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Response of yield, yield components and grain protein content of some bread wheat cultivars to split nitrogen applications in the New Valley.

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Abstract

This study was carried out in two field experiments at El-Dakhla oasis in the New valley governorate, Egypt, in 2009/2010 and 2010/2011 seasons on a sandy clay loam soil to study the split application effects of nitrogen fertilizer on the yield, yield components and grain protein content of three bread wheat cultivars (Giza 168 – Sakha 93 – Sids 1). Ten treatments of N application were examined. Each treatment was 100 Kg N/fed. applied in 2, 3 or 4 equal doses at tillering, stem elongation, heading and milk – ripe stages.

The obtained results can be summarized as follows:

1-Sieds cultivar showed the tallest plants in the two growing seasons. Split nitrogen applications at (N6, N8 and N10) treatments and at (N1, N2 and N8 treatments) gave the tallest plants in the first and in the second seasons.

Interactions (Sids 1 x N3, N8 and N6) and (Sids 1 x N8 and N6 treatments) gave the tallest plants in the first and the second seasons, respectively.

2- The highest values of No. of spikes/m^2 was obtained with Sakha 93 as well as at N9 treatment in both seasons. Interaction (Sakha 93 x N3 or Sakha 93 x N9) and (Sakha 93 x N9) gave highest values for No. of spikes/m^2, in the first and second seasons, respectively.

3- Sakha 93 gave the heaviest 1000- grain weight followed by Sids1 in both seasons. Split nitrogen applications at (N2 and N1 treatments) in the first season and at (N1 and N9 treatments), respectively, in the second season gave the highest values of 1000-grain weight. Sakha 93 x N1 or N2 as well as Sids 1 x N8 and Sakha 93 x N5 or N8 interactions gave the heaviest 1000-grain weight in the first and the second seasons, respectively.

4- The maximum grain yield/fed. was obtained by Giza168 and Sids1 in the first season, as well as with Sids1 and Giza168 in second season was not. Split nitrogen applications at N6 and N4 treatments gave the maximum grain yield/fed. in both seasons. Interaction between Sakha93 with N6 or N4 treatment and Sakha 93 x N6 interaction gave the maximum grain yields/fed. in the first and the second season, respectively.

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5- The highest values of protein percentages in grain were obtained either with Sids 1 or split nitrogen applications at N2 and N1 treatments in both seasons. The interaction between Sids 1 with N2 treatment gave the highest values of protein percentage in both seasons.

Key words: Bread wheat cultivars, Grain protein, Split nitrogen application.

Introduction

Extending the wheat cultivated areas in Egypt, especially on the newly reclaimed sandy clay loam soils and/or increasing the wheat yield per unit area are important national goals to reduce the amounts of wheat imports and secure future food supplies to meet the increasing domestic demand. Total grain yield of wheat consumption in Egypt (14.0 million tons/yearly) has increased drastically due to the consistent increase of the population growth which reached 1.96% yearly. In the same time, the actual local production reached 9.0 million tons in 2010/2011 season (F.A.O, 2011).

Application of nitrogen fertilizer is one of the most important treatment to increase grain yield and protein content in winter wheat .However, misuse of N fertilizer will not only affect grain yield and quality, but also cause a decline of economic benefits and related to the negative environmental effects (Shi Yu *et al.,* 2007).

The use of two and three split N applications increased grain yield and wet gluten content with differences among genotypes. The best N split strategy corresponded to two and three N splits: at planting and tillering or at planting, tillering, and flag leaf stages, respectively (Hirzel *et al*., 2011).

Nitrogen supply showed substantial effect on 1000-seed-weight and yield of Yumai 49. It is therefore concluded that quality parameters, yield and different types of the cultivars should be taken into consideration in nitrogen management (Feng Wei *et al*., 2005).

Mineral N applied at stem elongation, produced the highest yields. The highest protein content was achieved by applying Sulfan at the start of heading. Split applications of ammonium nitrate and of Sulfan combined with Azoslow (29 N + 18 C org.) or Entec 26 also gave good protein content but with Entec 26 alone the protein content was low (Cristiani and Alvisi, 2002**).**

Delayed fertilizer N application generally increased grain protein. Fertilizer N can be applied at ZGS 21 as required to optimize grain yield provided at least some fertilizer N is applied prior to seeding (Zebarth *et al*., 2007).

