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Response of Grain Sorghum (*Sorghum bicolor* L. Moench) to Potassium Fertilizer Rates and Omitting One Irrigation

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TWO FIELD trials were carried out at Ebshway, Fayoum Governorate, during 2002,2003 to study the effect of potassium fertilizer rates and omitting one irrigation at different growth stages on growth, yield and its components as well as chemical components of sorghum grains.The main findings could be summarized as follows:

1- Increasing K rates from 25 up to 75 kg K_2O / fed significantly increased plant height, TDW, LA, LAI, LAR, SLA, NAR, CGR, RGR, yield and its components as well as protein, total carbohydrate percentage and yields but no significant increment was recorded in SLW, harvest index, or crude fiber and ash percentages.
2- The general means of plant height, TDW, LA, LAI, LAR, SLA, RGR, CGR, NAR and yield and its components as well as chemical components were significantly decreased when sorghum plants were exposed to neglect 3^{rd} or 4^{th} irrigations except SLW and harvest index.
3- The interaction effects between potassium fertilizer rates and omitting one irrigation on plant height, TDW, LA, LAI, LAR, SLA, NAR, CGR, RGR, yield and its components as well as protein and total carbohydrates percentage and yields significantly increased when sorghum plants were exposed to neglected 5^{th} irrigation and fertilization at 75 kg K_2O / fed.

Keywords: Sorghum, Potassium fertilizer, Yield and Omitting one irrigation.

The new short and improved grain sorghum (*Sorghum bicolor* (L.) *Moench*) varieties are successfully grown in the newly reclaimed soils (sandy and calcareous) of Egypt. Grain sorghum is considered one of the most adapted summer cereal crop under adverse conditions of water shortage, salinity and low soil fertility. Its cultivated area (384000 fed.) in 2002 season, 70% of these area cultivated in El-Fayoum, Assuit and Sohag Governorates. Watering and potassium fertilizer are important factors affecting sorghum growth, yield and its components.

The productivity of sorghum plants depends on the available amount of fertilizer and water. To evaluate the yield of sorghum varieties, it is useful to estimate the ability of sorghum plants to accumulate dry matter. The dry weight / plant could be considered as dependant mainly on leaf area, net assimilation rate

and relative growth rate especially around flowering and near maturity. Many researches studied effect of irrigation and potassium supply on some field crops. Bordoli and Mallarino (1998) reported that potassium fertilization increased grain yield in corn.

Abou El-Defan *et al.* (1998) stated that increasing K-application rates increased grain and straw yield in wheat and significantly differences between the control and all the experimental treatments.

Roa (1999) showed that the leaf area index (LAI), crop growth rate (CGR) and net assimilation rate (NAR) decreased when sorghum plants were exposed to water stress. Under water stress situations in sorghum grain yield is mostly controlled by grain number (greater sink capacity) and better partitioning.These results are in harmony with Latif *et al.* (2000), Borges and Mallarino (2001), Castho (2001), Singh and Sharma (2001), El-Mahi *et al.* (2002), Ibrahim *et al.* (2002) and Singh *et al.* (2002).

The objectives of this study were to evaluate the effects the omitting one irrigation and potassium fertilizer on growth, yield of sorghum plants.

Materials and Methods

Two field experiments were carried out during the two successive seasons of 2002 and 2003 seasons at Ebshway, Fayoum Governorate to study the effect of potassium fertilizer rates and omitting one irrigation on growth, yield and chemical components of sorghum grains.

The experimental design was a split plot design with four replications, sub-plot size was 21 m^2 = 1/200 fed (6 m in width and 3.5 m in length), the distance between each row was 60 cm. Each sub-plot consisted of ten rows, five rows were devoted for plant growth sampling, while the other five rows were left for yield and its components determinations, the main plots were occupied by irrigation treatments, while potassium fertilizer were assigned in sub-plot.

