gains under these conditions. These results indicated that increasing the N levels from 50 to 75 kg N/fed., improved the associated physiological process and interpretation in the final grain yield and its components. These findings supported with those obtained by Sebastiano *et al*. (2005), Ahmed *et al*. (2011), Ali *et al.* (2011), Enayat *et al*. (2013), Youssef *et al*. (2013) and Shajaripour and Mojaddam (2014). Faizy *et al.*(2017) found that, increasing nitrogen fertilizer levels up to 80 kg N/fed significantly increased wheat grain yield (ardab fed^{-1}), straw yield (ton fed^{-1}) and 1000 grain weight (g).

4-Planting Dates x genotypes interaction (DxG):

Data in Table 2 and Fig. 1 showed that the most studied traits were responded significantly affected by DxG interaction in the both seasons. The imported genotypes (G2 and G3) were affected positively in plant height with late sowing, since the tallest plants (103.99 and 109.77 cm) followed by (100.06 and 105.56 cm) were detected with NGB 6404 followed by NGB 10893 genotypes at the late sowing in the 1st and 2nd seasons, respectively. On the other hand, shortest plants (81.69 and 87.51 cm) were detected by D2xG4 and D2xG1 interaction treatments in the 1st and 2nd seasons, respectively. Also, the longest spikes (13.36 and 14.77 cm) was with the G3 of the late sowing in the 1st and 2nd seasons, respectively. This results due to the originated of the G2 and G3 in the colder weather than the Egyptian genotypes. The genotypes were interacted by sowing dates for 1000-grain weight and the highest values (51.66 and 52.68 g) and (52.68 and 53.73 g) followed by (51.66 and 52.98 cm) were obtained from G3 in the late and early sowing dates in first and second seasons, respectively. The interactions between DxG had significant effect on grain yield, where the highest values (19.12 and 20.05 ard./fed.) followed by (18.36 and 19.28 ard./fed.) then (17.64 and 18.29 ard./fed.) were obtained by D2xG1, D2xG3 and D1xG1 interaction treatments in the first and second seasons, respectively (Fig.1 and 2). The biological and straw yield unaffected significantly by the interaction of DxG, in contrast the harvest index affected significantly by interaction of DxG, whereas the highest values (50.13 and 48.60%) followed by (49.74 and 48.82%) were found by NGB 6404 genotype (G2), when was sowing in late and early dates in the first and second seasons, respectively The obtained results indicated that the highest harvest index resulted from increasing the grain yield further than the biological yield. Similar results were obtained by Sadek (2000), Ejaz e*t al*.(2007), Rahman *et al*. (2009) and Munsif *et al*.(2015).

5- Planting Dates x Nitrogen fertilizer levels interaction (DxN):

The presented data in Table (2) showed that insignificant effects of DxN interaction on the plant height and spike length and its may be due to that these traits are genetic parameters. The 1000-grain weight increased significantly from 42.83 to 44.68g and from 43.55 to 45.66 g at late and early sowing dates under N fertilizer (50 kg N/fed.), while the increase 1000-grain weight did not differ significantly by sowing dates under 75 and 100 kg N/fed., in both seasons, these results may be due to the maximum N use efficiency done by proper growth temperature in the late sowing. The response grain yield for N2 and N3 levels were not differ significantly by sowing dates, whereas the increasing rates of grain yield were higher in the late sowing than the early sowing. This result is meaning that the plants under low N fertilizer level were subjected to mineral stress and maturated early before hot weather occurred. On the other hand the interaction of DxN was insignificantly on biological, yield, straw yield and harvest index. These results might be due to the better plant establishment and growth in 10 December date which permitted the plants to fully benefit from higher application of nitrogen. Ali, Amal *et al.* (2016) stated that the sipkes/m^2, number of grains/spike were the highest at 190.4 kg N/ha, in earlier (November 1^{st}) and later (December 1^{st}) sowing dates, respectively. These results are in harmony with those obtained by El- Gizawy (2009) and Dagash *et al.* (2014).

6- Genotypesx Nitrogen fertilizer levels interaction (GxN):

The data in Table (2) and Figs. (3 and 4) explained the behavior of the wheat genotypes under different N fertilizer rates. The significant effect of the GxD interaction was found for all studied traits, except spike length which did not affected significantly by this trial in both seasons.

