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PRODUCTIVITY OF TWO BREAD WHEAT CULTIVARS UNDER THREE SEEDING RATES

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ABSTRACT

This study was carried out in a private farm, Belcas, Dakahalia Governorate, Northern Delta, Egypt, during 2002/2003 and 2003/2004 seasons. The study tested the effect of three seeding rate (50, 70 and 90 kg/fed.) on the productivity of two wheat cultivars (Giza 163 and Sakha 69). The obtained data could be summarized as follow:

Significant cultivar differences could be detected regarding grain yield and almost of its attributes. Sakha 69 cultivar had shorter plants but longer spikes and larger number of grains and grain weight/spike than Giza 163, which had heavier 1000 grains weight than the former.

The increase of seeding rate to 90kg/fed yielded significant increase in the grain and straw yield/fed where dense sown plants were longer and produced larger number of spikes/m^2 though they had fewer number and grain weight /spike than the higher sown ones.

Significant simple correlation coefficients were detected between grain yield/fed and all attributes with few exceptions.

Keywords: Wheat cultivars, Seeding rate, correlation

INTRODUCTION

Egyptian total production of wheat hardly satisfies about 55% of consumption. Therefore, efforts should be devoted to narrow this gape. This could be achieved through the use of high yielding cultivars and the adoption of agricultural practices. (Soliman, Salwa, 2006). No doubt, the decision of a cultivar use is an important concern in an assay for maximizing wheat yield, (Hamada and Moussa, 2003). In addition, recent researches showed variation in the response of cultivars to seeding density. In Egypt, a successful varietals wheat policy was devoted. Such policy demands no dependence on only an unique superior cultivar, but on several ones of high yielding potentiality, resistance to the three rusts, high stability, noticeable adoption to the prevailing environments and in convenient with the proper agricultural practices. Thereafter, the two cultivars Giza 163 and Sakha 69 were released.

The previous two cultivars occupied most of wheat area. Such occupation depended on their adaptability in most Egyptian districts, having moderate air temperature, (Gomma and Co-authors, 1984 a). In many studies, such two cultivars produced the same yield of grain and straw. Some authors found significant superiority in favor to Sakha 69. They added that the failure of Giza 163 could be attributed to its relative susceptibility to strip rust. Oppositely, Abo Shetia and Abd El-Gawad (1995) pointed out that Giza 163 significantly exceeded Sakha 69, respecting plant height, straw yield and stability.

Plant density effects on crop yield showed increases up to a plateau value at moderate densities and significant reduction in such yield could be shown only at very high densities. Plant density greatly varies according to climatic conditions, soil, sowing date and varieties, (Gatc, 1995). Optimum seeding rate for different regions is a direct result of the relation between wheat density and its yield, (Anderson and Sawkins, 1997). Optimum seed rates were recommended in different areas; Belgium, as 200plant/m^2, (Gate, 1995), Northern Ireland, as 50 – 100 seeds/m^2, (Easson *et al.*, 1993) in the USA as 67 – 400 seeds/m^2 and in Europian Mediterranean countries as 400 – 500 seed/m^2, (Jaine, 2004) .

Egyptian studies showed different effects of seeding rate on some wheat attributes of growth and yield. The different results suggest that rate of seeding might be higher or lower than those used with other wheat cultivars in other wheat growing areas. However, positive effects of increasing seed rate were reported on yield and some its components by Zohry *et al.* (1998) up to 60 kg/fed., Yakout *et al.* (1998) up to 80 kg /fed. On the other hand, increasing seed rate depressed some growth contributors and yield of wheat as mentioned in the studies of El kholy (2000).

In many studies, significant correlation coefficients were obtained between grains yield/fed and each of spikes/m^2, No. of grains/spike, grain weight/spike and grain index. El-Marakby *et al.* (1992) found negative correlation when plant height was considered. The present study tried to evaluate yielding ability of Giza 163 and Sakha 69 wheat cultivars under three seeding rates, in Northern Delta site.

MATERIALS AND METHODS

A two-season experiment was carried out at a private farm in Belcas, Dakahalia Governorate, northern Delta, Egypt, during 2002/2003 and 2003/2004 seasons. The soil was clay loam containing an average of 2.25% organic matter and 30 ppm available N, in the 30 cm soil depth. Two cultivars, viz. Giza 163 and Sakha 69 and three seeding rates, viz 50, 70, and 90 kg/fed were studied. A split plot design with three replicates was used. Cultivars were randomly arranged in the main plots; meanwhile seeding rates were allocated in the sub ones. The experimental plot area was 42.0 m^2 (7.0 x 6.0 m).

