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EFFECT OF NITROGEN AND POTASSIUM LEVELS ON YIELD AND ITS COMPONENTS OF FOUR NEW BREAD WHEAT CULTIVARS

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ABSTRACT

In order to study the effect of nitrogen and potassium on yield and yield components on four bread wheat cultivars; Gemmiza 11, Sids 12, Sids 13 and Shandaweel 1, the treatments included three levels of nitrogen: 50, 75 and 100 kg N/fad accompanied by tow levels of potassium: 24 and 48 kg Ko2/fed. Field experiment was conducted at Sakha Agricultural Research Station, Agricultural Research Center, during the two growing seasons of 2008 - 2009 and 2009-2010. The treatments were arranged in a spilt-spilt plot design with four replications. The main plots were devoted to nitrogen levels and the sub-plots were allocated to potassium levels, while the sub-sub plots were designed to cultivars.

Increasing nitrogen levels up to 100 kg N/fad. Resulted in significant gradual increase in days to heading and maturity, plant height, number of spikes/^{m2}, number of kernels/spike, and grain yield/fad.

On the hand, there was no significant effect for potassium fertilization levels on the tested agronomic characters**.**

The results indicated that Gemmiza 11 was the earliest in heading and maturity in the two seasons. Shandaweel 1 gave the highest grain yield/fed in the first season while it was the latest one in days to maturity.Sids12 cultivars gave more spikes/^{m2}in the both seasons.While,Sids 13cultivars gave the highest values of 1000-grain weight.

The interaction between nitrogen and potassium, nitrogen and cultivars, potassium and cultivars and cultivars, nitrogen and potassium

rates did not show any significant effect on grain, straw yield/fed and harvest index in the two seasons. However, the interaction between nitrogen rates and cultivars and potassium and cultivars was significant for number grains/spike in the two seasons. The interaction between nitrogen levels and cultivars was significant for no. of spikes/^{m2} in the second season. Also, the interaction between nitrogen and potassium levels was significant for no. of spikes/^{m2} in the first season.

It could be concluded that Shandaweel 1 can be cultivated under fertilization at 100kgN/fed to produce the highest yields of grains and straw per Fadden.

INTRODUCTION

Wheat (triticum aestivum L EN.Thell) is one of the most important found crops in Egypt .Increasing wheat production per unit area appears to be the best solution for reducing the wheat production consumption food gap (Shehab El-Din1993) .The required yield increase may be achieved by high yielding wheat varieties and applying improved cultural practices i.e .optimum

land preparation, sowing date, sowing method, fertilization (form, rate and time of application) .

Nitrogen is one the most important elements in the nutrition of wheat plant, an essential part of all amino acids, protein and related compounds, it is a constituent of chlorophyll and carboxylating coenzymes. So, several investigation found increases in growth ,yield and its components i.e. Eissa(1993),Hameed *et.a l*(2004),Tammam and Tawfelis(2004),Protic et.al(2007) observed that increasing N-rate 100 kg/fed increased days to heading and maturity number of tillers/plant, spikes/m2,grain yield/spike ,grain yield/fed and loading ,but number of grain /spike and 1000-grain weight were not changed. However, plants supplied with 75kgN/fed up to 50kgN/fed were not significantly deferent from those provided with 100kg/fed, except for the number of spike/m2. Higher nitrogen up to 150kg/fed gave the highest grain yield. Abdel-Nour and Fateh(2011) and Khaled and El-Rawy(2012) reported that days to heading and maturity, no. of spikes/m2,no.of grains/spike ,1000-grain weight, grains weight/spike, grain and biological yields ,protein and carbohydrate percentages with increments of nitrogen application levels up to 75kg/fed.