The genotypes G2 and G3 (imported genotypes) responded significantly in plant length (cm), 1000-grain weight, grain yield, biological and straw yield to nitrogen fertilization, when N rates increased from 50 kg until 75 kg N.fed., only, meanwhile the Egyptian genotypes (G1 and G4) responded significantly in the same previous traits till 100 kg N/fed. This means that the foreigner genotypes were higher in their nitrogen use efficiency, as well as these genotypes did not require further N fertilization. Alves *et al.* (2015) showed that the variation of yield and its attributes in response to increasing N fertilization levels in wheat varieties, to the genetic constitution ability of the genotypes to benefit from the amount of N applied in relation to environmental conditions. These results are in agreement with thosementioned by Allam (2003), El-Borhamy and Gadallah (2009) and Abd El-Kreem, Thanaa and Ahmed (2013)**.**

7- Planting Dates x genotypes x Nitrogen fertilizer levels interaction (DxGxN):

The significant affected of the third order interaction on plant height, 1000-grain weight, grain yield and harvest index (Table 3). The tallest plants (106 and 113 cm) were observed in the genotype G2 at 75 kg N/fed in the late sowing (D2xG2xN2) interaction treatment in the first and second season respectively, while the shortest plants (79.13 cm) followed by (81.33 cm) were found in the genotype followed byG1 at the lowest N fertilizer level at lately and early sowing date i.e. (D2xG4xN1) and D1xG1xN1) interaction treatments in the first season, as well as the genotype G4 (81.50 cm) in the second N levels at late sowing date (D2xG4xN2) interaction treatments had the shortest plant. The genotype G3 had the heaviest in 1000-grain values (54.47 and 55.87%) followed by (53.80 and 54.40 g) and (53.35 and 54.73 g) followed by (52.80 and 53.73 g) at N3 and N2 at the late early sowing dates in the 2nd season, respectively. The highest grain yield values (21.59 and 21.04 ard./fed.) were obtained from the genotype G1 at late sowing date , when fertilizer by 100 kg N/fed (D2xG1xN3) and from the genotype G3 at the late sowing, when the 75 kg N level applied (D1xG3xN2) in the 2nd season. The highest harvest index values (54.73 and 52.95) followed by 52.91, then (52.21 and 51.12 %) were recorded from (D2xG3xN1) i.e. G3 at 50 kg N /fed at 1st and 2nd season, followed by (D2xG2xN3) i.e. G2 at N3 level in the 1st season at the late sowing date then (D1xG2xN3) interaction treatment) i.e. G2 at 100 kg N/fed at early sowing dates in the 1st and 2nd seasons respectively. The same conclusion was reported by Protic *et al.*, (2007) and Abdelnour, Nadya and Fateh (2011).

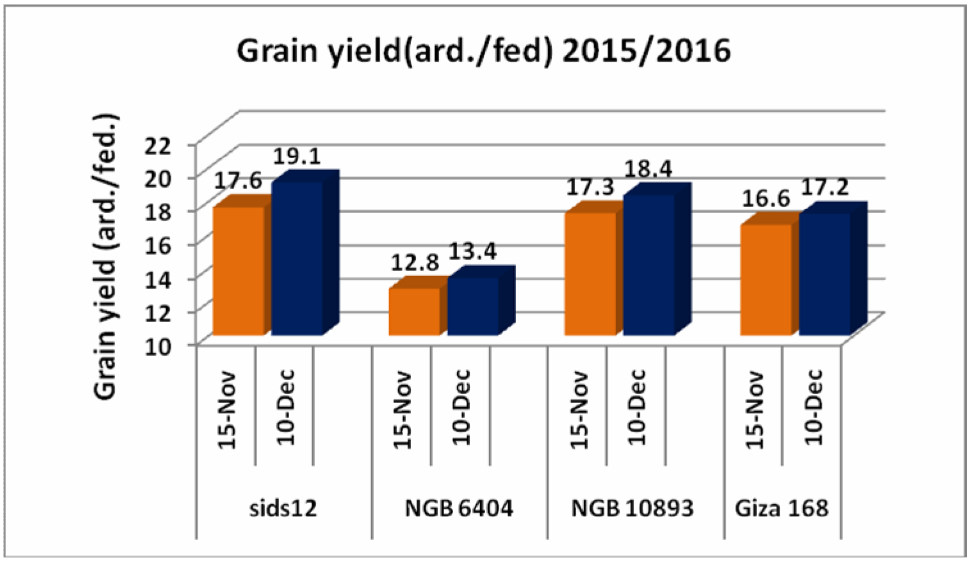

Figure (1): Grain yield (ard./fed.) for some bread wheat genotypes under two planting dates in 2015/2016.

