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Foliar Feeding of Potassium and Urea for Maximizing Wheat Productivity in Sandy Soil

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Abstract: The present study was undertaken to develop management recommendations that maximize growth and yield of wheat plants grown in sandy soil to meet the growing demands for wheat under the constrains of depleting natural resources, environmental fluctuation and increased population and also to study the efficiency of foliar feeding of urea and potassium. To achieve the aforementioned objectives, two field experiments were carried out at the Agricultural Production and Research Station, National Research Centre EL- Nubaria province, EL- Behira Governorate, Egypt, during the two successive winter seasons 2007/2008 and 2008/2009 to study the response of two wheat cultivars to foliar fertilizers of urea and potassium on growth and productivity the results could be summarized as follows. Gemmiza-10 cultivar significantly surpassed Sakha-93 in growth characters at 65, 90and 115 days after sowing and also, yield and its components. Foliar fertilizer of urea and potassium caused significant stimulatory effect on growth parameters, however, foliar feeding with urea 2% + K_2O 2% gave the highest significant values for all growth characters at 65, 90 and 115 days after sowing and also for yield and its components i.e. plant height, number of spikes /m^2, weight of spikes /m^2as well as grain, straw and biological yields / feddan. The interaction between Gemmiza-10 cultivar and foliar fertilizer of urea and potassium (urea 2%+K_2O 2%) showed a significant increase in growth characters at 65, 90 and 115 days after sowing and also yield and its components i.e. plant height, number of spikes /m^2, weight of spikes /m^2, grain, straw and biological yields /m^2, grain, straw and biological yields / feddan.

Key words: Foliar feeding, Potassium, Urea, Wheat cultivars, Sandy soil.

INTRODUCTION

Increasing wheat (*Triticum aestivum* L.) productivity is a national target to cope with the social and economic obligations that are the normal consequences of the continued high rates of population growth and to fill the gap between production and consumption. This urgent need requires continuous scientifically based implementation of effective agricultural practices on the limited cultivable land area and to increase production through cultivation of desert sandy soil under appropriate agronomic practices. Extending agriculture to desert land is one of the major components of the national agricultural strategy to increase agricultural production in Egypt.

The new goals of the Egyptian agricultural policy are to increase the local wheat production through the expansion of the cultivated area and optimization of agricultural inputs. The strategy of the Ministry of Agriculture is to increase the cultivated wheat area in the newly reclaimed lands and breeding high yielding varieties. Wheat cultivars differed in growth characters, Hassanein *et al*., (1997), El-Habbasha (2001), Hassanein (2001), Ahmed *et al*., (2006) and EL-Habbasha *et al*., (2008). In addition, wheat cultivars differed in yield and its components, Hassanein *et al*., (1997), EL-Habbasha (2001), Hassanein and Gomaa (2001), Hassanein *et al*., (2001) Ahmed *et al*., (2006), EL-Habbasha *et al*., (2008) and Shamsi *et al*., (2010).

During the last decades, foliar fertilization (FF) of nutrients has become an established procedure to increase yield and improve the quality of crop products (Romemheld and El-Fouly, 1999). This procedure can also improve nutrient utilization and lower environmental pollution through reducing the amount of fertilizers added to soil (Abou El-Nour, 2002). On the other hand, foliar feeding of a nutrient may actually promote root absorption of the same nutrient (Oosterhuis, 1998) or other nutrients through improving root growth and increasing nutrients uptake (El-Fouly and El-Sayed, 1997).

Foliar application of urea has been proved to be an effective technique of N fertilization. The adoption of foliar urea may help reduce the losses due to denitrification, leaching and immobilization, often associated

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with N fertilization to the soil system (Gooding, 2005). Nitrogen applied as FF increased chlorophyll synthesis in the leaves (Suwanarit and Sestapukdee,1989). Khan *et al*., (2009) revealed that foliar application of urea significantly increased plant height, spike length, hundred grain weight, biological yield, grain yield. They added that, nitrogen is the fundamental ingredients for all processes of protein synthesis.

