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ORIGINAL ARTICLE

RESPONSE OF TWO OATS VARIETIES TO NUTRIENT SPRAYING

Sabreen H.A. Alrubaiee[1]*, Huda A. Atab[2] and Mohammed Y. Merhej[2]

[1]Department of Crop, Agriculture College, Basrah University, Iraq.
[2]Department of Crops, Agriculture College, Al-Qasim Green University, Iraq.
E-mail: sabreen199197@gmail.com

Abstract: An experiment was conducted in a private farm in Babylon governorate, Iraq at latitude 32. 31°N and longitude 44.21°E in 2018-2019 growing season to study the effect of foliar fertilization with urea (0 and 1.0%) and high potash fertilizer (0 and 1%) on growth of two oat varieties (shafaa and oat 11). Randomized complete block design with three replicates 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 6 m^2 (3 × 2) containing 10 planting lines (20 cm apart and 3 m long). Di-ammonium phosphate (21% P_2O_5 and 18% N) at a rate of 140 kg ha^{-1} was adding at preparing the soil before planting. Urea fertilizer (46% N) was added as nitrogen source at 176 kg.ha^{-1} in two portions, one with DAP fertilizer and the other at elongation stage. The results showed that oat 11 variety was superior in plant height, chlorophyll content and grain protein content, while shafaa variety was superior in leaf area. Spraying of high K or urea fertilizer caused significant effect on plant height, leaf area, chlorophyll and grain protein content. The interactions caused significant effect on all the parameters studied.

***Key words*:** Oat varieties, Foliar fertilizer, High K fertilizer, Urea, Randomized complete block design (RCBD).

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1. Introduction

Oat (*Avena sativa* L.) is one of the important crops of gramineae family due to its multiple uses as a concentrated animal food crop and also used in human nutrition. The importance of oat cultivation has increased in recent times because its grains contain a relatively high percentage of protein, minerals, vitamins, antioxidants and a high percentage of insoluble fiber [Wani *et al*. (2014)]. The importance of high-yielding varieties is highlighted because of its high production capacity that achieves increased production. The soil and plant management is one of the most important factors affecting crop growth and foliar fertilizer is one of plant nutrition ways caused reduces the energy required to transport of elemental ions within the plant [Heyland and Werner (2000)] and provide the plant's nutrient requirements during the stages critical growth when the roots are not sufficient. Nitrogen is one of the essential nutrients necessary to complete plant life cycle because it is involved in many vital compounds such as amino acids, protein, chlorophyll and energy compounds. Also, potassium is important and the plant's need this element, may exceed all other nutrients in some stages of growth the plant. Iraqi soil contains large quantities of potassium, but a small percentage of it is ready for absorption, and this requires preparation the plant with potassium. And due to the lack of studies on spraying these two elements on oat plants, the importance of this study came to know the best cultivar suitable for cultivation and its response to spraying.

2. Materials and Methods

Factorial experiment was carried out in one of the private farmer in Mahawil region (10 km west of Hilla, latitude 32. 31^0 north and longitude 44.21^0 east), in the winter season 2018-2019 to study the effect of spraying

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with urea and high potash fertilizers on the growth of two oat varieties. Randomized complete block design (RCBD) with three replicates was used. It included two levels of urea fertilizer (control, B0 and spraying with 1.0%, B1) and two levels of high potash N-P-K (15-15-30), (control K0 and spraying at 1%, K1). The experimental unit area was 6 m^2 (3 × 2 m). Planting was done in lines 20 cm apart. Samples were taken from the field soil with a depth of (0 to 30 cm) to know some of its physical and chemical subjects (Table 1). The field was fertilized with DAP fertilizer (DAP, 18% N + 21% P_2O_5) at a rate of 140 kg hectare^{-1}. Urea fertilizer (46% N) was added as a source of nitrogen at a rate of 176 kg ha^{-1} in two parts first before planting with the DAP fertilizer and the second at elongation stage. Oat varieties were cultivated at 15-11-2018 and the spraying process was done three times, the first at the tillering stage, the second at the elongation stage and the third at the flowering stage. Other crop managements were performed as recommended. The measurements were taken and the data were analyzed

Table 1: Some chemical and physical characteristics of the field soil before planting.

