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Response of Two Wheat Cultivars to Different Nitrogen Sources in Newly Cultivated Land.

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ABSTRACT

Two field experiments were conducted during 2012/2013 and 2013/2014 seasons at Wadi El-Rayan Fayoum Governorate, Egypt to study growth, yield and yield components of two wheat cultivars as affected by nitrogen source. The results could be summarized as follows: There were significant differences for growth characters at 90 and 110 days from sowing in both seasons owing to varietal differences i.e. plant height(cm),No. of tillers/ plant, No. of leaves/ plant, No. of spikes/ plant, weight of spikes/ plant (g),total dry weight/ plant(g), leaf area/ plant(dm^2) and leaf area index. Sids-13 cultivar surpassed significantly Baniswef-4 in all growth characters at 90 and 110 days after sowing in both seasons. Sids-13 cultivar gave higher plant height, weight of spikes/ plant (g), grain index (g), grain yield/ plant (g), grain yield ton/ fed., straw yield ton / fed., biological yield ton/ fed., and harvest index in both seasons, while the differences between Sids-13 cultivar and Baniswef-4 cultivar in No. of tillers/ plant and No. of spikes/ plant failed to reach significant level at 5% in both seasons. Nitrogen addition as urea showed a favorable effect on improving growth of wheat as compared with the addition of Ammonium nitrate or Ammonium sulphate or Ammonia gas or slow-release N at all growth characters in both seasons at 90 days and 110 days after sowing. Results indicated that different sources of N fertilizer had significant effect on all characters of yield and yield components in both seasons except number of spikes/ plant. Addition nitrogen fertilizer as urea surpassed other sources of nitrogen fertilizer. Significant interaction between wheat cultivars and nitrogen sources was detected for all growth characters (except leaf area/ plant at 110 days after sowing, while, plant height, number of tillers/ plant, grain index, grain yield/ plant, grain yield/ fed., straw yield/ fed., biological yield/ fed., and harvest index% were significantly affected by interaction between wheat cultivars and nitrogen source.

Keywords: Wheat, cultivars, nitrogen source, growth characters, yield and yield components.

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INTRODUCTION

Wheat (*Triticum aestivum* L.) is consider the most strategic cereal crop in the world as well as in Egypt. Many efforts are continuously paid for increasing wheat productivity to decrease the gap between production and consumption by means of vertical and/or horizontal planting. Increasing wheat production per unit area can be achieved by breeding and cultivating the promising wheat cultivar and applying the optimum cultural practices such as fertilizer. There were significant differences between wheat cultivars in all characters under study reported by [1-6]. The total biomass is a result of the integration of metabolic reaction in the plant. Any factor influencing the metabolic activity of the plant at any period of its growth affect the yield.

Nitrogen is the most limiting factor in crop production and results in higher biomass and protein yields in plant tissue. The efficiency of nitrogen fertilizers increased by using slow-release nitrogen fertilizer which reduce nitrogen losses by leaching or volatilization of ammonia[7-9}.Among the great number of nitrogenous fertilizers, ammonium nitrate, ammonium sulphate, ammonium gas and urea are usually used in Egyptian wheat cultivation. Thus the evaluation of these forms to choice the best of them with regard to their effect on wheat yield and quality is of paramount importance. Many investigator reported in this aims [10-13 in Maize, 14-15].

Thus the aim of this investigation is to study growth and productivity of two wheat cultivars as affected by nitrogen sources.

MATERIAL AND METHODS

Two field experiments were conducted at new land at Wadi El-Rayan, El-Fayoum Governorate, Egypt during 2012/2013 and 2013/2014 seasons. The experiments were carried out to study the effect of nitrogen fertilizer sources on two wheat cultivars (*Triticum aestivum* L.). The physical and chemical characters of soil (30 cm depths) in the experimental site were as follows: sand 52.5 percentage, silt 20 percentage, clay 27 percentage, pH 8.02, organic matter 0.84 percentage, $CaCO_3$ 20.9 percentage, EC 2.9 m mhos/cm^3, soluble N 74 ppm according to as described by [16]. The experimental design was split plot design with four replications. Wheat cultivars were allocated in the main plots and nitrogen sources were allocated in sup- plots. The size of each plot was 10.5m^2 (1/400 feddan) 3.5 m long and 3 m wide. Each experiment included ten treatments which were the combination among two cultivars and nitrogen fertilizer sources treatments.