Potassium is one the most important element in the tonic for the transfer of carbohydrates from the leaves to grain. The balance between N, K and P fertilizers is critical for crop production and it can change the physiology of the plant. Each element affects the uptake of the other; phosphorus absorption is a common consequence of adding nitrogen fertilizer, (Grunes 1959). Several investigations gave much attention to potassium fertilizer to obtain high yield i.e. Ibrahim and abdel-Aal (1991) attributed the increase in 1000-grain weight and grain yield/fed to a certain levels of NPK comparing with the untreated plants. Bassiouny *et al*(1993) and Mitkesss et al.(1994) added that, the most economic yield performance was obtained at the best of 15kg P2O5 and 24kg K2O for the cultivated lands. On the other side, El-Rawy *et al*. (2007), El-Hag,Dalia (2008) and El-Samshy,Basma(2009) found that the addition of 70 kgN +15 kgP + 24kgK for bread wheat varieties increased growth characters, grain yield and yield components ,

The interaction between cultivars and N- fertilizer rates and interaction between cultivars and K-fertilizer rates had no significant effects for all the studied traits, El-Rawy *et al*.(2007),El-Hag,dlia (2008) and El-Samahy,Basma(2009), Khaled and El-Rawy(2012).

This investigation aimed to study the effect of different nitrogen and potassium levels on the yield and its components on four new bread wheat cultivar.

MATERIALS AND METHODS

The present study was carried out at the Experimental Farm of Sakha Agricultural Research Station, ARC during the two successive seasons of 2008/2009 and 2009/2010 to study the effect of three nitrogen

fertilizer levels (N1: 50, N2: 75 and N3: 100 kg N /fed) and two potassium levels (K1: 24 and K2:48 kg/fed) on the yield and its components and other traits of four bread wheat cultivars (Gemmiza 11, Sids 12, Sids 13 and Shandaweel 1).Howerver, the names and pedigrees of the four bread wheat cultivars used in this study are presented in Table 1

Table 1: Name and pedigree of four bread wheat cultivars.

No.	cultivars	Pedigree
1	Gemmiza 11	BOW"S"/KVZ"S"//7C/SER182/3/GIZA168/SAKHA61. GM7892-2GM-1GM-2GM-1GM-0GM
2	Sids 12	BUC//7C/ALD/5/MAYA74/ON//1160.147/3/BB/GLL/4/CHA T"S"/6/MAYA/VUL//CMH74A.630/4*SX. SD7096-4SD-1SD-1SD-0SD.
3	Sids 13	ALMAZ- 19= KAUZ "S" // TSI/SNB "S". ICW94-0375-4AP-2AP-030AP-0APS-3AP-0APS-050AP-0AP-0SD.
4	Shandaweel 1	CAZO/KAUZ//KAUZ. CMBW90 Y3279-OTOPM-010M-010Y-3M-0SH

The experiments were sown during the last week of November in the two seasons using spilt-spilt plot design with three replications. The plot area was٤.٢ m١.٢) ٢m x 3.5m length). The experiments included 24 treatments, which were the combinations of three nitrogen levels distributed at random in the main plots, two potassium levels assigned to the sub-plots and four cultivars allocated to the sub-sub-plots .Phosphorus fertilizer was applied in the form of calcium super phosphate (15 (%٥.at rate of 15 kg $P_٢O$/ ٥fed. during land preparation .Nitrogen was added in form of ammonium nitrate (33%٥.N (the%٢٠ of the total dose was applied at sowing %٤٠ ,before the first irrigation and %٤٠ before the second irrigation. Potassium fertilizer was added in the form of potassium sulphate (48% $K_٢$ O (at elongation stage .Soil structure and chemical analysis of the experimental site and the environmental data are presented in Table 2 and Table 3 respectively .

Table 2: Mechanical and chemical properties of the experimental soil at the experimental site during 2008/09 and 2009/2010 seasons.

Characters	2008/2009	2009/2010
Chemical analysis		
N (Available ppm)	26	24
P (Available ppm)	22	20.6
K(Available ppm)	315	407
Soil pH	8.06	7.89
Mechanical characters		
Sand %	18.2	16.3
Silt %	39.1	38.5
Clay %	42.7	45.2
Soil texture	clay	clay

Table 3: Monthly averages of temperature) ^{o}C ,(relative humidity and total rain fall at Sakha during 2008/2009 and 2009/2010.