In both seasons, the preceding crop was rice. Seeds were hand broadcasted on November 21st. During seed bed preparation, both phosphorus as calcium super phosphate (15.5% P_2O_5) at a rate of 100 kg/fed and potassium sulphate (48 % K_2O) at a rate of 50 kg k/fed were added. Nitrogen (80 kg N/fed) was applied as urea (46.5 % N) at three doses; (20 kg N/fed), (40 kg N/fed) and (20kg N/fed) before first irrigation, second irrigation and at heading, respectively. Harvest was done on May 15th. All other agriculture practices were done as recommended.

At harvest, an area (25x25 cm) from each plot was taken for studying plant height and number of spikes/ m^2. Traits of spike were measured from 10 spikes for each plot. Yield per plot for straw or grains was weighed and

consequently yields/fed were calculated. The studied traits were plant height (PH), spike length (SPK L), number of spiks/m^2 (SPK/$m^{2)}$, number of grains/spike (G/SPK), grain weight/spike (GW/SPK), grain index (GIX), straw yield/fed.(STY/fed), grain yield/fed (GY/fed) in Ardab where one ardab = 150 kg.

Analysis of variance for each season was done. The ratio between the variance of error in the two seasons was insignificant. Thereafter a combined analysis over the two seasons was performed. Means were compared using LSD test at $\propto$ 0.05 level of significance. Simple correlation coefficient (r) was calculated for each pair of the studied traits using combined data. All statistical analyses were carried out according to Gomez and Gomez (1983).

RESULTS AND DISCUSSION

1. Cultivar differences:

In both seasons(Table 1), Sakha 69 cultivar had shorter plants than Giza 163, but, the former had longer spikes than the later. Also, Sakha 69 had larger number of spikes / m^2 with heavier grain weight/ spike than Giza 163. However, Giza 163 had heavier 1000 grain weight but fewer number of grains/spike than Sakha 69. Superiority of Sakha 69 in these yield attributes was reflected finally in the grain yield / fed in both seasons and in the straw yield/fed in the second season.

These results clearly indicate that elongation of Giza 163 plants was on the expense of tillering which was reflected in fewer number of spikes/m^2 than Sakha 69. Moreover, the increase in number of spikes/m2 in Sakhs 69 was not on the expense of the number of grains/ spike and hence the grain weight / spike. However, a significant decrease was observed in the 1000 grains weight of Sakha 69 probably due to the increase of the number of grains / spike. This refers to an intera – spikelet competition in Sakha 69 caused by the larger number of grains/ spike.

According to these results, the superiority of Sakha 69 in grain yield per fed would be attributed to its superiority in spike length, number of grains/ spike which intern increased the grain weight /spike. This cultivar had also greater tillering capacity which was expected in having larger number of spikes / m^2.

Table 2 shows the combined effect of two seasons. Significant differences between Sakha 69 and Giza 163 cultivars for all studied traits were detected. Such significant differences could be attributed to the genetic variability between the two cultivars. Hamada and Moussa (2003) found that spike length, number of spikes/m^2, number of grains/spike, grain weight/spike, grain index and grain yield/fed showed their higher products on Sakha 69 versus Giza 163. It seemed that Sakha 69 with its longer spike (12.37 cm) carried greater number of grains/spike (46.90), which weighed heavier spike (1.54 gm). Such attributes well benefited the available environment and were turn in the grain yield/fed., resulting the higher one i.e.17.84 ard. Abo shetaia and Abd El-Gawad (1995) reported that the two

cultivars produced the same grain yield/fed in some comparisons. Giza 163 exceeded Sakha 69 cultivar with respect to plant height and straw yield/fed. El- Kholy (2000) found significant differences in plant height, number of spikes/m^2, straw yield and grain yield as affect by wheat genotypes. The superiority of Sakha 69 over Giza 163 was reported by some investigators of them Hamada and Moussa (2003) who found that the deficit in Giza 163 yield could be attributed to its susceptibility to strip rust.

2. Seeding rate effect:

Data in table 1 show that in both seasons, each increase in seeding rate was followed by a significant increase in plant height, but however, decreased spike length. The increase of seeding rate caused a significant increase in the number of spikes/ m^2 but decreased the grain weight/spike in the first season, due to the decrease in the number of grains / spike and the 1000-grain weight.