The experimental treatments can be described as follows:

Cultivars: 1- Baniswef-4 2- Sids-13

Nitrogen fertilizer sources:

1-Urea 2- Ammonium nitrate 3- Ammonium sulphate
4- Ammonia gas 5- Slow-release N.

Nitrogen fertilizer was added in three doses at rate of 100 kg N / fed. Where, 20 kg N/ fed., were added at sowing time, 40 kg N/ fed., added at the first irrigation and the third dose was applied 25 days after the first irrigation. N fertilizer added in the form of urea (46%) or, Ammonium nitrate (33.5%) or, Ammonium sulphate (20.6%) or, Ammonia gas (82%) or slow- release N (35.5%). Super phosphate fertilizer (15.5%P_2O_5) was applied before sowing at the rate of 150 kg/ fed. Potassium fertilizer was applied before sowing at a rate of 50 kg/ fed., in the form of potassium sulphate (48% K_2O). Sowing dates were November 15th and November 20th in both seasons, respectively, while, seeding rate was 70 kg/ fed. The normal agronomic practices of wheat were followed until harvest as recommended by Wheat Research Dep., Agric. Research Centre.

Growth characters:

Samples of ten guarded plants were taken at random of each plot for the four replication to determine the growth parameters at 90 and 110 days after sowing were plant height (cm), number of tillers/ plant, number of leaves/ plant, number of spikes/ plant, weight of spikes/ plant (g), total dry weight/ plant (g), leaf area/ plant (dm^2) and leaf area index were measured.

Yield and its components:

At harvest, 10 plants at random were taken from each plot to determine plant height (cm), number of tillers/ plant, number of spikes/ plant, weight of spikes/ plant (g), grain index (g) and grain yield/ plant(g).Grain yield (ton/fed.), straw yield (ton/fed.), biological yield (ton/fed.) and harvest index% was estimated from each plot.

Data obtained were exposed to the proper method of statistical analysis of variance differentiate among means of different as described by [17]. The treatments means were compared using the least significant differences (L.S.D.) test at 5% level of probability. Combined analysis was made from the two growing seasons hence the results of two seasons followed similar trend.

RESULTS AND DISCUSSION

1- Growth characters:

Effect of cultivars:

Data in Table (1) revealed that the differences between wheat cultivars in all characters under study in both seasons (plant height, No. of tillers/ plant, No. of leaves/ plant, No. of spikes/ plant, weight of spikes/ plant, total dry weight/ plant, leaf area/plant and leaf area index) at 90 and 110 days after sowing were significant. Sids-13 cultivar surpassed Baniswef-4 cultivar in all characters under study. The differences between wheat cultivars and differences between genotype concerning partition of dry matter, where wheat cultivar differed carbon equivalent, yield energy per plant and per fed., [4]. These results are in a harmony with those obtained by [1, 2, 4, 6, 9, 18].

Effect of nitrogen sources:

Data in Table (1) showed that plant height, No. of tillers/ plant, No. of leaves/ plant, No. of spikes/ plant, weight of spikes/ plant, total dry matter, leaf area and leaf area index at 90 and 110 days from sowing were significantly affected by different sources of nitrogen. The greatest values of all growth characters were obtained by application urea fertilizer followed by ammonium nitrate at all characters under study, while the difference between urea and ammonium nitrate failed to reach the significant level at 5% in No. of leaves/ plant at 90 and 110 days from sowing and No. of spikes/ plant at 110 days from sowing. Addition of urea or ammonium nitrate gave the best growth characters in both seasons, it could be concluded that, loss of N. from ammonium sulphate or ammonia gas by leaching was most rapid than from ammonium nitrate or urea [19].The superiority of urea and ammonium nitrate on the vegetative growth may be due to continuous release of N to wheat plants.