Optimizing fertilizer N use in sandy clay loam soils and at the same time achieving acceptable yields and adequate grain protein of wheat require knowledge of N uptake and utilization efficiency patterns in the plant in relation to the timing of split N application.

The present study aims to evaluate the split application of N fertilizer to a sandy clay loam soil in terms of N use, as well as yield, yield components and quality of three different bread wheat cultivars.

Materials and methods

Two field experiments were carried out at El- Dakhla oasis in New Valley ,Egypt during 2009/2010 and 2010/2011 seasons to study the split application effects of nitrogen fertilizer on the yield, yield components and grain protein of three different bread wheat cultivars. The soil of the experimental site is sandy clay loam. Some of physical and chemical properties of a representative soil sample are presented in Table (1).

Table 1: Some physical and chemical properties of a representative soil sample of the experimental site.

Season	Physical				Chemical						
	Sand (%)	Silt (%)	Clay (%)	Texture	CaCO3 (%)	OC (%)	ECe (ds/m)	pH (1:1)	Total N (mg/kg)	Olsen-p (mg/kg)	CH_3COONH_4-k (mg/kg)
2009/2010	67	8	24	Sandy clay loam	4.53	0.58	4.75	7.9	761.60	6.10	374.10
2010/2011	66.5	10	23.5	Sandy clay loam	4.50	0.56	4.80	7.8	760.00	6.05	375.0

A randomized complete block design using split –plot arrangement of treatments with four replications was employed. The main plots were devoted to the three bread wheat cultivars (i.e. Giza 168, Sakha 93 and Sids 1), the sub-plots were assigned for treatments of the split N application. Each sup- plot had an area of 10.5 m^2 and was treated with ammonium nitrate (33.5 % N) at a total level of 100 kg N/ fed. that was hand-broadcasted in splits distributed at the successive growth stages. Ten N treatments were examined as shown in Table (2). The preceeded crop was maize in the second season only.

Table (2): Treatments of nitrogen (kg N/feddan) added as splits at different growth stages of wheat.

Milk-ripening	Growth stage			Nitrogen Treatment
	Heading	Stem Elongation	Tillering	
-	50	-	50	N1
50	-	-	50	N2
-	50	50	-	N3
50	-	50	-	N4
50	50	-	-	N5
-	33.33	33.33	33.33	N6
33.33	-	33.33	33.33	N7
33.33	33.33	-	33.33	N8
33.33	33.33	33.33	-	N9
25	25	25	25	N10

Each N treatment was applied either as 2, 3 and 4 times that correspond with different growth stages. An activation dose at a level of 10 kg N/fed . was added to each sub-plot at sowing. The grains were sown by hand-broadcasting at a seeding rate of 80 kg/fed .on Des.3 and Des.2 for the first and second seasons, respectively. Recommended rates for sandy soils of 15.5 kg P_2O_5/fed. as super-phosphate (15.5%) and 25 kg K_2O/fed as potassium sulfate (48%) were broadcasted before sowing. Other agricultural practices were performed as recommended for wheat production in sandy soils.

Characters, sampling and measurement:

At harvest sample of five plants was taken randomly from each sub-plot in three replicates to measure, the plant height. Number of spikes/m2 was determined by counting all the spikes on a square meter. The grains yield/fed. was estimated from the grain yield/plot. A bulk samples from each plot was used to determined the 1000-grain weight.

Total nitrogen content in the grains was determined by using micro-kjeldahl method, as described by A.O.A.C. (1990), the crude protein in grains was calculated by multiplying the total nitrogen % by a factor of 5.75%.

Statistical analysis:-

All the obtained data were subjected to analysis of variance according to the method described by Gomez and Gomez (1984). The least significant difference (L.S.D) at 5% level of probability was used to compare the differences among means.

Results and Discussion

The results obtained in this respect concerning each of the some characters studied (i.e. plant height, No. of spikes/m^2, 1000-Grain weight, grain yield (ardab/fed.), protein percentage in grains) will be discussed here under the following:

1-plant height:

Data in Table (3) revealed that plant height was significantly affected by wheat cultivars, split nitrogen application and their interaction in the two seasons. The tallest plants were obtained with Sids 1 cultivar in both seasons. Split nitrogen applications either at (N6, N8, N10 and N7 treatments) or at (N1, N2, N8 and N10 treatments) gave the tallest plants in the first and the second seasons, respectively.

