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RESPONSE OF TWO OAT VARIETIES TO FOLIAR FERTILIZATION WITH POTASSIUM AND UREA FERTILIZERS

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Abstract

An experiment was conducted in a private farm in Babylon governorate, Iraq at latitude 32. 31^0 N and longitude 44.21^0E in 2017-2018 growing season to study the effect of foliar fertilization with urea (0 and 0.5%) and high potash fertilizer (0 and 1%) on growth and yield of two oat varieties (shafaa and oat 11). Split-split plots arrangement in randomized complete block design with three replications was used, the main plots contained the varieties and the sub plots contained high-potash fertilizers (b0 and b1), while sub-sub plots contained urea spraying (C0 and C1). The experimental unit was (3 × 2) m containing 10 planting lines (20 cm apart and 3 m long). Di-ammonium phosphate (21% P2O5 and 18% N) at a rate of 140 kg / ha was adding at preparing the soil before planting. Urea fertilizer (46% N) was added as nitrogen source at 176 kg.ha^{-1} in two portion, one with DAP fertilizer and the other at flowering stage. Foliar fertilization were done three times, at elongation phase, tiller phase and flowering stage. The results showed that Shafaa variety was superior in plant tillers number, spikes number in m^2, grain yield which reached 3.95 tons.ha^{-1}, biological yield and harvest index compared to oats 11. Foliar fertilization with high potash or urea gave high number of plant tillers, spikes number in m^2, grain yield (3.95 tons.ha^{-1}), biological yield and harvest index compared to control.

Key words: oats, spraying with Urea, spraying with high potash.

Introduction

Oat (*Avena sativa* L.) is an important grain crop through its various uses, such as animal feed or human food. Oatmeal, which contains high antioxidant is used in the preparation of some baby foods and some biscuits in western countries for its components of high nutritional value (Ahmad *et al*., 2014). Oat importance was increased in recent times due to its use in human nutrition because it contains a relatively high proportion of protein, minerals, unsaturated fatty acids, vitamins, antioxidants as well as the fact that the retention of its original elements more than the rest of grains and its contain of high proportion of insoluble fiber (Wani *et al.*, 2014).

There are many factors contributing to increase crop production, including selection of good varieties with high potential to invest available environmental resources to increase production. Foliar fertilizer is important to reduces the energy consumption required for transfer the element ions within the plant (Heyland and Werner, 2000). It is effective in nutrient balancing by providing plant nutrients requirements which are not sufficiently obtained from soil especially during critical and sensitive plant growth stages (Martin, 2002).

Nitrogen is one of the necessary nutrients to complete plant life by its roles in many biochemical compounds and contributes to most biochemical and biochemical processes. Potassium is very important and plant needed to this element may exceed all other nutrients at some plant growth stages, and it is necessary to adding foliar fertilizers. The importance of this study was to determine the best suitable varieties to cultivate in Babylon, and its respond to foliar fertilizers with potash and urea.

Materials and methods

An experiment was conducted in private farm in Al-Mahaweel area (Babylon governorate, Iraq) at latitude 32.31^0N and longitude 44.21^0E in 2017/2018 growth

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season to study the effect of foliar fertilizer with urea and high potash fertilizer on growth and yield of two oat varieties in silt clay loam (table 1). Split-split plots arrangement within randomized complete block design with three replications. The main plots consist of the varieties [shafaa (a1) and oat 11 (a2)] , sub plots consist of high potash fertilizer treatments [control (b0) and 1% (b1)] , sub-sub plots consist of urea treatments [control (c0 and 0.05% (c1)]. The experimental unit area was 6 m^2 (3 × 2 m). Oat seeds were planted at 22/10 2017 on lines 20cm apart. Soil field was fertilized by 140 $kg.ha^{-1}$ of Di-ammonium phosphate (21% P_2O_5 and 18% N) at seeding time, and urea (140 $kg.ha^{-1}$) separated at seeding and flowering phases. The foliar fertilizers were added three times, first attillering phase, second at elongation phase and third at flowering stage. The data were taken as follow: number of spikes per m^2, grains number per spike (as average of 15 spikes), weight of 1000 grains, grain yield, biological yield and harvest index %, which calculated from the following equation: (Gonzalez *et al*., 2007. (Harvest index = grain yield / dry matter × 100.

Table 1 : Some characteristics of field soil before planting.