These finding are supported with those obtained by [12, 14 , 15 , 20].

Effect of interaction between wheat cultivars and nitrogen sources:

The effect of interaction between wheat cultivars and nitrogen sources on all growth characters were significant at 90 and 110 days from sowing in both seasons except leaf area/ plant at 110 days after sowing failed to reach the significant level.

Data in Table (2) indicated that the effective treatments for plant height, No. of leaves/ plant, No. of spikes/ plant, weight of spikes/ plant, total dry weight/ plant, leaf area/ plant and leaf area index at 90 and 110 days from sowing, and No. of tillers/ plant at 90 days from sowing were obtained from Sids-13 wheat cultivar fertilized with urea, while Baniswef-4 with urea for No. of tillers/ plant at 110 days from sowing. However, the effective treatment for No. of leaves/ plant at 90 and 110 days from sowing and No. of spikes/ plant at 90 days from sowing were noted also by Sids-13 with ammonium nitrate.

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Table 1: Effect of cultivars and nitrogen fertilizer sources on growth characters of wheat plant at 100 and 115 days after sowing (Average of 2012/ 2013 and 2013/ 2014 seasons).

Characters / Treatments	Plant height		No. of tillers /plant		No. of leaves /plant		No. of spikes /plant		Weight of spikes "g/plant"		Total dry weight/plant (g)		Leaf area/ plant (dm^2)		LAI	
	100	115	100	115	100	115	100	115	100	115	100	115	100	115	100	115
Cultivars																
Baniswef-4	105.20	108.00	5.120	5.068	24.20	21.07	2.987	3.030	3.375	4.009	9.40	12.80	10.59	12.65	2.54	2.95
Sids-13	107.05	110.67	5.356	5.050	27.53	23.80	3.025	3.117	3.452	4.109	11.21	14.96	12.14	14.39	2.87	3.40
L.S.D. at 5%	0.10	057	0.005	0.005	0.29	1.25	0.005	0.037	0.003	0.015	0.30	0.30	0.10	0.45	0.13	0.24
Nitrogen Fertilizer Sources																
Urea	110.80	115.00	5.413	5.130	31.17	27.67	3.058	3.138	3.753	4.157	14.12	18.54	14.72	17.60	3.56	4.14
Ammonium nitrate	108.59	111.17	5.288	5.090	30.50	27.00	3.035	3.110	3.547	4.108	12.07	16.54	12.78	15.63	3.04	3.61
Ammonium sulphate	106.15	109.00	5.235	5.058	25.17	22.50	3.007	3.073	3.368	4.073	10.00	13.33	10.73	13.63	2.57	3.16
Ammonia gas	103.59	107.00	5.175	5.017	22.00	18.50	2.988	3.043	3.222	4.022	8.00	11.00	9.28	10.58	2.15	2.58
Slow-release N	101.50	104.50	5.078	5.000	20.50	16.50	2.943	3.003	3.177	3.933	7.33	10.00	9.27	10.13	2.22	2.38
L.S.D. at 5%	0.27	0.45	0.004	0.007	1.31	1.30	0.035	0.019	0.015	0.019	0.22	0.23	0.35	0.37	0.12	0.09

Table (2): Effect of interaction between cultivars and nitrogen fertilizer sources on growth characters of wheat plant at 100 and 115 days after sowing (Average of 2012/ 2013 and 2013/ 2014 seasons)