On the other hand, foliar application of potassium significantly increased number of spikes /m^2, number and weight of grains /spike, 1000-grain weight, grain and straw yields of wheat (Sarkar and Bandyopadhyay, 1991 and Abou EL-Defan, *et a1*., 1999). In this concern, Abdi *et al*., (2002) reported that foliar spraying of potassium with 1 or 5% (KCL) before flowering increased grain yield and number of grain per head, while, spraying after flowering increased significantly protein content and 1000 kernel weight. Khan *et al*., (2006) studied the response of wheat to foliar application under rain fed conditions. The results indicated that potassium application with concentration 0.5% as KCL significantly increased the biological yield of wheat. EL-Abady *et al*., (2009) stated that maximum values of grain and straw yields as well as quality of grains and seed could be achieved from wheat cultivar Sakha 93 sprayed with 3.0 % K_2O.

MATERIAL AND METHODS

Two field experiments were carried out at reclaimed sandy soil in the farm of Research and Production station, National Research Centre, El-Nubaria Province, El-Behira Governorate, Egypt, during the two successive winter seasons of 2007/2008 and 2008/2009 to study response of two wheat cultivars to foliar fertilizers of urea and Potassium on growth and productivity.

Some physical and chemical characters of soil (0-30cm depth) in the experimental site were as follows: Sand 91.76%, Silt 3.33%, clay 6.26%, PH 7.45, Organic matter 0.27%, Ca CO_3 1.53%, EC 0.4ds/m, soluble N 7.78 ppm, available P 3.66 ppm and available K 23 ppm soil measured as described by Chapman and pratt, (1978).

Each experiment included eighteen treatments which were the combinations between two wheat cultivars and nine foliar fertilizers treatments of urea and potassium.

The treatments of this study were:

A- Wheat cultivars:

Gemmiza-10 cultivar.

Sakha - 93 cultivar.

B- Foliar application:

1. Control (tap water).
2. Foliar spray of 1% urea as 10gm urea / Liter (urea 46 %N).

Foliar spray of 2% urea.

Foliar spray of 1% K_2o in form of magic potassium Liquid 36.5% K_2O as 27.4 cm^3 / Liter.

Foliar spray of 2% K_2O.

Foliar spray of 1% urea + 1 % K_2O.

Foliar spray of 1% urea + 2 % K_2O.

Foliar spray of 2% urea + 1 % K_2O.

Foliar spray of 2% urea + 2 % K_2O.

The experiments were laid in a split plot design with three replications, where, wheat cultivars occupied the main plots and foliar fertilizers of urea and potassium were allocated at random in sub plots. Each plot consisted of 15 rows (20 cm spacing) of 3.5 meter length i.e.10.5 m^2 (1/400 feddan).

Wheat cultivars were planted on 25th and 24th November in 2007 and 2008 seasons, respectively, with seed rate of 60 kg / feddan. The spraying treatments of either urea or potassium solution (400 liter / feddan) were applied at 35 and 50 days after sowing. Phosphorus and potassium were added during seed bed preparation at 100 kg /feddan each of calcium superphosphate (15.5% P_2O_5) and potassium sulfate (48% K_2O). Nitrogen fertilizer was added at 80 kg /feddan as ammonium sulfate (20.6 % N) in two equal doses on 15 and 45 days after sowing. Sprinkler irrigation was applied as needed. Standard cultural practices of growing wheat followed by the farmers of this district were adapted. Samples of one square meter were taken at random from the middle rows of each plot from the three replicates to measure plant height " cm ", number of spikes / m^2, weight of spikes " g" / m^2, dry weight of shoots (tiller + leaves) "g" / m^2, plants total dry weight "g" /m^2 and flag leaf area "cm^2" at 65, 90 and 115 days from sowing.