In the second season, the use of the medium seeding rate (70kg/fed) recorded the highest number of grains/spike and the heaviest 1000-grain weight. Therefore, the grain weight / spike was increased with the increase of seeding rate up to 90kg/fed.

Regarding the grain and straw yields / fed, seeding rate had more pronounced and clear effect in the first than in the second season, where each increase in seeding rate was followed by a significant increase in each of the grain and straw yield/fed. This was also true in the second season, but when the rate of seeding was increased from 50 to 90 kg /fed when the first seeding rate increment did not yield a significant increase in the grains or straw yield/fed.

Table 2 shows the combined effect of two seasons. Seeding rate significantly affected the studied traits. It is clear that the significant highest values of plant height, (122.6cm), number of spikes/m^2, (426.3), grain weight/spike (1.53 gm), straw yield/fed(4.4 ton) and grain yield/fed (15.89 ard.) were produced by the highest seed rate (90.0 kg/fed). On the other hand, the lowest rate resulted in producing the highest values of spike length (11cm), number of grains/spike (42.1), and grain index (56 gm). The negative effect of highest seed rate on some yield makers could be attributed to the increase in population, as a result of higher seeding rate and consequently low penetration of light within wheat canopy, hence high competition between plants for water, minerals and other environmental factors. Similar relsults on plant height were reported by Abd El-latif and El-Tuhamy(1986).

It was observed that taller plants gave shorter spikes. Zohry *et al* (1998) found that seeding rate did not significantly affect spike length. Number of spikes/m^2 and plant height showed an opposite trend to that of spike length. Such phenomenon may be attributed to the role of apical dominance, which always promotes plant elongation. Such promotion reduced the rate of building materials necessity to tillers hence spikes formation. The present results are in line with those of Abo-Shetaia and Abd El- Gawad (1995).

Number of grains/spike is a good indicator to spike length, because of the clear positive relation between them. The greatest number of

grain/spike(42.07) and spike length(11.00cm) were shown by seeding with 50kg seeds/fed. The present findings are in accordance with those reported by Yakout, *et al.* (1998).

Greater number of grains on a certain spike length produced light seed weight was clearly shown in Table 3, where the heaviest weighed grains/spike (1.53gm) was obtained from the lowest number of grains/spike, (35.8). Both traits were detected by sowing 90 kg/fed.

Straw yield/plant was gradually increased as seeding rate increased. The highest straw yield/fed (4.40 ton) was obtained from the highest seeding rate (90kg/fed). It seemed that straw yield/fed had benefited from the positive effects of highest seeding rate mainly, on plant height (122.6cm). Taller plants were considered, as a main attributor to straw yield/fed in the studies of El- Kholy (2000).

Grains yield/fed as a final result of all yield attributers had benefited from the progressive effects of highest seed rate on plant height, grain weight/spike and grain index. Such positive effects were turn in grain yield/fed. The three seed rates 50, 70 and 90 kg/fed yielded 14.83, 15.14 and 15.80 ard/fed, respectively. The present results are in full harmony with those of Abd El-latif and El-Tuhamy (1986), Yakout *et al.* (1998) and El-Kholy (2000).

3. Interaction effects:

Table 2 includes the obtained combined means as affected by the interaction between cultivars and seed rates. It is obvious that the combinations significantly affected all traits except plant height and spike length. It was observed that seeding Sakha 69 by 90.0 kg/fed produced the highest values regarding number of sipkes/m^2 (451.3) and grain weight/spike (1.7gm). Such superior two products were turn in grain yield/fed and produced, at final, the highest grain yield/fed (18.55 ardab). In addition, the highest seeding rate well interacted with Giza 163 and produced higher values regarding plant height (133.0cm) and spike length (12.6cm). El- Kholy (2000) agreed with the previous findings, but disagreed with those recorded on plant height, spike length; grain weight/spike and straw yield/fed.

4. Correlation study

Table 3 represents correlation coefficients between each pair of the studied eight traits (Combined data). It is clear that all correlation coefficients were significant, except those of number of spikes/m^2 with each of grain weight/spike (0.135), grain index (0.253), straw yield/fed. (0.047) and that between grain index and straw yield/fed (-0.018). Also, the calculation declared that most of estimations were positive, however, the negative signs were shown on plant height correlation with all traits except straw yield/fed (0.582). Similarly, the later trait showed negative signs with all other traits, except No. of spikes/m^2. Fore grain yield/fed., it could be summarized that the trait was significantly correlated with all traits, with positive signs except with plant height (-0.932) and straw yield/fed (-0.392). These results explained and ,agreed with the previously mentioned in the analysis of variance presentation. Correlation results herein are in convenient with those of El Marakby *et al.* (1992) and El kholy (2000).