Characters / Treatments		Plant height		No. of tillers /plant		No. of leaves /plant		No. of spikes /plant		Weight of spikes "g/plant"		Total dry weight/plant (g)		Leaf area/ plant (dm^2)		LAI	
		100	115	100	115	100	115	100	115	100	115	100	115	100	115	100	115
Cultivars x Nitrogen Fertilizer Sources																	
Baniswef-4	Urea	110.00	113.00	5.200	5.150	29.00	26.33	3.047	3.080	3.700	4.093	13.00	17.00	13.77	16.60	3.30	4.08
	Ammonium nitrate	108.00	110.00	5.150	5.100	27.00	24.00	3.027	3.060	3.490	4.063	11.00	15.00	11.80	14.63	2.90	3.17
	Ammonium sulphate	105.00	108.00	5.120	5.070	24.00	21.00	3.003	3.040	3.330	4.033	9.00	12.00	9.80	12.77	2.30	3.03
	Ammonia gas	102.00	106.00	5.090	5.020	21.00	18.00	2.977	3.010	3.190	3.983	7.00	10.00	8.80	9.63	2.08	2.27
	Slow-release N	101.00	103.00	5.040	5.000	20.00	16.00	2.883	2.960	3.163	3.870	7.00	10.00	8.80	9.60	2.13	2.22
Sids-13	Urea	111.60	117.00	5.627	5.110	33.33	29.00	3.070	3.197	3.807	4.220	15.23	20.07	15.77	18.60	3.82	4.20
	Ammonium nitrate	109.17	112.33	5.427	5.080	34.00	30.00	3.043	3.160	3.603	4.153	13.14	18.07	13.77	16.63	3.18	4.05
	Ammonium sulphate	107.30	110.00	5.350	5.047	26.33	24.00	3.010	3.107	3.407	4.113	11.00	14.67	11.67	14.50	2.83	3.28
	Ammonia gas	105.18	108.00	5.260	5.013	23.00	19.00	3.000	3.077	3.253	4.060	9.00	12.00	9.77	11.53	2.22	2.90
	Slow-release N	102.00	106.00	5.117	5.000	21.00	17.00	3.003	3.047	3.190	3.997	7.67	10.00	9.73	10.67	2.30	1.28
L.S.D. at 5%		0.38	0.63	0.005	0.010	1.86	1.84	0.049	0.026	0.021	0.027	0.31	0.32	0.49	n.s	0.17	0.13

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Table (3): Effect of cultivar differences and nitrogen fertilizer sources on yield and its components of wheat (Average of 2012/ 2013 and 2013/ 2014 seasons)

Treatments	Plant height "cm"	No. of tillers /plant	No. of spikes /plant	Weight of spikes "g/plant"	Grain index "g"	Grain yield "g/plant"	Grain yield "ton/fed."	Straw yield "ton/fed."	Biological yield "ton/fed."	Harvest index %
Cultivars										
Baniswef-4	109.61	4.97	2.989	4.000	35.53	2.566	2.011	3.199	5.211	38.48
Sids-13	112.11	4.85	3.015	4.060	36.70	3.289	2.574	3.237	5.814	44.21
L.S.D. at 5% level	1.17	n.s	n.s	0.036	0.63	0.032	0.110	0.007	0.119	1.23
Nitrogen Fertilizer Sources										
Urea	116.67	5.02	3.028	4.110	40.70	3.248	2.567	3.246	5.812	44.01
Ammonium nitrate	112.50	5.00	3.015	4.035	39.18	3.065	2.412	3.252	5.664	42.44
Ammonium sulphate	110.47	4.98	3.003	4.027	36.25	2.922	2.277	3.230	5.508	41.19
Ammonia gas	108.07	4.82	2.987	3.993	33.70	2.782	2.179	3.199	5.390	40.27
Slow-release N	106.60	4.73	2.982	3.967	30.87	2.622	2.029	3.161	5.190	38.83
L.S.D. at 5% level	0.88	0.09	n.s	0.021	0.43	0.037	0.050	0.007	0.048	0.61

Table (4): Effect of interaction between cultivars and nitrogen fertilizer sources on yield and its components of wheat (Average of 2012/ 2013 and 2013/ 2014 seasons).