Studied traits		**Value**		
Soil mixture (g kg^{-1})	Sand	434	Ec	1.5 dS m^{-1}
	Silt	405	Na	123 mg kg^{-1}
	Clay	152	Ca	126.8 mg kg^{-1}
Soil texture		Silt loam	K	17.2 mg kg^{-1}
pH		7.6		

using the method of analysis of variance according to statistical program (Genstat).

3. Results and Discussion

Table 2 shows that oat varieties and the levels of urea and potash spraying caused significant effect and v2 gave the highest rate of 111.67 cm compared to v1 (oats 11 variety) that gave a rate of 106.37 cm. This may be due to the nature Genetic composition of the variety. It is also noted that potassium spraying gave an average of 110.23 cm, while the comparison treatment without spraying gave the lowest average of 107.81cm. This may be due to the role of potassium in raising the efficiency of the plant in photosynthesis, which leads to an increase in the rate of carbohydrate production [Abu Dhahi and Yunus (1988)]. Likewise, urea spray was significantly superior to an average of 111.94 compared to control treatment that gave the

Table 2: shows the effect of two classes of oats and the levels of urea and potash spray on plant height.

Var.	**Potash**	**Urea**		**Var. × Potash**
		S0	**S1**	
Vl	B0	105.24	106.16	105.70
	Bl	105.93	108.16	107.04
V2	B0	97.76	122.09	109.93
	Bl	115.47	111.36	113.42
L.S.D $_{0.05}$		3.21		2.26
Var. × Urea		S0	S1	Menu Var.
Vl		105.58	107.16	106.37
V2		106.62	116.73	111.67
L.S.D $_{0.05}$		2.26		1.60
Potash × Urea		S0	S1	Men of potash
B0		101.50	114.13	107.81
Bl		110.70	109.76	110.23
L.S.D $_{0.05}$		2.26		1.60
Men of Urea		106.10	111.94	
L.S.D 0.05		1.60		

lowest average of 106.10 cm. This may be due to the positive effect of nitrogen in increasing of nods number in the early stages of growth in addition to its role in elongation of internodes by increasing cell division and expansion as well as its in indole acetic acid (IAA) synthesis, which in turn leads to elongation of internodes [Taiz and Zeiger (2002)]. The interaction caused a significant effect and the combination of V2K1 gave the highest average of 113.42, while the combination V1K0 gave the lowest average of 105.7 cm. The interaction of varieties and urea caused significant effect and V2S1 gave 116.73 compared to the V1S0, which gave the lowest average of 105.58 cm.

Table 3 shows that the varieties , potash and urea spraying and their interaction significantly affected plant leafy area. Oat 11 variety exceeded significantly and gave the highest average of 64.34 cm^2 compared to the second variety which gave the lowest average of 53.56 cm^2 . This is due to the difference in the genetic characteristics. It is also noticed from the table that potash spraying significantly gave the highest value reached to 60.07 cm^2 compared to control treatment which gave the lowest average of 57.82 cm^2. Urea spraying significantly gave the highest value reached to 61.96 cm^2 compared to control treatment that gave

Table 3: Effect of oat varieties and spraying of urea and potash on leaf area.

Var.	Potash	Urea		Var. × Potash
		S0	S1	
Vl	B0	61.13	65.65	63.39
	B1	62.95	67.63	65.29
Vl	B0	49.14	55.37	52.25
	B1	50.51	59.21	54.86
L.S.D $_{0.05}$		2.63		1.86
Varieties × Urea		S0	S1	Men of Var.
Vl		62.04	66.64	64.34
V2		49.83	57.29	53.56
L.S.D $_{0.05}$		1.86	1.29	
Potash × Urea		S0	S1	Menu Potash
B0		55.14	60.51	57.82
B1		56.73	63.42	60.07
L.S.D $_{0.05}$		1.86	1.29	
Menu Urea		55.93	61.96	
L.S.D 0.05		1.29		

Table 4: Effect of oat varieties, urea and potash levels on chlorophyll.