To avoid the interference between treatments, 1.5 m beds were left among experimental sub-plots. Sorghum grains cv. Meina were sown on 6^{th} and 8^{th} June in 2002 and 2003 seasons, respectively. After three weeks, plants were thinned to two plants / hill for omitting one irrigation, whereas plants were adjusted according to potassium fertilizer and their interaction. Phosphorus was added in the form of super-phosphate (15.5 % P_2O_5) at the rate of 150 kg / fed. and 90 kg N / fed. was applied in from of ammonium nitrate (33.5 % N) for the experiments. Nitrogen was added in two equal split applications, before 1^{st} and 2^{nd} irrigations to study the interaction between potassium fertilizer and omitting one irrigation at various growth stages.

The different irrigation treatments were :

1. Normal irrigation, as a control, where six irrigations were applied during the seasons at 2 weeks intervals.
2. Omitting the third irrigation, plants were about beginning of flowering, head (panicle) extended into flag leaf sheath (at 51 DAP).
3. Omitting the fourth irrigation, plants were at half bloom stage (at 66 DAP).
4. Omitting the fifth irrigation, plants were at soft dough stage at (81 DAP).

Potassium fertilizer

Potassium fertilization levels were 25, 50 and 75 kg K_2O / fed. Potassium was applied in the form of potassium sulphate (48 % K_2O). These rates were applied in one dose before the first irrigation, after 21 days from planting. At 90 DAP the following growth attributes were recorded :-

1- Plant height (cm). 2- Total dry matter accumulation (g). 3- Leaf area per plant (LA / plant) (dm^2). 4- Leaf area index (LAI). 5- Leaf area rates (LAR) (Blade leaf area in dm^2 / the whole plant dry weight in g). 6- Specific leaf area (SLA) (Blade leaf area in cm^2 / leaf dry weight in g). 7- Specific leaf weight (SLW) (leaf dry weight in g / blade leaf area in cm). 8- NAR = $(W_2 - W_1) (\log_e A_2 - \log A_1) / (A_2 - A_1) (t_2 - t_1)$, Greogory (1926) . 9- RGR = $\log_e W_2 - \log_e W_1 / (t_2 - t_1)$, Blackman (1951). 10- CGR, $(W_2 - W_1) / (t_2 - t_1)$ where W_1, A_1 and W_2, A_2 refer to dry weight of the whole plant and leaf area at time t_1 and t_2 in weeks, respectively.

At harvest, about 120 DAP, ten individual guarded plants were taken randomly from each sup-plot of the rows for determination of following variable:

1- Weight of panicle (g). 2- Grain weight / panicle (g) 3- Straw yield / plant (g). 4-Grain index (1000 grain weight in g). 5- Straw yield / plant (g). 6-Shelling percentage.

Whereas, on the basis of plot size, the following traits were estimated:

1- Grain yield (ton / fed). 2- Straw yield (ton / fed). 3- Biological yield (ton / fed). 4- Harvest index % (grain yield / biological yield × 100).

The following chemical constituents in grain samples were determined :

Total nitrogen was determined by micro-Kjeldahl methods (A.O.A.C. 1980). Crude protein was calculated by multiplying the N values by 5.75 factors according to Baghott and Puri (1979). Total carbohydrate was determined according to Montgomery (1961). Crude fiber and ash of grains were separately determined according to A.O.A.C. (1980).

Combined analysis was made for the two seasons according to Snedecor and Cochran (1990) and the means were compared using LSD test at 0.05 level.

Results and Discussion

1- Growth characters of sorghum plants as affected by potassium fertilizer rates and omitting one irrigation

A- Effect of potassium rates

Irrespective of omitting one irrigation, Table 1 shows that in general, increasing K-application rate, increased plant height, TDW, LA, LAI, LAR and SLA except SLW. The treatment of 75 kg K_2O / fed. gave the highest, heavier plants and thinner leaves. This may be due to the stimulative effect of potassium rates on vegetative growth and reproductive organs.

TABLE 1. Growth attribute and leaf growth characters of sorghum plants at 90 days as affected by potassium fertilizer rates and omitting one irrigation (combined of two seasons).