Treatments		Plant height "cm"	No. of tillers /plant	No. of spikes /plant	Weight of spikes "g/plant"	Grain index "g"	Grain yield "g/plant"	Grain yield "ton/fed."	Straw yield "ton/fed."	Biological yield "ton/fed."	Harvest index %
Cultivars x Nitrogen Fertilizer Sources											
Baniswef-4	Urea	114.00	5.03	3.010	4.070	40.53	2.883	2.270	3.262	5.532	41.03
	Ammonium nitrate	111.00	5.01	2.997	4.017	38.63	2.710	2.133	3.224	5.357	39.81
	Ammonium sulphate	109.80	5.00	2.997	3.993	35.80	2.617	2.060	3.205	5.268	39.00
	Ammonia gas	107.30	4.93	2.980	3.977	32.70	2.437	1897	3.182	5.082	37.34
	Slow-release N	105.93	4.89	2.967	3.953	30.00	2.183	1.697	3.120	4.817	35.23
Sids-13	Urea	119.33	5.00	3.047	4.150	40.87	3.613	2.863	3.230	6.093	46.99
	Ammonium nitrate	114.00	4.99	3.033	4.090	39.73	3.420	2.690	3.280	5.970	45.06
	Ammonium sulphate	111.13	4.96	3.010	4.060	36.70	3.227	2.493	3.254	5.784	43.38
	Ammonia gas	108.33	4.71	2.993	4.010	34.69	3.127	2.462	3.216	5.698	43.20
	Slow-release N	107.27	4.58	2.997	3.980	31.73	3.060	2.360	3.203	5.563	42.42
L.S.D. at 5% level		1.24	0.13	n.s	n.s	0.61	0.052	0.071	0.010	0.067	0.87

2- Yield and yield components:

Effect of cultivars:

The results reported in Table (3) indicate clearly that, there were significant differences between the two wheat cultivars at harvest time in plant height, weight of spikes/ plant (g), grain index (g) , grain yield/ plant(g),grain yield (ton/fed.), straw yield (ton/fed.), biological yield (ton/fed.) and harvest index%. While number of tillers/ plant and number of spikes/ plant failed to reach the significant level at 5%. Data illustrated that Sids-13 cultivar surpassed Baniswef-4 cultivar in the above characters.

It could be concluded the varietal differences between wheat cultivars may be due to genetically differences between cultivars, as well as, the superiority of Sids-13 in grain yield/ fed., over Baniswef-4 might be due to the increase in weight of spikes/ plant, seed index and grain yield/ plant. These results are in harmony with those obtained by[5,6,9,21-23] in wheat, also,[12-14] in maize.

Effect of nitrogen sources:

Data in Table (3) revealed that yield and its components were affected by differed sources of nitrogen (plant height, number of tillers/ plant, weight of spikes/ plant, grain index, grain yield/ plant, grain yield/fed., straw yield/fed., biological yield/fed. and harvest index%) except number of spikes/ plant in both seasons. Applied urea gave the highest values of yield and yield components compared with other sources of nitrogen. It is worthy to mention that the differences between applied urea, ammonium nitrate or ammonium sulphate failed to reach the significant level of 5%. This result may be due to that urea from was easier and faster in absorption and utilization by plants. Also indicated clearly the vital role of N in plant life and its contribution in increasing the grain yield. Such results clarified that N is essential for cell division and elongation as well as the root growth and dry matter content.

These results are in close conformity with those of [24,25] in wheat,[12-15,20] in maize.

Effect of interaction between wheat cultivars and nitrogen sources:

The effect of interaction between wheat cultivars and nitrogen sources on plant height, number of tillers/ plant, grain index, grain yield/ plant, grain yield/fed., straw yield/fed., biological yield/fed and harvest index% were significant Table (4). The highest values of plant height, grain index, grain yield/ plant, grain yield/fed., biological yield/ fed., and harvest index% were obtained from sids-13 with applying urea followed by ammonium nitrate. However the effective treatment for straw yield/ fed., was achieved by Sids-13 cultivar given ammonium nitrate.

It is obvious from data Table (4) the differences between Baniswef-4 with urea or ammonium nitrate or ammonium sulphate and Sids-13 given urea or ammonium nitrate or ammonium sulphate were not significant. These results are in agreement with those obtained by [12,14].

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