Character	Value	Character	Value
Sand ($g.kg^{-1}$)	443	Available N $mg.kg^{-1}$	
Silt ($g.kg^{-1}$)	405	Available P $mg.kg^{-1}$	
Clay ($g.kg^{-1}$)	152	Available K $mg.kg^{-1}$	17.2
Soil texture	Silt loam	Available Ca $mg.kg^{-1}$	126.8
pH	7.6	Ec $dS.m^{-1}$	1.5

Results and discussion

Table 2 showed that shafaa variety (a1) was superior in plant tillers number, and gave the highest rate of 441.5 compared to Oat 11, which gave an average of 419.7. This result was due to the genotypes differences and their susceptibility to the surrounding conditions (Trehan *et al*., 1970). Potassium spraying was superior and gave an average of 434.0, while control treatment gave less average (427.2). This may be due to the role of potassium in raising plant efficiency in photosynthesis process, which leads to increase the rate of carbohydrates (Abu-Dhahi and Al-younis, 1988). Urea spraying was significantly higher with an average of 436.4 compared with control treatment which gave 424.8. This is due to the positive effect of nitrogen in increasing the photosynthesis process in early growth stages, and regulates plant hormones work such as auxin and cytokinen, which increases meristematic cells division and thus positively affects vegetative growth and flowering (Noulas, 2002). The interaction between varieties and potassium spraying caused a significant effect, and a1b1 was superior (444.2), while a2b0 gave the lowest average of 415.5. The interaction between varieties and urea spray caused a significant effect and a1c1 gave the highest average of 445.0 compared to a2c0 which gave lowest average of 411.5. The interaction between the factors caused a significant effect and a1b1c1 gave the largest number of tiller (446), while a2b0c0 gave the lowest number of tillers amounted to 409 $tillers.m^{-2}$.

Table 2 : Effect of oat varieties, levels of potassium and urea on $tillers.m^{-2}$

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	433.0	442.3	438.0
	C1	444.0	446.0	445.0
A2	C0	409.0	424.0	411.5
	C1	422.0	433.7	427.8
Potash average		427.2	434.0	
$LSD_{0.05}$	Interaction=9.2potash=2.43			6.44
Interaction of varieties *potash fertilizer				**Average of var.**
a1		438.8	444.2	441.5
A2		415.5	423.8	419.7
$LSD_{0.05}$		2.53		2.35
Interaction of urea and * potash fert.				**Average of urea**
c0		421.3	433.0	424.8
c1		428.2	439.8	436.4
$LSD_{0.05}$		6.53		6.39

Table 3 showed that Shafaa variety significantly gave the highest average of oats panicle (416.3) compared to oat 11 variety, which gave the lower average of 394.9. This result was due to the increase in tiller number (table 2), and most of this tillers hold panicle. Potash spray treatment caused a significant increase of panicles to an average of 414.2 compared to control treatment which gave the lowest average of 397.1. This may be due to the role of potassium in delaying leaf aging, which is positively reflected in prolonging its life and thus increase plant efficiency in photosynthesis that caused an increase in plant tillers and panicles (Najad, 2010). Urea spraying caused a significant effect in increasing oat panicles to 416.5 compared to control treatment which gave 394.8 $panicles.m^{-2}$. This was due to that nitrogen led to improved growth and increasing photosynthesis process net, thus increasing tillers number (table 2) and then increasing of number of panicles. The interaction between varieties and potassium spray caused significant effect and a1b1 was superior by giving 424.0 $panicles.m^{-2}$ compared to a2b0 which gave 385.5. The interaction between varieties and urea spray caused significant effect and A1c1 gave the highest average of 424.7 compared to a2c0 (381.5

panicles.m^{-2}). The interaction of a1b1c1 was superior and gave the highest average of 435.7 compared to a2b0c0 (379.0 panicles.m^{-2}).

Table 3: Effect of oat varieties , levels of potassium and urea on panicles.m^{-2}

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	403.7	412.3	408.0
	C1	413.7	435.7	424.7
A2	C0	379.0	384.0	381.5
	C1	392.0	424.7	408.3
Potash average		397.1	414.2	
$LSD_{0.05}$	Interaction=8.60potash=2.88			6.19
Interaction of varieties *potash fertilizer				**Average of var.**
a1		408.7	424.0	416.3
A2		385.5	404.3	394.9
$LSD_{0.05}$		4.02		4.98
Interaction of urea and * potash fert.				**Average of urea**
c0		391.3	398.2	394.8
c1		402.8	430.2	416.5
$LSD_{0.05}$		6.05		5.82

Table 4 showed that shafaa variety was superior in the weight of a thousand grains and gave higher average of 45.37 g compared to oat 11 variety, which gave 42.13 g. These may be due to genetic variations of this two varieties. Potash spraying caused significant effect by increasing the weight of a thousand grains to 44.68 g compared to control treatment which gave 42.82 g. Spray of urea caused an increase of the weight of a thousand grains to 44.78 g compared to control treatment which gave 42.72 g. The interaction between variety and potassium spray caused a significant effect and a1b1 gave the highest average of 46.74 , while a2b0 gave the lowest average of 41.66. On the other hand varieties G.A.×urea spray had a significant effect too and a1c1 gave the highest average of 46.03 g, while a2c0 gave 40.74 g. In a1b1c0 gave the highest mean of 47.70 g, while a2b0c0 gave the lowest mean of 39.99 g.