Character / Treatments			Plant height (cm)	TDW (g)	LA (dm^2)	LAI	LAR (dm^2/g)	SLA (cm^2/g)	SLW (mg/cm^2)
Potassium rates		25	149.52	237.05	25.49	2.12	10.75	521.30	1.93
		50	154.00	245.09	30.41	2.54	12.41	526.04	1.97
		75	157.59	251.38	32.50	2.71	12.93	534.84	2.00
L. S. D			2.14	5.83	1.12	0.12	0.82	6.22	N.S
Omitting one irrigation		Control	154.22	249.31	30.01	2.50	12.04	548.12	1.91
		3rd	149.61	231.62	25.86	2.16	11.16	453.35	2.24
		4th	152.27	240.19	28.09	2.34	11.69	526.97	1.88
		5th	154.51	250.88	29.84	2.49	11.89	550.69	1.83
L. S. D			2.10	6.22	1.33	0.07	0.25	12.32	N.S
The interaction effect	25	3rd	146.52	228.12	23.34	1.95	10.23	489.26	2.20
		4th	149.40	239.72	25.82	2.18	10.77	525.84	1.82
		5th	152.63	243.31	27.30	2.28	11.22	548.79	1.78
	50	3rd	150.70	239.28	28.61	2.34	11.96	498.27	2.22
		4th	154.47	245.51	30.51	2.54	12.43	527.07	1.87
		5th	156.82	250.47	32.11	2.68	12.82	552.78	1.82
	75	3rd	155.40	243.34	30.71	2.56	12.62	504.77	2.25
		4th	158.11	250.30	32.63	2.74	13.04	535.41	1.90
		5th	159.25	260.51	34.15	2.85	13.11	564.34	1.85
L. S. D			2.10	4.20	3.15	0.32	1.20	12.23	N.S

B- Omitting one irrigation

Table 1 shows that regardless of potassium fertilizer rates, the general mean of plant height, TDW, LA, LAI, LAR and SLA decreased when sorghum plants exposed to omitting 3rd or 4th irrigations, compared to the normal irrigation, but no significantly differences between the omitting 5th irrigation and the control treatment. It could be noted that potassium application improved the water content of the leaves and the plants showed more tolerance to drought stress. Similar results were reported by El-Hattab *et al.* (2000), Castho (2001) and El-Mahi *et al.* (2002).

2- The interaction effects between potassium fertilizer rates and omitting one irrigation

Table 1 shows that the interaction effects between potassium rates and omitting one irrigation on plant height, TDW, LA, LAI, LAR and SLA were increased significantly with increasing potassium rates up to 75 kg K_2O / fed in the various depriving one irrigation, but SLW was not significantly changed . Higher value of the previous characters was obtained when sorghum plants were exposed to omitting 5th irrigation and fertilizer 75 kg K_2O /fed except SLW. This means that raising potassium levels up to 75 kg K_2O / fed gave the heavier plants and thinner leaves. Thus it means that the sorghum plants have the ability to form roots which penetrate soil particles, searching for soil moisture deeper soil layers. Leaf thickness in sorghum plants were determined in terms of SLA and SLW. Greater SLA and smaller SLW indicate thinner leaves and vice verse .

3- Physiological characters of sorghum as affected by potassium fertilizer rates and omitting one irrigation at various growth stages

A- Effect of potassium fertilizater rates

Irrespective of omitting one irrigation, RGR, CGR and NAR of sorghum plants were significantly affected by potassium fertilizer rates (Table 2). Greater variables were significantly obtained when plants fertilized by 75 kg K_2O / fed., however, the least values were registered when plant fertilized by 25 kg K_2O / fed. It could be concluded that RGR, CGR and NAR of sorghum plants increased as potassium rates increased and this in turn gave higher values of physiological parameters which lead to greater metabolic substances, therefore more photosynthetic activity was obtained. The yield results reported here were greater and this confirm our results.

B- Effect of omitting one irrigation

Regardless of potassium fertilizer rates, data in Table 2 show significant differences, in plant growth analysis between the various omitting one irrigation. With regard to RGR, CGR and NAR, it could be noted that the omitting the 3rd, 4th, or 5th irrigations during the growth season of sorghum plant, greatly decreased RGR, CGR and NAR. The decline in plant growth analysis might be attributed to reduction in leaf surface area. Similar results were reported by Singh and Sharma (2001) and Singh *et al.* (2002).