At harvest one square meter was taken randomly from the middle rows of each plot for the three replications to determine : plant height "cm", number of spikes / m^2, weight of spikes "g" / m^2, grain index "g" (100 grain weight), grain yield "g" / m^2, straw yield "g" / m^2 and biological yield "g" / m^2. In addition,

grain yield "ton / feddan", straw yield "ton / feddan" and biological yield "ton / feddan" were determined from the whole area of experimental units from the three replicates then converted to yield per feddan and harvest index (grain yield / biological yield x 100). All data were subjected to statistical analysis according to procedure outlined by Snedecor and Cochran (1990). Treatments means were compared by L.S.D test. Combined analysis of the two seasons was calculated according to the method of Steel and Torrie (1980).

RESULTS AND DISCUSSIONS

A-Growth Characters:

Varietal Differences:

There were significant differences between both wheat cultivars in all growth characters at 65, 90 and 115 days after sowing. In addition, it is clear from table (1) that Gemmiza-10 cultivar significantly surpassed Sakha – 93 with regard to plant height, number of spikes / m^2, weight of spikes "g" / m^2, dry weight of shoots "g" / m^2, plant total dry weight "g" / m^2 and flag leaf area cm^2 at 65, 90 and 115 days from sowing. It could be concluded that varietal differences between wheat cultivars may be due to genetical differences between cultivars and differences between genotypes concerning partition of dry matter, where wheat cultivars differed in carbon equivalent, yield energy per plant and per feddan (Abd EL –Gawad *et al*., 1987). Similar results of varietals differences in growth parameters in this study were obtained by Hassanein *et al*., (1997), El-Habbasha (2001), Hassanein (2001), Zaki *et al*., (2004), Ahmed *et al*., (2006) and El-Habbasha *et al*., (2008).

2-effect of Foliar Fertilizer:

Data reported in Table (1) show that all foliar feeding treatments significantly stimulated all growth characters of wheat plants i.e. plant height, number of spikes / m^2, weight of spikes "g" / m^2, dry weight of shoots "g" / m^2, plant total dry weight "g" / m^2 and flag leaf area cm^2 at 65, 90 and 115 days after sowing. Data showed that application of (urea 2% + K_2O 2%) gave the highest values of all the previous characters at the three vegetative samples compared with the other treatments.

In this concern, Michael *et al.,* (2004) attributed such enhancement effect of spraying plants with K^+ on growth to the favorable influence of these nutrients on metabolism and biological activity and its stimulating effect on photosynthetic pigments and enzyme activity which in turn encourage vegetative growth of plants. Moreover, Mengel (2002) added that K work as a catalyst for enzyme activation in plant, protein synthesis, starch formation and translocation of proteins. Another key role of potassium is the regulation of water use in the plant (osmoregulation). This osmoregulation process affects water transport in the xylem, maintains high daily cell turgor pressure which affects cell elongation for growth and most importantly it regulates the opening and closing of the stomates which affect transpirational cooling and carbon dioxide uptake for photosynthesis (Hsiao and Läuchli, 1986). On the other hand higher level of foliar nitrogen application increase photosynthesis in the leaves resulting in increased vegetative growth. These results were reported by Sarhan and Abd El-Maksoud (2002) and Khan *et al*., (2009). In addition, El-Abady *et al*., (2009) stated that, foliar application of urea increased productivity of the plants and the rate of dry matter translocation to the grains. Similar results were obtained by Abou El-Defan *et al*., (1999) El-Sabbagh *et al*., (2002) and Yassen *et al*., (2010).