Month	Temperature (^{o}C)				Relative humidity (%)		Rainfall (mm)	
	٠٩/٢٠٠٨		١٠/٢٠٠٩		Mean		Mean	
	Max*.	Min*.	Max.	Min.	٠٩/٢٠٠٨	١٠/٢٠٠٩	٠٩/٢٠٠٨	١٠/٢٠٠٩
Nov.	26.00	8.30	25.11	10.32	67.58	64.72	0.5	0
Dec.	22.35	7.08	22.72	8.92	67.65	66.44	17.5	5.8
Jan.	20.57	7.07	21.77	7.77	67.05	71.48	3.5	0
Feb.	21.14	7.28	23.38	9.19	64.88	65.11	12.5	22.2
Mar.	22.34	7.13	23.92	9.18	65.54	62.09	0	0
Apr.	27.15	11.00	28.77	11.76	62.65	68.62	0	0
May	29.63	13.12	30.26	15.43	60.69	57.88	0	0

***Max = maximum, Min = minimum* . Mgro meteorological data climatic factor from Sakha Station) ,A.R.C.(**

The data were recorded in the two growing seasons for number of days to heading, days to maturity, plant height, number of spikes/m2, number of kernels/ spike, 1000-kernel weight, straw yield (ton/fed), grain yield (ardab/fed) and harvest index.

Data recorded were analysed according to Steel and Torrie (1984).The means of the treatment were compared using the Least Significant Difference (LSD) at 5 % of probability as described by Waller and Duncan (1969). The statistical analyses were performed using analysis of variance technique by MSTATC computer software package.

RESULTS AND DISCUSSION

Agronomic traits.

The data in Table 4 revealed that cultivars were significantly different in both seasons .Gemmiza 11was the earliest cultivar in heading and maturity date in both seasons. Plant height was significantly affected by cultivars whereas Sids 13 was the tallest one, while, Sids 12 was the shortest in height. These differences between cultivars may be due to the genetic variation among the four cultivars. These results are in general agreement with these of Eissa (1995),Tammam and Tawfelis (2004)and Abdel-Nour and Fateh (2011) and Khaled and El-Rawy(2012) .

Application of the different nitrogen levels had significant effects for days to heading in the second seasons only, and days to maturity in both seasons. However, number of days to heading, and maturity were increased with increasing nitrogen level up to 100 kg/fad. The lateness of maturity date could be explained by the increasing in vegetative growth with increasing nitrogen applications. Similar results were obtained by El-Rawy et al (2007), El-Sayed, Soad and Hammad (2007) and Khaled and El-Rawy(2012).

Also, in the seam Table, plant height was significantly affected by nitrogen levels in both season, and the response of plant height to nitrogen application was positive linear, such increase in plant height may be occurred due to the stimulation of cell division and internodes elongation resulted from increasing nitrogen applications.Tammam and Tawfelis (2004**)**,El-Rawy *et al*,(2007) and Abdel-Nour and Fateh(2011) And Khaled and El-Rawy (2012) found the same result. .

The effect of potassium levels on the three characters was not significant in both seasons

Table 4: Average of days to heading, days to maturity and plant height for four wheat cultivars as affected by the three nitrogen and the two potassium levels in two seasons, 2008/2009 and 2009/2010.

Treatments	Days to heading		Days to maturity		Plant height	
	2008/2009	2009/2010	2008/2009	2009/2010	2008/2009	2009/2010
Nitrogen Fertilizer						
50KgN/fed	93.2	95.0	147.2	141.1	107.7	100.9
75KgN/fed	93.5	95.0	148.1	141.8	108.3	102.7
100KgN/fed	93.9	96.2	149.5	143.3	107.2	102.8
F-test	Ns	*	**	**	Ns	Ns
LSD at 5%	-	0.9	1.0	0.9	-	-
Potassium fertilizer						
24 Kg/fed	93.7	95.5	148.4	142.4	107.0	102.8
48Kg/fed	93.4	95.5	148.1	141.8	108.4	101.5
F-test	Ns	Ns	Ns	Ns	Ns	Ns
Cultivars						
Gemmaiza	89.5	91.3	146.8	140.4	102.7	99.0
Sids 12	98.3	99.5	148.3	142.9	98.3	94.8
Sids 13	91.6	93.2	147.2	140.8	116.0	109.2
Shandaweel 1	94.7	98.0	150.7	144.2	113.8	105.6
F-test	**	**	**	**	**	**
LSD at 5%	1.8	0.7	1.2	0.5	1.8	2.7
Interactions						
NxK	NS	NS	NS	NS	NS	NS
NxCV	NS	NS	NS	NS	NS	NS
KxCV	NS	NS	NS	NS	NS	NS
NxKxCV	NS	NS	NS	NS	NS	Ns
F-test	NS	NS	NS	NS	NS	NS

Yield and yield component characters:

Data in Table 5 showed that cultivars had no significant effects on number of grains/spike in the two seasons, while, number of spikes/m^2, and grain weight had highly significant effects. Moreover, Sids 13 gave the heaviest grain weight while, Sids 12 produced the lowest weight in the two

seasons. Sids12 also outnumbered the other three cultivars in the two seasons.