Table 1: Some agronomic traits of two wheat cultivars, seeding rate and its interaction in 2002/2003 and 2003/2004 seasons

Treatments	Plant height (cm)		Spike length (cm)		Spikes/m^2 (no)		Grains/spike (no)	
Seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Wheat cultivars								
Giza 163 (C_1)	130.2	129.1	10.13	9.37	377.4	379.1	32.38	32.53
Sakha 69 C_2)	126.5	94.8	12.50	12.24	418.1	422.6	45.67	48.15
Significance	*	*	*	*	*	*	*	*
Seeding rate								
50 kg/fed (S_1)	126.7	109.4	11.60	11.0	372.8	369.7	43.22	40.94
70 kg/fed (S_2)	128.5	111.5	11.20	10.86	396.6	404.8	38.45	43.83
90 kg/fed (S_3)	130.0	115.1	11.30	10.56	424.0	428.5	35.40	36.25
LSD $_{0.05}$	0.72	0.90	0.12	0.23	13.5	17.0	1.00	4.00
Interactions								
$C_1 \times S_1$	127.7	126.3	10.80	9.20	351.2	344.5	34.43	32.23
$C_1 \times S_2$	130.2	127.8	9.80	9.46	381.1	391.2	13.90	33.76
$C_1 \times S_3$	132.7	133.3	9.80	9.46	400.0	402.4	30.80	31.60
$C_2 \times S_1$	125.6	92.4	12.40	12.80	394.3	394.8	52.00	49.64
$C_2 \times S_2$	126.8	95.2	12.50	12.26	412.0	418.4	45.00	53.90
$C_2 \times S_3$	127.2	96.8	12.70	11.66	448.0	454.5	40.00	40.90
LSD $_{0.05}$	NS	NS	NS	NS	11.77	13.3	0.52	4.40

Table 1: continued:

Treatments	Grain weight/ spike (gm)		1000 grains (gm)		Straw yield/fed. (ton)		Crain yield/ fed (ard)	
Seasons	1st	2nd	1st	2nd	1st	2nd	1st	2nd
Wheat cultivars								
Giza 163 (C_1)	1.27	1.17	56.7	54.56	4.47	4.24	13.7	11.75
Sakha 69 C_2)	1.58	1.51	52.7	53.42	3.89	4.33	17.6	18.07
Significance	*	*	*	*	*	*	*	*
Seeding rates								
50 kg/fed (S_1)	1.56	0.96	56.8	55.18	3.99	4.25	14.8	14.76
70 kg/fed (S_2)	1.39	1.34	55.2	56.42	4.20	4.16	15.8	14.51
90 kg/fed (S_3)	1.32	1.74	52.2	50.37	4.35	4.45	16.3	15.47
LSD $_{0.05}$	0.15	0.35	1.4	1.2	0.13	0.20	0.9	0.81
Interactions								
$C_1 \times S_1$	1.40	0.82	58.3	51.96	4.41	4.00	13.3	11.06
$C_1 \times S_2$	1.23	1.15	56.7	53.80	4.50	4.16	14.0	11.56
$C_1 \times S_3$	1.17	1.53	55.1	57.92	4.50	4.56	13.8	18.46
$C_2 \times S_1$	1.72	1.08	55.2	58.40	3.57	4.49	16.5	17.46
$C_2 \times S_2$	1.55	1.51	53.6	59.04	3.90	4.16	17.5	18.30
$C_2 \times S_3$	1.46	1.94	49.2	42.82	4.20	4.34	18.8	N.S
LSD $_{0.05}$	0.18	0.22	1.70	1.11	0.80	0.40	NS	NS

Table 2:Combined means of the studied traits for the two wheat cultivars, as affected by seeding rates and their interactions