3- Effect of Interaction Between Wheat Cultivars and Foliar Fertilizer:

Results reported in Table (2) indicated that the most effective treatment for all growth characters were obtained from spraying Gemmiza-10 cultivar with (urea 2% + K_2O 2%). Meanwhile, Sakha-93 cultivar with urea 2% + K_2O 2% foliar fertilizer gave the highest value of dry weight of shoots "g" and flag leaf area cm^2. The before mentioned results were true in the three vegetative samples at 65, 90 and 115 days after sowing. In our experiment, foliar spray of both K and urea generally increased plant height, number of tillers, plant dry weight, seed index, straw yield, grain yield, biological yield and harvest index. This suggests the quick absorption of nitrogen due to foliar spray of urea and the positive effect of potassium foliar application on growth parameters may be due to that potassium increased efficiency of the plant for utilization nitrogen which is essential for plant growth as well as other processes related to nitrogen metabolism (Forshey and Makee, 1970). The above findings are in line with the previous studies Abdi *et al.,* (2002), Masauskas and Masauskiene (2002) and Mahajan *et al.,* (2004).

Table 1: Effect of cultivars and foliar fertilizer on growth characters of wheat plants at 65, 90 and 115 days after sowing. (Average of 2007 / 2008 and 2008 / 2009 seasons).

Characters		Plant height "cm"			No. of spikes " /m^2"			Weight of spikes "g/m^2"			Dry weight of shoots "g/m^2"			Plant total dry weight "g/m^2"			Flag leaf area "cm^2"		
Days after sowing	Treatment	65	90	115	65	90	115	65	90	115	65	90	115	65	90	115	65	90	115
Cultivars	Gemmiza-10	107.6	116.0	124.7	467.8	478.6	484.0	690.4	824.5	899.1	675.1	783.0	812.4	1365.6	1607.6	1713.6	55.9	70.4	61.3
	Sakha-93	104.5	113.6	121.2	461.7	473.3	478.6	681.0	797.1	890.9	670.0	779.1	800.3	1350.5	1597.7	1640.4	55.1	67.2	58.8
L.S.D at 5% level		2.11	1.18	3.16	5.10	3.11	4.11	7.13	10.21	15.17	3.51	2.10	6.24	12.11	7.16	56.10	0.01	1.01	0.03
Foliar Fertilizers																			
	Control	92.2	97.5	108.3	447.6	456.3	463.1	657.7	752.2	853.1	647.0	755.5	782.0	1304.7	1532.7	1625.1	37.6	53.2	45.7
	Urea 1%	98.3	104.2	114.2	453.2	461.7	469.2	663.6	784.2	863.6	652.9	761.6	787.7	1316.6	1545.7	1651.2	45.6	59.2	51.8
	Urea 2%	104.7	110.0	118.2	457.7	468.9	474.6	672.7	790.7	878.3	662.6	772.6	795.2	1335.3	1574.9	1564.9	49.3	62.7	55.4
	K_2O 1%	101.0	113.7	117.5	460.8	472.3	477.1	678.7	862.3	887.3	667.6	775.6	801.0	1346.3	1638.0	1688.3	51.1	66.2	57.3
	K_2O 2%	106.2	115.6	120.7	464.6	476.1	481.8	686.1	812.1	893.2	672.7	782.7	806.2	1358.8	1594.8	1588.8	55.2	69.8	61.2
	Urea 1% + K_2O 1%	109.2	117.2	123.2	467.6	480.7	485.8	693.1	822.2	905.8	677.8	788.8	811.6	1370.9	1611.2	1717.4	61.6	72.8	64.4
	Urea 1% + K_2O 2%	111.7	121.1	131.6	473.0	485.1	489.7	699.2	837.8	916.2	685.0	793.3	816.1	1384.2	1631.1	1732.3	64.1	75.7	65.6
	Urea 2% + K_2O 1%	114.3	124.6	134.6	477.7	488.8	493.2	706.1	844.7	923.1	690.1	798.1	825.2	1396.2	1642.8	1758.3	66.1	78.7	67.7
	Urea 2% + K_2O 2%	117.2	129.4	138.4	480.6	493.5	497.0	714.3	851.3	934.6	695.0	801.6	832.1	1409.3	1652.9	1766.7	69.2	81.3	71.2
L.S.D at 5% level		2.11	1.03	2.00	1.00	2.00	3.00	4.10	3.12	6.00	1.10	2.50	4.10	10.20	5.10	12.10	2.10	3.10	1.03

Table 2: Effect of interaction between cultivars and foliar fertilizer on growth characters of wheat plants at 65, 90 and 115 days after sowing. (average of 2007 / 2008 and 2008 / 2009 seasons).