Response of wheat cultivars to splitting of N fertilizer was significantly different in both seasons. Table 3 indicated that Sids 1 showed the tallest plants through N8, N6 and N2 in the 1st season and through N1, N2, N6, N8 and N9 in the 2nd season without significant differences among these treatments in each season.

These differences in plant height may be attributed to genetic variations among cultivars, as well as the nitrogen fertilizer might have encouraged the meristimatic activity and increased the vegetative growth.

Kharub and Subhash (2010) revealed that plant height was difference among varieties as well as split N application at various growth stages.

Similar results were obtained by Wagan *et al*. (2002) and Sadeghi *et al.* (2009).

Table (3): Plant height (cm) as affected by wheat cultivars, split N application and their interaction in 2009/ 2010 and 2010/2011 seasons.

Var.	Season 2009/2010				Season 2010/2011			
Tre.	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**
N1	95.17	93.00	90.77	**92.98**	104.80	117.47	108.40	**110.22**
N2	99.50	95.50	91.80	**95.60**	107.10	119.47	101.50	**109.36**
N3	96.87	112.67	84.30	**97.94**	103.50	114.90	104.20	**107.53**
N4	84.90	98.40	86.60	**89.97**	106.37	111.90	98.50	**105.59**
N5	90.30	95.00	81.00	**88.77**	87.00	101.40	91.70	**93.37**
N6	100.40	109.40	92.60	**100.80**	105.00	119.90	98.70	**107.87**
N7	97.93	102.00	95.50	**98.48**	102.13	108.50	101.90	**104.18**
N8	99.70	111.43	87.10	**99.41**	100.73	120.80	105.80	**109.11**
N9	97.70	103.27	81.37	**94.11**	102.17	117.50	99.70	**106.46**
N10	99.70	105.90	92.40	**99.33**	104.30	116.70	104.30	**108.43**
Mean	**96.22**	**102.66**	**88.34**	**95.7**	**102.31**	**114.85**	**101.47**	**106.2**

L.S.D 0.05 A (Var.) =	2.42	3.80
B (N.) =	2.88	2.47
AB (Var. x N) =	4.99	4.28

2- Number of spikes/ m²:-

Data in Table (4) indicated that spikes/m^2 was significantly effected by wheat cultivars. The highest values was obtained with Sakha93 in both seasons. These results may be attributed to the genetic variations among cultivars and weather climatic conditions.

Split nitrogen applications was significantly effected No. of spikes/m² and the highest values were obtained at N9 treatment in the first season and in the second season from N9, N2 and N7, treatments. Interaction of Sakha 93 x N3 treatment gave the highest values for No. of spikes/m^2 in both seasons.

Similar findings were prepared by Wagan *et al*. (2002); Raigar and Pareek (2003); Limon-Ortega and Villasenor-Mir (2006); Akmal *et al.* (2007); Jan *et al*. (2007); Otteson *et al.* (2008); Navneet *et al.* (2010) and Kharub and Subhash (2010).

Table (4): Number of spikes/ m²Spikes/m^2 as affected by wheat cultivars, split N application and their interaction in 2009/2010 and 2010/2011 seasons

Var.	**Season 2009-2010**				**Season 2010-2011**			
Tre.	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**
N1	451.3	361.7	437.6	**416.9**	441.0	353.3	475.7	**423.3**
N2	405.0	423.6	416.7	**415.1**	458.0	468.7	450.3	**459.0**
N3	389.7	403.1	484.7	**425.8**	366.3	437.3	529.0	**444.2**
N4	427.1	345.0	456.0	**409.4**	457.7	349.0	465.0	**423.9**
N5	356.7	437.7	454.7	**416.4**	399.0	422.3	499.7	**440.3**
N6	433.1	381.3	425.0	**413.1**	458.3	380.3	494.0	**444.2**
N7	406.0	412.0	449.7	**422.6**	422.0	427.0	498.7	**449.2**
N8	395.0	362.0	432.0	**396.3**	408.0	333.3	451.7	**397.7**
N9	443.0	433.7	484.2	**453.6**	462.7	422.3	502.0	**462.3**
N10	431.7	396.0	413.7	**413.8**	455.3	384.0	443.7	**427.7**
Mean	**413.9**	**395.6**	**445.4**	**418.3**	**432.8**	**397.8**	**481.0**	**437.2**