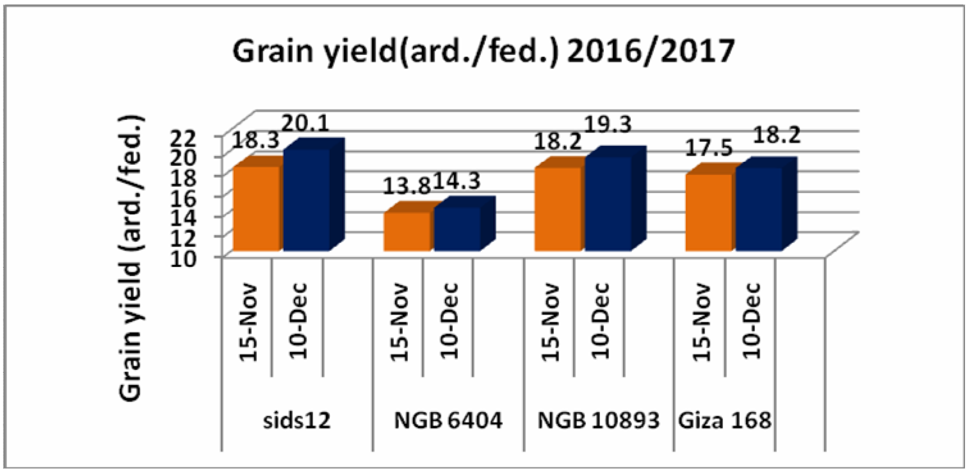

Figure (2): Grain yield (ardab/fed) for some bread wheat genotypesunder two planting dates in 2016/2017.

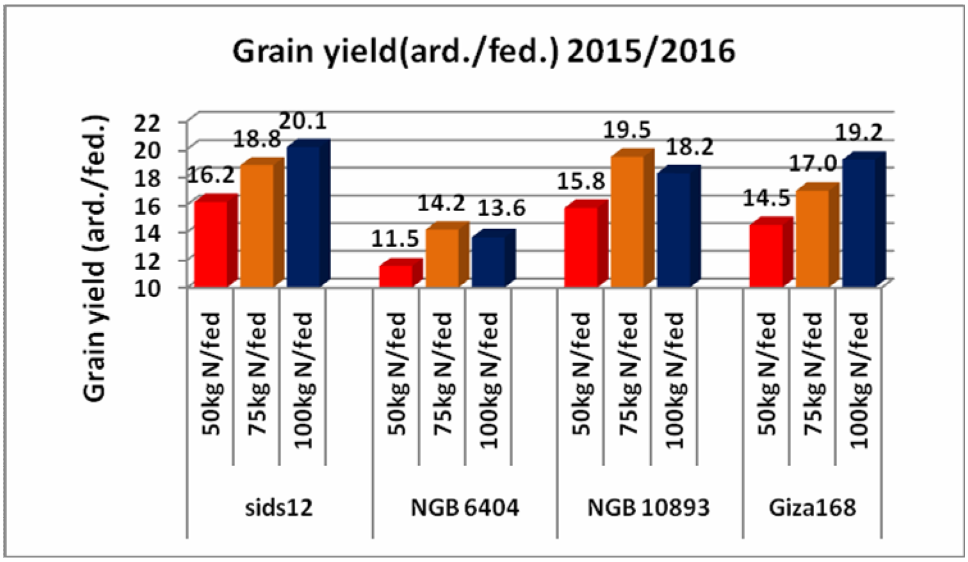

Figure (3): Grain yield (ard./fed.) for some bread wheat genotypes under three nitrogen fertilizer levels in 2015/2016.