Characters	Plant height "cm"			No. of spikes " /m^2"			Weight of spikes "g/m^2"			Dry weight of shoots "g/m^2"			Plant total dry weight "g/m^2"			Flag leaf area "cm^2"		
Days after sowing																		
Cultivars × Foliar fertilizer	65	90	115	65	90	115	65	90	115	65	90	115	65	90	115	65	90	115
Gemmiza-10																		
Control	94.2	98.3	110.3	450.2	457.3	463.1	660.2	782.2	855.2	650.0	756.0	789.0	1310.2	1538.2	1644.2	40.2	56.2	46.1
Urea 1%	100.2	106.3	115.2	456.2	463.2	470.2	667.1	788.0	865.1	655.6	763.2	792.3	1322.7	1551.3	1657.4	46.3	60.2	51.5
Urea 2%	106.2	110.8	119.3	460.0	470.4	477.1	675.1	793.2	879.3	665.2	776.2	798.2	1340.3	1569.3	1677.5	48.2	64.3	55.4
K_2O 1%	102.7	115.2	119.8	465.5	475.4	480.1	680.2	812.5	884.4	669.2	779.2	803.0	1349.4	1591.7	1692.4	50.1	68.1	57.5
K_2O 2%	107.2	115.2	122.1	469.1	480.1	486.3	689.2	822.2	895.2	675.3	785.0	812.2	1364.5	1607.2	1707.3	55.1	71.2	64.2
Urea 1% + K_2O 1%	110.2	117.0	126.3	470.1	483.2	490.5	696.0	833.2	910.4	680.4	792.7	818.1	1376.4	1625.9	1728.5	63.1	75.3	66.4
Urea 1% + K_2O 2%	113.2	122.1	133.1	475.6	489.1	493.1	705.2	855.1	922.4	688.5	795.6	822.0	1393.7	1650.7	1744.4	65.1	77.3	67.1
Urea 2% + K_2O 1%	115.3	126.0	136.1	480.3	492.4	496.3	715.2	862.2	931.0	694.0	799.0	835.0	1409.2	1661.2	1784.0	66.1	79.2	70.2
Urea 2% + K_2O 2%	119.2	133.3	140.2	483.1	496.1	499.2	725.5	872.1	944.1	698.0	801.0	842.1	1423.5	1673.1	1786.2	69.1	82.1	73.2
Sakha-93																		
Control	90.2	96.7	106.2	445.0	455.2	463.1	655.2	772.2	851.0	644.0	755.0	775.0	1299.2	1527.2	1606.0	35.0	50.1	45.2
Urea 1%	96.3	102.1	113.2	450.2	460.1	468.2	660.2	780.1	862.0	650.2	460.0	783.0	1310.4	1540.1	1645.0	45.0	58.1	52.1
Urea 2%	103.2	109.2	117.1	455.3	467.4	472.1	670.2	788.2	877.2	660.0	769.0	792.2	1330.2	1580.4	1452.2	50.4	61.1	55.4
K_2O 1%	99.2	112.1	115.2	456.0	469.2	474.2	677.2	792.2	885.2	666.0	772.0	799.0	1343.2	1684.2	1684.2	52.1	64.2	57.1
K_2O 2%	105.2	116.0	119.2	460.0	472.1	477.2	683.0	802.0	891.2	620.1	780.3	800.2	1353.1	1582.3	1470.3	55.2	68.4	58.2
Urea 1% + K_2O 1%	108.2	117.4	120.2	465.1	478.2	481.1	690.2	811.2	901.2	675.1	785.4	805.2	1365.3	1596.6	1706.4	60.1	70.2	62.4
Urea 1% + K_2O 2%	110.1	120.0	130.0	470.5	481.1	486.3	693.2	820.5	910.0	681.4	791.0	810.2	1374.6	1611.5	1720.2	63.1	74.2	64.1
Urea 2% + K_2O 1%	113.2	123.2	133.2	475.0	485.1	490.1	697.0	827.2	915.1	686.2	797.1	815.2	1383.2	1624.3	1732.5	66.1	78.3	65.2
Urea 2% + K_2O 2%	115.2	125.5	136.7	478.1	490.8	494.7	703.0	830.5	925.0	692.0	802.2	822.2	1395.0	1632.7	1747.2	69.2	80.4	69.2
L.S.D at 5% level	3.55	2.00	1.00	2.70	3.10	0.73	3.20	1.11	2.00	4.22	2.30	4.00	7.15	3.11	5.27	1.00	3.15	2.27