L.S.D 0.05 A (Var.) =	14.21	15.9
B (N.) =	11.30	13.9
AB (Var. x N) =	19.57	24.2

3- 1000-grain weight:-

Data in Table (5) revealed that wheat cultivars, nitrogen applications treatment and their interaction had significantly effect on 1000-grain weight in both seasons. Sakha 93 gave the highest 1000-grain weight followed by Sids1 in both seasons. Split applications at (N2 & N1 treatments) and at (N1 & N9 treatments) gave the highest 1000-grain weight in the first and the second seasons, respectively. (Sakha 93 x N1 and Sakha 93 x N2) interaction gave the highest

1000-grain weight in first and in the second seasons (Sids 1 x N8 and Sakha 93 x N5) gave highest values without significant differences.

The differences among varieties for 1000-grain weight may be attributed to genetic make up. The differences for nitrogen fertilizer due to the increase dry weight of vegetative organs. Das and Mitra (2011) reported that 1000-grain weight was different among varieties. Also, split N applications increased 1000-grain weight, since the physiological role of nitrogen in plants growth. Results are agreement with those stated by Feng Wei *et al*. (2005); Akmal *et al.* (2007); Yadav *et al.* (2007); Sadeghi and Bahrani (2009); Zhao *et al.* (2009); Kharub and Subhash (2010); Modhej and Lack (2011); Wang *et al*. (2011) and Jan *et al*. (2011).

Table (5):1000-grain weight (g) as affected by wheat cultivars, split N application and their interaction in 2009/2010 and 2010/2011 seasons.

Var.	**Season 2009/2010**				**Season 2010/2011**			
Tre.	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**
N1	48.88	56.13	59.88	**54.96**	56.00	59.00	59.50	**58.17**
N2	50.88	58.38	58.88	**56.05**	52.75	55.25	57.25	**55.08**
N3	49.88	57.38	56.88	**54.71**	55.75	59.50	56.75	**57.33**
N4	51.13	55.13	57.88	**54.71**	54.25	52.25	59.00	**55.17**
N5	48.13	53.38	55.13	**52.21**	53.00	59.50	60.00	**57.50**
N6	48.88	55.13	58.38	**54.13**	51.25	57.25	59.25	**55.92**
N7	50.38	56.88	57.38	**54.88**	49.00	51.25	58.25	**52.83**
N8	48.88	53.38	57.38	**53.21**	50.25	60.75	60.00	**57.00**
N9	50.38	56.38	53.13	**53.30**	59.25	59.00	56.25	**58.17**
N10	47.88	54.38	58.88	**53.71**	50.00	58.25	55.25	**54.50**
Mean	**49.53**	**55.66**	**57.38**	**54.19**	**53.15**	**57.20**	**58.15**	**56.17**

L.S.D 0.05 A (Var.) =	2.01	0.951
B (N.) =	1.774	1.463
AB (Var. x N) =	3.072	2.535

4- Grain yield (ardab/fed.):-

Data in Table (6) showed that wheat cultivars, split nitrogen applications and their interactions were significantly effected grain yield/fed. and the highest grain yield/fed. was obtained with Giza168 and Sids1 in both seasons, since the differences between the two cultivars did not reach the significance. Split nitrogen applications at N6 and N4 in first season and at N6 in second season, gave the maximum grain yield. With regard to the interaction between wheat cultivars and N treatments, Table 6 cleared that Giza 168 produced its highest grain yield with N9 treatment, while Sids 1 showed its highest grain yield through N6 and N7 without significant difference. However, Sakha 93 cv. produced the greatest grain yield via N4 and N6 treatments, this was in the 1st season. Similar trend was observed in the 2nd season. Generally, as an average of the two seasons, highest grain yield per feddan was obtained when Sakha 93 cv. was fertilized with 100 kg/N feddan applied in equal 3 doses of tillering, elongation and heading growth stages (N6). On the other hand, all varieties showed the least grain yield per feddan when N fertilizer was applied in two equal doses at heading and milk- ripening stage (N5) in both seasons.