Var.	Potash	Urea		Var. × Potash
		S0	S1	
Vl	B0	44.16	57.00	50.58
	B1	48.33	53.51	50.92
V2	B0	62.77	62.77	64.49
	B1	65.67	68.49	67.08
L.S.D $_{0.05}$		2.44		1.73
Var. × Urea		S0	S1	Menu Var.
Vl		46.25	55.26	50.75
V2		64.22	67.35	65.78
L.S.D$_{0.05}$		1.73		1.22
Potash × Urea		S0	S1	Menu Potash
B0		53.46	61.60	57.53
B1		57.00	61.00	59.00
L.S.D $_{0.05}$		1.73		1.22
Menu Urea		55.23	61.30	
L.S.D $_{0.05}$		1.22		

the lowest average of 55.93 cm^2. This may be due to that nitrogen led to better growth and more processed food, and thus reduced competition for food that reflected in increasing of leaf area. The interaction of varieties and potash caused significant effect and V1K2 was superior with an average of 65.29 cm^2, when the bilateral interference between the varieties and spraying potassium. The interaction between the varieties and spraying the urea caused significant effect and V1U2 was excelled with an average of 66.64. The interaction of the three factors caused significant effect, and V1K1U1 caused the highest value reached to 67.63 compared to V2K0U0, which gave the lowest value of 49.14 cm^2.

Table 4 showed that the varieties and spraying of potash and urea fertilizers as well as their interaction caused a significant effect on chlorophyll and V2 variety gave the highest average of 65.78 compared to the second variety, which gave the lowest average of 50.75. This may be due to the difference in the genetic characteristics. Spraying of potash caused significant effect by increasing chlorophyll to 59.00 compared to control treatment that gave the lowest average of 57.53. This may be due to the effect of potassium in many enzymes. Urea spraying increased chlorophyll to 61.30 compared to control treatment that gave the lowest value of 55.23. This reason may be attributed to the fact that nitrogen improved growth and increased processed food which involved in building chlorophyll. The interaction between varieties and potash caused significant effect and V2B2 was superior by giving 67.08. The interaction between the varieties and urea spraying caused significant effect and V2S1 was superior by giving 67.35. The triple interaction between the factors gave the highest average of 68.49 at V2B1S1 combination and the less average of 44.16 was obtained at V1B0S0.

Table 5 showed that varieties did not differ significantly in the average of protein in cereals. Potash spraying significantly increased protein percentage by giving 12.29 compared to control treatment that gave an average of 11.55. This increase can be attributed to the appropriate processing of the potassium component in the grain formation stage and the effective cycle in building amino acids and proteins and storing them in different parts and its availability in the grain filling stage as well as its effect in stimulating and stimulating plant enzymes and to its role in the transport of carBohydrates Dratia, as the appropriate additions of this element encouraged the plant to increase vegetative growth and its ability to raise the efficiency of photosynthesis, which

Table 5: Effect of oat varieties, urea and potash levels on cereal protein.

Var.	Potash	Urea		Var. × Potash
		S0	S1	
Vl	B0	11.03	11.39	11.21
	B1	11.21	13.32	12.27
V2	B0	11.51	12.25	11.88
	B1	11.20	13.39	12.29
L.S.D $_{0.05}$		1.12		1.02
Var. × Urea		S0	S1	Menu Var.
Vl		11.12	12.36	11.74
V2		11.36	12.82	12.09
L.S.D $_{0.05}$		1.02		n.s
Potash × Urea		S0	S1	Menu Potash
B0		11.27	11.82	11.55
B1		11.21	13.36	12.29
L.S.D $_{0.05}$		1.02		0.72
Men of Urea		11.24	12.59	
L.S.D $_{0.05}$		0.72		

led to an increase in the percentage of protein in cereals. This is consistent with Nejad *et al.* (2010). Also, it is noticed from the table that the urea spray treatment was significantly superior at an average of 12.58 compared to the control treatment that reached the lowest average of 11.24 and the reason for the superiority of urea addition in the characteristic of the protein grains percentage may be due to its role in nitrogen processing, which led to increased growth and increases the level of photosynthesis and thus increases proteins. Table 4 also indicates a significant effect of interference between the varieties and spraying factors, as the combination (V2B0) and (V1B1) outperformed the highest average of 12.29 and 12.27 respectively, while the combination (V1B0) gave the lowest average of 11.21 as for the interference. The duo between the varieties and the urea spray treatment, the V1S1 synthesis was superior to an average of 12.35 and a significant overlap appeared between the two spray treatments. As the combination of B1S1 significantly increased with an average of 13.35, while the combination of B1S0 gave the lowest average of 11.21, while the triple interference between the varieties and the two spray treatments was given the highest average of 13.39 when the combination V2B1S1 and the lowest average of 11.03 when the combination V1B0S0.

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