B- Yield and Yield Components:

1-Varietal Differences:

According to data presented in Table (3) a significant variation between cultivars was observed in all studied character i.e. plant height, number of spikes /m^2,weight of spikes "g" / m^2, grain index "g", grain yield "g" / m^2, straw yield "g" / m^2, biological yield "g" / m^2, grain yield "ton /fed.", straw yield "ton / fed.", biological yield "ton / fed." and harvest index %. Gemmiza-10 cultivar significantly surpasses Sakha-93 cultivar in all characters under this study.

It could be concluded that varietal differences between wheat cultivars may be due to genetical differences between cultivars, as well as, the range of cultivar response. It is noteworthy to mention that differences in yield potential of wheat depend undoubtedly on the part of photosynthetic partitioned into grain yield. However, this depends on source size and translocation. Abd El- Gawad *et al*., (1987) found that wheat cultivars differed in partitioning and migration of the total available photosynthate to economic yields. Also, wheat cultivars differed in carbon equivalent for vegetative matter, grains per plant and per fed. As well as coefficient energy of crop and harvest index %.

These results were in harmony with the results obtained by Hassanein (2001), Hassanein and Gomaa(2001), Hassanein *et al*., (2001), Sarhan and Abd El-Maksoud (2002),Zaki *et al*., (2004), Ahmed *et al*., (2006) and El-Habbasha *et al*., (2008).

2-Effect of Foliar Fertilizer:

Data presented in Table (3) indicated that all foliar fertilizer spraying with urea and K_2O significantly increased plant height, number of spikes / m^2, weight of spikes "g" / m^2, grain yield "g" / m^2, straw yield "g" / m^2, biological yield "g" / m^2, grain yield "ton / feddan", straw yield "ton / feddan" and biological yield "ton / feddan". Data also show that the highest level of foliar fertilizer (urea 2% + K_2O 2%) gave the greatest mean values for all the previous characters, meanwhile control treatment (i.e. untreated plants) gave the lowest yield and its components values.

Table 3: Effect of cultivars and foliar fertilizer on yield and its components of wheat plants. (average of 2007 / 2008 and 2008 / 2009 seasons)