These results may be attributed to genetic make up among cultivars. Post pouring N fertilizer application increased the accumulation and translocation of carbon and nitrogen during floret development (Wang *et al*., 2011). Nitrogen requirement of variety varies depending on its genetic yield potential and environmental at conditions (Dogan *et al*., 2008). The response of grain yield to N fertilizer differed from that reported temperate climates (Elvira *et al*. 2004). Wang *et al*. (2011) indicated that grain yield (ardab/fed.) was different between varieties. Applying 2 Splits of N at 3 weeks from sowing and stem elongation produced the highest grain yield. Similar results were in the same line by Raigar and Pareek (2003); Shirpurkar *et al.* (2007); Anureet Kaur *et al*. (2010); Kara (2010); Naseri *et al*. (2010); Coventry *et al*. (2011); Jan *et al*. (2011); Saifuzzaman *et al*. (2011) and Hirzel *et al*. (2011).

Table (6): Grain yield (ardab/fed.) as affected by wheat cultivars, split N application at their interaction in 2009/2010 and 2010/2011 seasons.

Var.	**Season 2009/2010**				**Season 2010/2011**			
Tre.	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**	**Giza 168**	**Sids1**	**Sakha 93**	**Mean**
N1	12.55	12.78	13.03	**12.78**	13.48	13.45	13.88	**13.60**
N2	12.78	12.00	12.88	**12.55**	13.83	12.90	13.53	**13.42**
N3	13.10	12.15	11.98	**12.41**	13.93	13.00	12.98	**13.30**
N4	14.35	13.80	16.00	**14.72**	14.90	14.60	15.95	**15.15**
N5	11.70	11.23	7.03	**9.99**	12.48	11.88	8.00	**10.78**
N6	13.53	14.73	16.05	**14.77**	14.20	15.83	16.90	**15.64**
N7	12.33	14.33	13.48	**13.38**	13.30	15.20	14.88	**14.46**
N8	12.73	14.18	9.72	**12.21**	13.53	15.28	10.73	**13.18**
N9	15.00	13.60	12.85	**13.82**	15.50	14.60	14.40	**14.83**
N10	13.78	12.95	13.58	**13.43**	14.93	14.20	14.83	**14.65**
Mean	**13.19**	**13.18**	**12.66**	**13.01**	**14.01**	**14.09**	**13.61**	**13.90**

L.S.D 0.05 A (Var.) = 0.220 0.268
B (N.) = 0.249 0.378
AB (Var. x N) = 0.431 0.655

5- Protein percentage in grains:

Present results in Table (7) revealed that wheat cultivars, Split nitrogen applications and their interaction were significantly effected grain protein percentage in both seasons. Grains of sids 1 cv. was the highest in protein content in followed by Sakha 93 cv. in both seasons. Concerning the effect of splitting of N fertilizer on protein content, highest value was observed at N2 in both seasons. However, there are some treatments were on bar with N2 such as N4, N7 and N10 in the 1st season, as well as N1, N3, N4, N7 and N8 in the 2nd season (Table 7).

With regard to interaction between the both factors. Table 7 indicated that the highest value of protein content was found in Sids 1 cv. grains via N2 treatment in both seasons.

These results may be attributed to genetic make up among cultivars. The response of protein percentage in grains to N fertilizer differed realized at splitting N application at heading and milk-ripe stages. Zebrath *et al*. (2007) showed that protein percentage in grains was different between cultivars. Plants that received one full dose of N at milk- ripening had the highest values of protein percentage in grains. Similar results were reported by Cristiani and Alvisi (2002).

Table (7):Grain protein percentage as effected by wheat cultivars, split N application and their interaction in 2009-2010 and 2010-2011 seasons.

Var.	**Season 2009/2010**				**Season 2010/2011**			
Tre.	**Giza 168**	**Sids 1**	**Sakha 93**	**Mean**	**Giza 168**	**Sids 1**	**Sakha 93**	**Mean**
N1	12.32	12.26	11.92	**12.17**	12.37	12.30	11.90	**12.19**
N2	11.92	12.67	12.22	**12.27**	11.82	12.63	12.30	**12.25**
N3	11.99	12.38	11.69	**12.02**	12.07	12.54	11.62	**12.08**
N4	12.17	11.65	12.20	**12.01**	12.09	11.93	12.15	**12.06**
N5	11.52	12.01	11.99	**11.84**	11.60	11.99	12.04	**11.88**
N6	11.88	11.96	11.96	**11.93**	11.85	12.03	12.06	**11.98**
N7	11.83	12.17	12.11	**12.04**	11.91	12.17	12.21	**12.10**
N8	11.94	12.15	12.02	**12.04**	11.92	12.15	12.13	**12.07**
N9	11.7	12.3	11.97	**12.03**	11.6	12.3	11.86	**11.97**