Table ٥: Average of No. of spikes/m ,٢grain /spike and-١٠٠٠ grain weight for four bread wheat cultivars as affected by three nitrogen and two potassium levels in two seasons ٢٠٠٩/٢٠٠٨, and 2009/2010 .

Treatments	Spikes/m^2		Grains/spike		1000-Grain weight	
	2008/2009	2009/2010	2008/2009	2009/2010	2008/2009	2009/2010
Nittogen fertilizer						
50KgN/fed	353.5	378.7	67.2	63.4	44.9	41.6
75KgN/fed	375	364.7	69.0	65.2	43.9	40.7
100KgN/fed	375.8	371	69.8	65.7	43.9	40.7
F-test	NS	NS	NS	NS	NS	NS
LSD at 5%	-	-	-	-	-	-
Potassium fertilizer						
24 Kg/fed	366.5	379.3	69.6	65.6	44.4	41.1
48Kg/fed	369.8	363.6	67.7	63.9	44.1	40.9
F-test	NS	NS	NS	NS	NS	NS
Cultivars						
Gemmaiza	356.6	335.8	72.3	68.2	45.1	41.9
Sids 12	446.1	445.5	67.1	63.3	36.4	32.3
Sids 13	284.2	281.5	68.9	64.7	53.8	50.4
Shandaweel 1	385.6	403	66.4	62.6	41.7	38.6
F-test	**	**	NS	NS	**	**
LSD at 5%	38.7	37.2	-	-	1.6	1.4
Interactions						
NxK	*	NS	NS	NS	NS	NS
NxCV	NS	*	*	*	NS	NS
KxCV	NS	NS	*	*	NS	NS
NxKxCV	NS	NS	NS	NS	NS	NS
F-test	-	-	-	-	-	-

Data revealed that number of grains /spike, grain weight and number of spikes/m^2 were not significantly affected by the different nitrogen levels or potassium levels. Generally, data showed that number of grains/spike and number of spikes/m^2 were increased with increasing nitrogen levels up to 100 kg N/fed in the two seasons. This increase in grains number per spike could be attributed to the increase in number of fertile florets per spikelets and seed set per spike as encouraged by increasing nitrogen levels. These results are in harmony with those obtained by Tammam and Tawfelis (2004), Protic *et. al*(2007), EL-Hag ,Dali(2008), Abdel-Nour and Fateh, (2011) and Khaled and El-Rawy (2012).

Data in Table 6 show that straw yield, grain yield and harvest index were highly significantly influenced by cultivars.

Table 6: Average of grain/yield (ardab/fad), straw/yield (ton/fad) and harvest index. for four wheat cultivars as affected by two potassium levels and three nitrogen levels in the two seasons ,2008/2009 and 2009/2010.

Treatments	Grain yield(ardab)		Straw yield(ton)		Harvest index %	
	2008/2009	2008/2010	2008/2009	2009/201	2008/2009	2009/2010
Nitrogen fertilizer						
50kgN/fed	23.5	19.4	5.5	3.8	39.0	43.8
75kgN/fed	23.2	19.8	5.5	4	38.9	42.5
100kgN/fed	24.3	20.0	5.7	4.1	39.1	42.0
F-test	*	NS	NS	**	NS	**
LSD at 5%	0.8	-	-	0.2	-	0.8
Potassium fertilizer						
24 Kg/fed	23.6	20.4	5.6	4	38.9	43.1
48Kg/fed	23.7	19.1	5.6	3.9	39	42.4
F-test	NS	NS	NS	NS	NS	NS
Cultivars						
Gemmaiza	23.9	21.4	5.2	3.8	40.8	42.8
Sids 12	23.1	18.1	5.3	3.8	39.7	41.7
Sids 13	23.5	20.9	5.8	4.1	37.7	43.2
Shandaweel 1	24.2	18.7	5.9	4.2	37.9	40.3
F-test	*	**	**	**	**	**
LSD at 5%	0.7	1.1	0.4	0.2	0.8	1.2
Interactions						
CVxN	NS	NS	NS	NS	NS	NS
CVxK	NS	NS	NS	NS	NS	NS
NxK	NS	NS	NS	NS	NS	NS
NxKxCV	NS	NS	NS	NS	NS	NS
F-test	-	-	-	-	-	-