Characters / Treatment		Plant height cm	Number of spikes/m²	Weight of spikes "g/m²"	Grain index "g"	Grain yield "g/m²"	Straw yield "g/m²"	Biological yield "g/m²"	Grain yield "ton/fed."	Straw yield "ton/fed."	Biological yield "ton/fed."	Harvest index %
Cultivars	Gemmiza-10	125.9	624.72	1017.67	4.01	765.293	1256.083	2021.377	3.061	5.024	8.086	37.86
	Sakha-93	119.67	614.16	979.73	3.73	699.908	1226.224	1926.134	2.801	4.905	7.706	36.35
L.S.D at 5% level		3.22	6.17	30.31	0.27	55.213	12.242	75.273	0.211	0.112	0.030	0.21
Foliar Fertilizers												
	Control	111.82	596.27	951.16	3.62	636.68	1156.54	1793.27	2.547	4.627	7.174	35.5
	Urea 1%	115.88	604.33	967.15	3.73	693.205	1185.91	1879.111	2.773	4.744	7.517	36.89
	Urea 2%	119.36	609.42	973.26	3.79	719.14	1208.695	1927.835	2.877	4.835	7.712	37.31
	K_2O 1%	119.19	615.63	978.31	3.79	730.92	1223.705	1954.625	2.924	4.895	7.819	37.4
	K_2O 2%	121.91	622.24	987.69	3.85	743.42	1244.09	1987.51	2.974	4.977	7.951	37.4
	Urea 1% + K_2O 1%	124.25	623.81	999.87	3.89	751.45	1262.86	2014.31	3.006	5.052	8.058	37.3
	Urea 1% + K_2O 2%	127.14	627.81	1005.19	3.98	762.66	1281.675	2044.335	3.056	5.127	8.183	37.35
	Urea 2% + K_2O 1%	132.34	633.97	1059.37	4.06	772.72	1294.705	2067.425	3.091	5.179	8.27	37.38
	Urea 2% + K_2O 2%	136.19	639.31	1066.33	4.14	781.21	1312.205	2095.415	3.133	5.249	8.382	37.38
L.S.D at 5% level		2.01	1.2	4.02	N.S	7.22	15.022	18.151	0.02	0.042	0.031	N.S

Table 4: Effect of interaction between cultivars and foliar fertilizer on yield and its components of wheat plants. (Average of 2007 / 2008 and 2008 / 2009 seasons).

Characters / Cultivars × Foliar fertilizer		Plant height cm	Number of spikes/m²	Weight of spikes "g/m²"	Grain index "g"	Grain yield "g/m²"	Straw yield "g/m²"	Biological yield "g/m²"	Grain yield "ton/fed."	Straw yield "ton/fed."	Biological yield "ton/fed."	Harvest index %
Gemmiza-10												
	Control	115.22	607.42	960.21	3.73	653.21	1166.42	1819.63	2.613	4.666	7.279	35.9
	Urea 1%	117.31	612.5	971.11	3.85	713.17	1198.62	1911.79	2.853	4.794	7.647	37.31
	Urea 2%	121.11	615.62	976.2	3.92	749.15	1222.22	1971.37	2.997	4.889	7.886	38
	K_2O 1%	122.17	618.11	980.11	3.84	768.57	1235.28	2003.85	3.074	4.941	8.015	38.35
	K_2O 2%	125.11	622.17	995.21	3.97	783.44	1263	2046.44	3.134	5.052	8.186	38.28
	Urea 1% + K_2O 1%	127.31	627.31	1011.31	4	789.57	1285	2074.57	3.158	5.14	8.298	38.06
	Urea 1% + K_2O 2%	130.17	630.21	1017.21	4.12	798.16	1298	2096.16	3.193	5.197	8.385	38.08
	Urea 2% + K_2O 1%	135.5	637.51	1120.5	4.22	810.2	1310	2120.2	3.241	5.24	8.481	38.21
	Urea 2% + K_2O 2%	139.21	692.11	1127.15	4.3	822.17	1326.21	2148.38	3.289	5.305	8.594	38.27
Sakha-93	Control	108.41	585..11	942.11	3.5	620.15	1146.66	1766.81	2.481	4.587	7.068	35.1
	Urea 1%	114.45	596.15	963.18	3.6	673.24	1173.2	1846.44	2.693	4.693	7.386	36.46
	Urea 2%	117.61	603.22	970.31	3.65	689.13	1195.17	1884.3	2.757	4.781	7.538	36.57
	K_2O 1%	116.21	613.15	976.51	3.69	693.27	1212.13	1905.4	2.773	4.849	7.622	36.38
	K_2O 2%	118.71	617.17	980.17	3.72	703.4	1225.18	1928.58	2.814	4.901	7.735	36.38
	Urea 1% + K_2O 1%	121.18	620.31	988.42	3.78	713.33	1240.72	1954.05	2.853	4.963	7.816	36.53
	Urea 1% + K_2O 2%	124.11	625.41	993.17	3.83	727.16	1265.35	1992.51	2.919	5.061	7.98	36.58
	Urea 2% + K_2O 1%	129.18	630.42	998.23	3.9	735.24	1279.41	2014.65	2.941	5.118	8.059	36.49
	Urea 2% + K_2O 2%	133.17	636.5	1005.51	3.98	744.25	1298.2	2042.45	2.977	5.193	8.17	36.44
L.S.D at 5% level		0.35	2.17	5.51	N.S	3.51	15.16	10.22	0.113	0.12	0.151	N.S