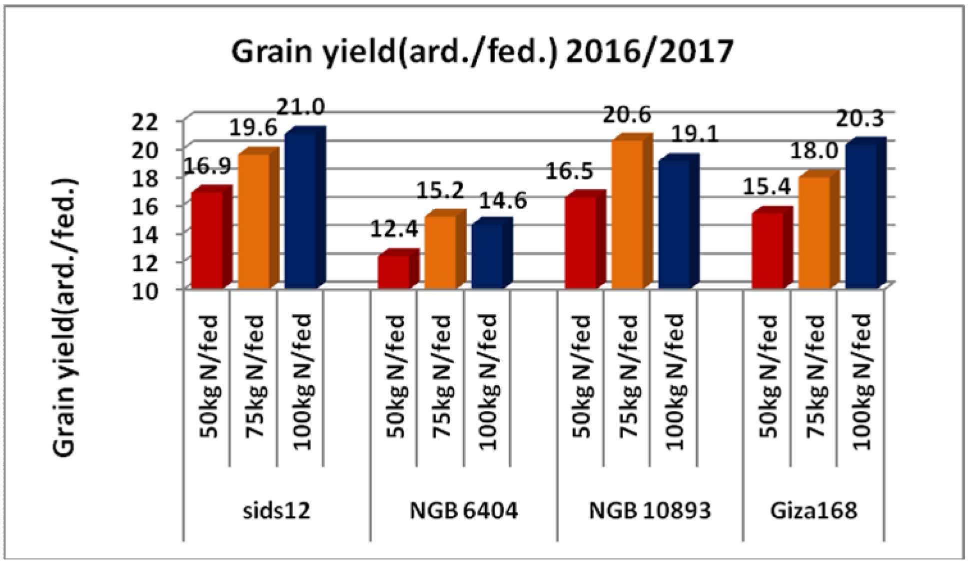

Figure (4): Grain yield (ard./fed.) for some bread wheat genotypes under three nitrogen fertilizer levels in 2016/2017.

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سلوك بعض التراكيب الوراثية من قمح الخبز تحت مواعيد زراعة ومعدلات سماد نيتروجينى مختلفة في محافظة سوهاج

ياسر أحمد محمد حفني، نحيف ابراهيم محمد

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الملخص

أقيمت تجربتان حقليتان بمزرعة كلية الزراعة بالكوثر جامعة سوهاج فى خلال موسمي الزراعة ٢٠١٥/٢٠١٦، ٢٠١٦/٢٠١٧ لتحديد تأثير ميعادين زراعة (١٥ نوفمبر ،١٠ ديسمبر) وثلاث مستويات من السماد النيتروجينى (٥٠ نيتروجين كجم/فدان ، ٧٥كجم نيتروجين/فدان ، ١٠٠ كجم نيتروجين/فدان) على المحصول ومكوناته لأربعة تراكيب وراثية من قمح الخبز (سدس ١٢،جيزة ١٦٨،NGB6404 ، NGB10893).

استخدم تصميم القطاعات كاملة العشوائية في شكل القطع المنشقة مرتين فى أربعة مكررات.

وأشارت النتائج إلى:

- وجود تأثير معنوي لكل من ميعادي الزراعة على جميع الصفات المدروسة ما عدا طول السنبلة ومحصول القش في كلا الموسمين، كما وجد تأثير معنوي لمستويات السماد والاصناف في كلا الموسمين على كل الصفات المدروسة أرتفاع النبات (سم)، طول السنبلة (سم)، وزن الـ ١٠٠٠ حبه بالجرام، محصول الحبوب (بالاردب /فدان)، المحصول البيولوجى (طن/فدان)، محصول القش (طن/فدان) ودليل الحصاد(%).
- زيادة معدل السماد النيتروجينى الى ١٠٠كجم/فدان أدى إلى زيادة معنوية في المحصول ومكوناته فى كلا الموسمين ما عدا طول النبات (سم)، طول السنبلة (سم) ودليل الحصاد (%).
- أعطي سدس ١٢ و NGB10893 أعلى محصول حبوب (أردب/ فدان) مقارنة بباقى التراكيب الوراثية في كلا الموسمين.
- اعطى التركيب الوراثيNGB10893 أعلى قيم لطول السنبلة (سم) ، وزن الألف حبة جم في كلا الموسمين. بينما اعطى التركيب الوراثي NGB6404 أعلى القيم لطول النبات(سم).
- أدت الزراعة في الميعاد المتأخر(١٠ديسمبر) الى زيادة معنوية أرتفاع النبات (سم)، طول السنبلة (سم) ،وزن الـ ١٠٠٠ حبه بالجرام، محصول الحبوب (بالاردب /فدان) ،المحصول البيولوجى (طن / فدان) ،محصول القش (طن / فدان).
- تم الحصول على أعلى محصول حبوب (٢١,٥٩ و ٢١,٠٤ أردب/فدان) عند زراعة التركيب الوراثي سدس ١٢ في ميعاد ١٠ديسمبر وإضافة ١٠٠كجم نيتروجين /فدان و(٢١,٠٤) عند زراعة التركيب الوراثيNGB10893 في ميعاد ١٠ ديسمبر واضافة ٧٥ كجم نيتروجين للفدان علي الترتيب.