Accordingly, Shandaweel 1 produced significantly more straw yield than the other three cultivars in the two seasons, and out-yielded in grain yield than in Gemmiza 11, Sids 12 and Sids 13 in the first season, while, Gemmiza 11 out-yielded in grain yield the other three cultivars in the second seasons. The data in Table 6 also, show that harvest index of the four cultivars was highly significant in the two seasons .The combined data showed that Gemmiza 11 gave the highest values in the two seasons.

The effect of potassium fertilizer levels on the three characters was not significant in both seasons.

Regarding nitrogen levels, grain yield was significantly increased with the in increment nitrogen levels up to 100kg N/ fad in the first seasons. Such increases in yield could be mainly due to similar increases in number of spikes/m2 and number of grains/spike. These results are in close agreement with those obtained by Tammam and Tawfelis (2004), Abdel-Nou rand Fateh (2011) and Khaled and EL-Rawy (2012).

Straw yield was highly significantly increased due to increasing nitrogen levels in the second seasons ,the data also, show that increasing nitrogen levels increased straw yield .These results could be attributed to the

increase in number of spikes/m ٢and plant height due to increasing nitrogen levels .Generally ,data show that straw yield and grain yield were increased with increasing nitrogen levels up to 100 kg N/fed .in the two seasons. Similar results were obtained by Tammam and Tawfelis ,(٢٠٠٤El-Sayed,Soad and Hammad (٢٠٠٧)and Khaled and El-Rawy (٢٠١٢).

INTERACTIONS

Data in Table 6 show that the interactions among the three studied factors were not significant. Similar results were obtained by El-Rawy et al. (2007) and El-Hag, Dalia (2008).

Data in Table7 show that the interaction between cultivars and Potassium on grains/spike was significant in the two seasons. In addition, the data show that Gemmiza 11 fertilized by 24 kg Potassium /fed in the first season gave the highest number of grains/spike. El-Rawy et al. (2007) and El-Hag, Dali (2008) found that the interaction between cultivars, potassium and nitrogen rates did not show any significant effect on grains/spike.

Table 7: Effect of the interaction between potassium and cultivars on grains/spike in two seasons, 2008/2009 and 2009/2010.

Treatments	Gemmiza 11		Sids 12		Sids 13		Shandaweel 1	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
Potassium								
24kg/fed	74.0	69.8	66.1	62.4	68.2	64.4	70.0	66.0
48kg/fed	70.5	66.5	68.0	64.1	69.5	65.6	62.8	59.2
LSD KxCVat 5%	3.84							

Data in Table 8 illustrates the interaction between cultivars and nitrogen on grains/spike in two seasons. Data show highly significant effects among the cultivars and nitrogen in both seasons. The combined data show that Gemmiza 11 fertilized by 100 kg N/fad in the first season gave the highest number of grains/spike.El-Rawy *et al*. (2007) and El-Hag, Dalia (2008) found that the interaction between cultivars and nitrogen did not show any significant effect on grains /spike.

Table 8: Effect of interaction between nitrogen and cultivars on grains/spike in two seasons ,2008/2009 and 2009/2010.

Treatments	Gemmiza 11		Sids 12		Sids 13		Shandaweel 1	
	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10	2008/09	2009/10
Nitrogen								
50kgN/fed	69.2	65.3	64.6	61.3	68.0	74.8	66.6	62.9
75kgN/fed	67.4	63.6	70.0	65.7	72.6	68.5	66.1	62.7
100kgN/fed	80.1	75.6	66.5	62.8	66.1	62.3	66.4	62.3
LSD NxCV at 5%	4.36							

The data of the interactions between cultivars and nitrogen on Spikes/ m^2 in 2009-2010 are presented in Table 9.