Table 5 showed that shafaa variety (a1) gave higher yield of 3.99 t.ha^{-1} compared to oat 11 variety (a2), which gave 3.59 t.ha^{-1}. The increase in grain yield was due increasing panicles number per m^2 (table 3) and the weight of 1000 grains (table 4). Potassium spraying caused significantly high grain yield of 4.01 t.ha^{-1} compared to control treatment 3.57 t.ha^{-1}. This was due to the availability of potassium at grain formation stage and its effective cycle in amino acids and proteins synthesis and transferring to grains at grains filling stage as well as its

Table 4: Effect of oat varieties, levels of potassium and urea on 1000 grains weight

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	41.71	47.70	44.70
	C1	46.27	45.78	46.03
A2	C0	39.99	41.48	40.74
	C1	43.33	43.74	43.53
Potash average		42.82	44.68	
$LSD_{0.05}$	Interaction=1.9 potash=1.2			1.5
Interaction of varieties *potash fertilizer				**Average of var.**
a1		43.99	46.74	45.37
A2		41.66	42.61	42.13
$LSD_{0.05}$		1.5		1.2
Interaction of urea and * potash fert.				**Average of urea**
c0		40.85	44.80	42.72
c1		44.59	44.76	44.78
$LSD_{0.05}$		1.5		1.2

Table 5: Effect of oat varieties, levels of potassium and urea on grains yield (t.ha^{-1})

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	3.31	3.75	3.53
	C1	4.39	4.50	4.44
A2	C0	3.28	3.31	3.30
	C1	3.29	4.49	3.89
Potash average		3.57	4.01	
$LSD_{0.05}$	Interaction=0.38 potash=0.21			0.29
Interaction of varieties *potash fertilizer				**Average of var.**
a1		3.85	4.12	3.99
A2		3.29	3.90	3.59
$LSD_{0.05}$		0.29		0.21
Interaction of urea and * potash fert.				**Average of urea**
c0		3.30	3.53	3.42
c1		3.84	4.49	4.01
$LSD_{0.05}$		0.29		0.21

effect in the stimulation of plant enzymes and to its role in the transfer of carbohydrate materials which caused an increase vegetative growth and grain yield. This was consistent with the findings of Najad (2010). Urea spraying caused significantly higher grain yield (4.01 t.ha^{-1}) compared to control treatment (3.42 t.ha^{-1}). This was due to the role of nitrogen in increasing growth and the level of photosynthesis, which reflected in increasing panicle number per m^2 (table 3) and the weight of 1000 grains (table 4). The interaction between the varieties

Table 6: Effect of oat varieties, levels of potassium and urea on biological yield (t.ha^{-1})

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	11.16	11.70	11.43
	C1	13.61	13.09	13.35
A2	C0	10.34	11.09	10.72
	C1	11.31	13.42	12.37
Potash average		11.60	12.33	
$LSD_{0.05}$	Interaction=0.99 potash=0.57			0.69
Interaction of varieties *potash fertilizer				**Average of var.**
a1		12.38	12.39	12.39
A2		10.83	12.26	11.54
$LSD_{0.05}$		0.69		0.57
Interaction of urea and * potash fert.				**Average of urea**
c0		10.75	11.40	11.07
c1		12.46	13.26	12.86
$LSD_{0.05}$		0.69		0.57

Table 7: Effect of oat varieties, levels of potassium and urea on harvest index (%)

Varieties	urea	b		Varieties * urea
		b0	b1	
A1	C0	29.69	32.00	30.84
	C1	32.25	34.35	33.30
A2	C0	29.69	29.87	30.83
	C1	31.79	33.49	31.33
Potash average		30.72	32.43	
$LSD_{0.05}$	Interaction=1.8 potash=1.0			1.25
Interaction of varieties *potash fertilizer				**Average of var.**
a1		30.97	33.17	32.07
A2		30.48	31.68	31.08
$LSD_{0.05}$		1.25		1.00
Interaction of urea and * potash fert.				**Average of urea**
c0		30.74	30.94	30.84
c1		30.70	33.92	32.31
$LSD_{0.05}$		1.25		1.00

and potassium spraying caused a significant effect and (a1b1) gave the highest grain yield (4.12 t.ha^{-1}), while a2b0 gave the lowest yield (3.29 t.ha^{-1}). The interaction between the varieties and urea spraying caused a significant effect and a1c1 was superior (4.44 t.ha^{-1}), while a2c0 gave the lowest average of 3.30 t.ha-1 . Spraying both of potassium and urea(b1c1) gave the highest grain yield (4.49 t.ha^{-1}), while control (b0c0) gave the lowest yield (3.30 t.ha^{-1}). Spraying of potassium and urea on shafaa variety (a1b1c1) gave the highest yield (4.5 t.ha^{-1}), while a2b0c0 gave the lowest yield (3.31 t.ha^{-1}).