Increasing in yield and yield components by foliar urea and potassium was also observed by Khan *et al*., (2006), Khan *et al.*, (2009) and El-Abady *et al*., (2009). Such stimulatory effect of K application yield might be attributed to bitter plant growth as a result of K on the vegetative growth characters and its role in counteracting the competitive effect of other cations especially Na which led to better nutrients absorption by plants (Marschner, 1995). He added that K increases root growth, builds cellulose and reduces lodging. Furthermore, Khalid *et al*.,(2006) mentioned that, adequate K result in superior of water use efficiency and mention a normal balance between carbohydrates and protein results in stronger wheat straw and assist in grain filling. On the other hand, this increment may be due to the stimulating effect of urea through improving the physiological performance of plants and multiple advantage of foliar application such rapid and efficient response to plant needs, less product needed and independence of soil conditions (Yildirim *et al*., 2007). Similar results were observed by Mailto *et al.*, (2006) who reported that wheat grain and straw yields were significantly increased by the integral application of urea. It is also recognized that supplementary foliar fertilization during crop growth improves the mineral status of plants and increase the crop yield (Kolota and Osinska, 2001). In our experiment, this stimulatory effect may be due to potassium and urea feeding during growth stages which might have enhanced accumulation of assimilates in the grains and thus resulting in heavier grains of wheat.

3-Effect of Interaction Between Wheat Cultivars and Foliar Fertilizer:

The interaction between cultivars and foliar fertilizer urea and potassium on plant height, number of spikes / m^2, weight of spikes / m^2, grain yield / m^2, straw yield / m^2, biological yield / m^2, grain yield / feddan, straw yield / feddan and biological yield / feddan was significant (Table 4). It is noteworthy to mention that foliar application with urea 2 % + K_2O 2% on Gemmiza-10 cultivar is considered to be the most favorable treatment of all the before mentioned characters.

It may be observed from table (4) that the behavior of both cultivars was almost similar for all application treatments, however, Gemmiza-10 had relatively greater response than Sakha-93 that may be attributed to improved HI and 1000 grain weight of this cultivar under these treatments.

Such enhancement in seed quality parameters may be attributed to the role of potassium in increasing translocation of photoassimilates from leaves to the grains. These results are partially agreed with those found by Fusheng (2006)

Conclusions:

Optimizing yield is an important component of economical wheat production. Managing fertilizer inputs is essential as they can be a significant portion of total crop input costs.

The findings of this research indicate that foliar feeding of potassium and urea in wheat is an efficient method that maximizes growth and yield of wheat plants grown in newly reclaimed sandy soil. Those findings gave clue about the fertilizer application techniques to enhance yield and net benefit. The integrated application of urea 2 % + K_2O 2% is recommended for Gemmiza-10 cultivar at environmental conditions of El-Nubaria province, El-Behira Governorate.

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