The results show that the interaction between cultivars and nitrogen levels were highly significant in the second season. The combined data indicated that application of 100 kg N/fad gave the highest number of spikes/m^2 from the cultivars Sids 12 ,these results are in harmony with those obtained by Tammam and Tawfelis(2004),Abdel-Nour and Fateh(2011).

Table 9: Effect of interaction between nitrogen and cultivars on Spikes/ m^2 in 2009-2010 growing season ,2008/2009 and 2009/2010,

Treatments	Gemmiza 11 2009-2010	Sids 12 2009-2010	Sids 13 2009-2010	Shandaweel 1 2009-2010
Nitrogen				
50kgN/fed	342.5	482.6	273.6	416.0
75kgN/fed	380.8	392.8	300.8	384.4
100kgN/fed	344.1	461.0	270.0	408.8
LSD NxCVat5%	24.75			

It could be concluded that Shandaweel 1 can be cultivated under fertilization at 100 kg/fad to produce the highest yields of grains and straw per Fadden.

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تأثير مستويات التسميدالنتروجينى والبوتاسى على المحصول ومكوناتة لاربعة أصناف جديدة من قمح الخبز

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قسم بحوث القمح - معهد بحوث المحاصيل الحقلية - مركز البحوث الزراعية

أقيمت تجربتان حقليتان لدراسة تأثير مستويات مختلفة من التسميد النتروجين والبوتاسى المحصول ومكونات لاربعة أصناف جديدة من قمح الخبز هي جميزة ١١ ، سدس ١٢، سدس ١٣ وشندويل ١ في محطة البحوث الزراعية بسخا مركز على البحوث الزراعية خلال موسمي ٢٠٠٨/ ٢٠٠٩و٢٠٠٩/٢٠١٠ واستخدم ثلاثة مستويات من السماد النتروجيني وهى٥٠ ، ٧٥ و١٠٠كجم ن/فدان مع مستويين من التسميد البوتاسي ٢٤ و ٤٨كجم بو/فدان واستخدم تصميم القطع المنشقة مرتين فى اربعة مكررات وتتلخص اهم النتاج فى الاتى :

زيادة التسميد النيتروجيني إلى ١٠٠كجم/فدان أدى إلى زيادة عدد أيام طرد السنابل والنضج ،طول النبات ،عدد حبوب السنبلة ،عدد السنابل /م٢ وكذلك محصول القش والحبوب للفدان . على العكس من ذلك لم تتأثر صفة وزن الـ ١٠٠٠ حبة بزيادة مستويات التسميد

اظهرت الدراسة الى ان الصفات المدروسة لم تظهرأى تأثير معنوى مع مستويات التسميد البوتاسى

كذلك اشارت الدراسة الى ان الصنف جميزة ١١ كان ابكر الاصناف فى التزهير والنضج عن باقى الاصناف فى موسمى الزراعة. بينماالصنف سدس ١٢ اعطى سنابل / م٢ اكثر عددا فى كلا الموسمي.و الصنف سدس ١٣ اعطى اعلى وزنا لل١٠٠٠ حبة فى كلا الموسمين .واعطى الصنف شندويل ١ اعلى محصول حبوب فى الموسم الأول فى حين انة كان اخر الأصناف فى النضج . بينما الصنف جميزة ١١ كان اعلى فى عدد حبوب السنبلة فى الموسم الاول واعطى اعلى محصول حبوب فى الموسم الثانى .

كان التفاعل بين التسميد النيتروجينى والأصناف معنوياً لصفة عدد السنابل/م٢ فى الموسم الثانى أما التفاعل بين التسميد النتروجينى والبوتاسى فكان معنويا لصفة عدد السنابل/م٢ للموسم الاول ,و كان التفاعل بين التسميد النتروجينى والاصناف والتسميد البوتاسى و الاصناف معنويا لصفة عدد حبوب السنبلة فى كلا الموسمين.ولم يكن للتفاعل بين التسميد النتروجينى والبوتاسى والاصناف اى تاثير معنوى للصفات المدورسة.

توصى الدراسه الى ان زراعة الصنف شندويل ١ بمعدل ١٠٠كج ن للفدان يعطى اعلى محصول من الحبوب والقش للفدان تحت ظروف شمال الدلتا.

بتحكيم البحث

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