Table 6 showed that shafaa variety (a1) gave higher biological yield (12.39 t.ha^{-1}) compared to oat 11 variety (a2), which gave 11.54 t.ha^{-1}. This result may be due to the genetic variations. Potassium spraying caused a significant increase in biological yield to 12.33 t.ha^{-1} compared to control treatment (11.60 t.ha^{-1}). This was due to the potassium role in increasing tillers (table 2) , panicle numbers (table 3) and grain yield (table 5). Urea spraying caused a significant increase in biological yield to 12.61 t.ha^{-1} compared to control 11.32 t.ha^{-1}. The interaction between varieties and potassium spray caused a significant effect and a1b1 gave the highest average of 12.39 t.ha^{-1}, while a2b0 gave the lowest average of 10.83 t.ha^{-1}. The interaction between varieties and urea spray had a significant effect too, and a1c1 gave the highest average of 13.35 t.ha-1, while a2c0 gave 10.72 t.ha^{-1}. Spraying both mineral on shafaa variety (a1b1c1) gave highest biological yield (13.61 t.ha^{-1}) compared to oat 11 variety with control treatment a2b0c0 (10.34 t.ha^{-1}).

Table 7 showed that variety caused a significant effect on harvest index and shafaa variety (a1) gave higher harvest index 32.07%, while the Oat 11 (a2) gave a minimum of 31.08%. Potassium spraying increased harvest index to 32.43% compared to control treatment, which gave an average of 30.72%. This result was due to the important role of potassium in increasing the efficiency of photosynthesis , activating various enzymes, activating the transfer from sinck to source, and increasing the grain yield (table 5), which reflected in increasing harvest index (Bakht, 2010). Urea spray caused a significant increase of harvest index to 32.31% compared to the control (30.84%). Table (6) indicates that the interaction between the varieties and potash spraying caused a significant effect on harvest index, where (a1b1) gave the highest harvest index was 33.17%, while a2b0 gave the lowest average of 30.48%. Varieties × urea caused the same effect and a1c1 gave the highest average of 33.30% compared to a1c0 (30.84%). Spraying both potassium and urea on shafaa variety a1b1c1 gave highest harvest index 34.35 compared to a2b0c0 that gave 29.06%.

References

Ahmad, M., G. Z. Zaffar., Z. A. Dar and M. Habib (2014). A review on oat (*Avena sativa* L.) as a dual-purpose crop. *J. Sci. Res. and Essays,* **9(4)** : 52 -59.

Bakht , A., M . Shafi, M. Zubair, M.A. Khan and Shah (2010). Effect of foliarvs soil application of nitrogen on yield and

yield components of wheat varieties. *Pak.J. Bot.,* **42(4)**: 2737-2745.

Dubey, A., G. S. Rathi and R.Sahu (2013). Effect of nitrogen levels on green fodder yield of oat (*Avena sativa)* varieties .*Forage Res.,* **39(1)**: pp. 39-41 .

Gonzalez, A., M. Isaura and A. Luis (2007). Response of barley genotypes to terminal soil moisture stress : phenology, growth and yield. *Aust. J. Agric . Res.,* **58**: 29-37.

Heyland, J.D. and A. Werner (2000). Wheat and wheat improvement. *Agro. J.,* **3(2)**: 195-103.

Najad , S.D., T.S.N. and S. Laek (2010). Study effect drought stress and different levels potassium fertilizer on K^+ accumulation in corn. *Nature and Sci.,* **8(5)**.

Noulas, Ch., P. Stamp, A. Soldati and M. Liedgens (2005). Nitrogen use efficiency of spring wheat genotypes under field and Lysimeter conditions. *Journal of Agronomy and Crop Science,* **190(2)***:* P.111.

Trehan, K.B., V.K. Ehatanger and R.C. Sharma (1970). Genotypic and phenotypic variability in sex–row barley (*Hordeumvulgare* L.). *Indian J. Agric. Sci.,* **40**: 801-804.

Wani, S.A., T.R. Shah, B. Bazaria, G.A. Nayika, A. Gull, K. Muzaffar and P. Kumar (2014) *UJP.,* **3**:14-20.