Treatments	Plant height (cm)	Spike length (cm)	Spikes/ m^2 (no)	Grains/ spike (no)	Grain weight/ spike (gm)	1000 grains (gm)	Straw yield/fed. (ton)	Crain yield/ fed (ard)
Cultivars								
Giza 163 (C_1)	129.7	9.75	378.4	32.4	1.22	55.6	4.36	12.73
Sakha 69 (C_2)	110.7	12.37	420.4	46.9	1.54	53.0	4.10	17.84
Significance	*	*	*	*	*	*	*	*
Seeding Rates								
50 kg/fed (S_1)	118.1	11.00	400.7	42.1	1.26	56.0	4.12	14.83
70 kg/fed (S_2)	120.0	10.92	426.3	41.1	1.36	55.8	4.18	15.14
90 kg/fed (S_3)	122.6	10.00	426.3	35.8	1.53	51.3	4.40	15.89
LSD $_{0.05}$	0.52	0.950	0.645	0.645	0.010	0.077	0.182	0.094
Interactions								
$C_1 \times S_1$	127.0	9.63	426.3	33.3	1.11	55.1	4.21	12.18
$C_1 \times S_2$	129.0	9.63	347.9	32.8	1.19	55.3	4.33	12.77
$C_1 \times S_3$	133.0	12.60	386.2	31.2	1.35	56.5	4.53	16.13
$C_2 \times S_1$	109.0	12.38	401.2	50.8	1.40	56.8	4.03	17.48
$C_2 \times S_2$	111.0	12.18	394.6	41.5	1.53	56.3	4.03	17.48
$C_2 \times S_3$	112.0	12.18	451.3	40.5	1.7	46.0	4.27	18.55
LSD $_{0.05}$	NS	NS	0.913	0.346	0.014	0.103	0.257	0.134

Table 3: Simple correlation coefficients between each pair of the eight studed traits, combined data

Characters	Plant height	Spike length	Spikes/ m^2 (no)	Grains/ Spike (No)	Grain weight/ spike	1000 grains weight	Straw yield/ fed.
Spike length	-.989*						
Spikes/m^2(no)	-0.555*	0.571*					
Grains/spike (no)	-0.941*	0.938*	0.364*				
Grain weight/spike	-0.890*	0.882*	0.135 ns	0.932*			
1000 grains weight	-0.68*	0.474*	0.253 ns	0.271 ns	0.377*		
Straw yield/fed	0.582*	-0..565*	0.047 ns	-0.669*	-0.724*	-0.018 ns	
Grain yield/fed.	-0.932*	0.941*	0.941*	0.807*	0.814*	0.468*	-0.392*

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إنتاجية صنفين من قمح الخبز تحت ثلاث معدلات تقاوي

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أجريت تجربتان حقليتان بمركز بلقاس دقهلية ، شمال الدلتا خلال موسمي ٢٠٠٢/٢٠٠٣ و ٢٠٠٣/٢٠٠٤. بهدف دراسة انتاجية صنفين من قمح الخبز(جيزة ١٦٣ وسخا ٦٩) تحت ثلاث معدلات للتقاوي(٧٠،٥٠، ٩٠ كجم/فدان). استخدم تصميم القطع المنشقة مرة واحدة في ثلاثة مكررات، حيث وزع الصنفان علي القطع الرئيسية ومعدلات التقاوي على القطع الشقية وكانت مساحة القطعة التجريبية ٤٢م٢(٦ × ٧م) .اجري التحليل التجميعي لنتائج الموسمين.

وكانت النتائج كما يلي :-

- لوحظت اختلافات صنفية معنويه في جميع الصفات، حيث تفوق الصنف سخا ٦٩ علي الصنف جيزة ١٦٣ في المحصول ومعظم الصفات، وكان متوسط محصول الحبوب/فدان ١٢,٧٣ و ١٧,٨٤ إردب للصنفين جيزة ١٦٣ وسخا ٦٩ على الترتيب .
- أثرت معدلات التقاوي معنويا علي جميع الصفات، حيث تفوق معدل ٩٠ كجم/فدان علي المعدلين الأخرين وأعطي ١٥,٨٩ إردب/فدان.
- كان التفاعل المتبادل بين العاملين معنويا في تأثيره علي جميع الصفات موضع الدراسة ماعدا طول النبات وطول السنبلة. ولقد أعطي زراعة الصنف سخا ٦٩ بمعدل تقاوي ٩٠ كجم/فدان اعلي محصول (١٨,٥٥) إردب/فدان.
- كانت معظم قيم معامل الارتباط البسيط بين كل زوج من الصفات معنوية وموجبة. كانت الارتباطات سالبة فقط عندما يشارك أي من طول النبات أو محصول التبن مع الصفات الأخرى.