	7	4			9	7		
N10	11.69	12.11	12.14	**11.98**	11.62	12.01	12.24	**11.96**
Mean	**11.90**	**12.17**	**12.02**	**12.03**	**11.89**	**12.21**	**12.05**	**12.05**

L.S.D 0.05 A (Var.) = 0.161 0.126

B (N.) = 0.173 0.212

AB (Var. x N) = 0.447 0.369

Conclusion

It may be concluded that studied wheat cultivars grown on sandy clay loam soil can be improved through split applications of N fertilizer. Applying the recommended dose of N in two splits at three weeks from sowing and stem elongation or three splits at three weeks from sowing, stem elongation and heading seem to optimizing yield components, grain yield and protein percentage in grains.

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استجابة المحصول ومكوناته والمحتوى البروتيني بالحبوب لبعض أصناف قمح الخبز بتجزئة السماد النيتروجيني بالوادي الجديد

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أجريت هذه الدراسة على بعض اصناف القمح خلال موسمي ٢٠١٠/٢٠٠٩، ٢٠١١/٢٠١٠ بمزرعة خاصة بواحة الداخلة ، محافظة الوادي الجديد ، مصر، وكان نوع التربة رملية طينية طمية ، لدراسة تأثير تجزئة السماد النيتروجيني على المحصول ومكوناته وبروتين الحبوب لثلاثة أصناف مختلفة من قمح الخبز (جيزة ١٦٨ ، سخا٩٣ ، سدس ١) باستخدام انقسام عشرة معاملات تسميد ،وكانت الجرعة المستخدمة في التسميد ١٠٠ كجم ن/فدان وتطبق إما على ٢ أو ٣ أو ٤ مراحل نمو وهم (بعد ثلاثة أسابيع من الزراعة(التخليف) ، الاستطالة ، طرد السنابل ، طور النضج اللبني).

ويمكن تلخيص النتائج على النحو التالي :

١- حصل علي أطول النباتات مع الصنف سدس ١ في موسمي الزراعة ومع تجزئة النيتروجين مع المعاملات (N6, N8, N10) في الموسم الأول والمعاملات (N1, N2, N8) في الموسم الثاني كما أعطت التفاعلات في الموسم الأول ما بين (سدس ١ × N5 ، N8 و N6) و (سدس١ × N8 ، N6 و N2) في الموسم الثاني.

٢- حصل علي أعلى القيم من عدد السنابل / م[2] كانت مع الصنف سخا ٩٣ وأيضاً مع تجزئة السماد النيتروجيني وهي المعاملة (N9) في كلا موسمي الزراعية وكانت أفضل القيم في التفاعل ما بين سخا٩٣ × N3 و سخا٩٣ × N9 في الموسم الأول والثاني علي الترتيب .

٣- أعطى الصنف سخا٩٣ أثقل وزن الألف حبة ويليه الصنف سدس١ في كلا موسمي الزراعة وكانت أفضل معاملات تجزئة النيتروجين هي (N1 و N2) في الموسم الأول وفي الموسم الثاني (N9 و N1)، وفي التفاعل ما بين الاصناف والتسميد كانت أعلى القيم مع الصنف سخا ٩٣ × N1 أو N2 في الموسم الأول ومع الصنف سدس١ × N8 ، سخا٩٣ × N5 و N8 و سدس١ × N5 و N3 في الموسم الثاني.

٤- اعطى الصنف جيزة ١٦٨ و سدس١ أعلى محصول من الحبوب/ فدان في الموسم الأول إضافة الى الصنف سدس١ ، جيزة ١٦٨ في الموسم الثاني . أفضل معاملات تجزئة النيتروجين مع N6 و N4 في كلا موسمي الزراعة وأعطى التفاعل ما بين سخا٩٣ × N6, N4 في الموسم الأول ، سخا٩٣ × N6 في الموسم الثاني أعلا محصول حبوب / فدان.

٥- كانت أعلى القيم من النسبة المئوية لبروتين الحبوب للصنف سدس ١ ومع معاملات تجزئة النيتروجين N2 وN1 في كلا موسمي الزراعة. كما كانت أعلي القيم للنسبة المئوية للبروتين للتفاعل بين الصنف سدس ١ والمعامل N2 في كلا موسمي الزراعة.