C- The interaction affect between potassium rates and omitting one irrigation

The interaction effects between potassium rates and omitting one irrigation on RGR, CGR and NAR of sorghum plants were significantly affected at the various growth periods. Higher values of RGR, CGR and NAR were recorded when sorghum plants fertilized by 75 kg K_2O / fed at the two growth periods (60 – 75) and (75 – 90) in the various omitting one irrigation, but the lower values of the pervious characters were obtained when sorghum plants fertilized by 25 kg K_2O / fed at the two growth periods (60-75) and (75-90) in the all neglected one irrigation. It could be noted that increasing K use is going parallely with larger flag leaf area that is usually major assimilates source to the developing grains.

TABLE 2. Physiological characters of sorghum plants as affected by potassium fertilizer rates and omitting one irrigation (combined of two seasons).

Treatments \ Characters / DAP			RGR mg/cm²/day		CGR mg/cm²/day		NAR mg/cm²/day	
			60 - 75	75 - 90	60 - 75	75 - 90	60 - 75	75 - 90
Potassium rates		25	177.17	122.04	15.92	12.89	628.99	375.76
		50	182.24	134.07	17.31	14.56	708.07	431.82
		75	186.41	143.72	19.62	16.41	737.58	459.60
L. S. D			4.32	6.27	1.93	2.01	20.12	25.13
Omitting one irrigation		Control	190.12	145.32	22.17	18.33	773.16	522.12
		3rd	186.98	142.72	18.77	17.82	752.66	489.02
		4th	176.90	135.73	16.54	14.34	630.42	439.52
		5th	-	121.39	-	11.69	-	338.64
L. S. D			3.12	2.93	1.77	2.96	30.42	22.11
The interaction effect	25	3rd	182.22	130.28	17.72	16.35	675.62	473.34
		4th	172.12	125.52	14.11	12.60	582.35	392.62
		5th	-	110.33	-	9.71	-	261.33
	50	3rd	186.31	142.51	18.18	17.50	789.71	490.57
		4th	178.17	137.60	16.43	14.08	626.42	443.53
		5th	-	122.11	-	12.10	-	361.35
	75	3rd	192.41	155.37	20.41	19.62	792.65	503.15
		4th	180.41	144.07	18.82	16.34	682.50	482.41
		5th	-	131.73	-	13.26	-	393.24
L. S. D			6.24	4.37	1.27	2.07	17.37	31.22

4- Yield and yield components as affected by potassium fertilizer rates and omitting one irrigation

A- Yield and its components as affected by potassium fertilizer rates

It is obvious from Table 3 that increasing potassium levels from 25 up to 75 kg K_2O / fed significantly increased yield and its components except harvest index. Since, increasing potassium rates from 25 to 75 kg K_2O / fed increased dry weight / panicle by (5.8, 9.04 %), grain weight / panicle by (11.38, 18.00), shelling % by (5.3, 7.8 %), grain index by (5.1, 10.5 %), straw yield / plants by (2.3, 3.4 %), grain yield ton / fed by (5.03, 7.5 %), straw yield ton / fed by (1.3, 4.6 %) and biological yield ton / fed by (1.8, 5.1 %) but harvest index not significant increased by (3.1, 2.4 %) when potassium rates increased from 25 up to 75 kg K_2O / fed. These results may support the finding of increasing grain yield, straw and biological yield ton / fed, viz. dry and grain weight / panicle, seed index, straw yield / plants, with increasing potassium rates.

TABLE 3. Yield and yield components of sorghum plants as affected by potassium fertilizer rates and omitting one irrigation (combined of two season).

Characters / Treatments		Dry weight/panicle (g)	Grain weight/panicle (g)	Shelling %	Grain index (g)	Straw yield/plant (g)	Grain yield (ton/fed)	Straw yield (ton/fed)	Bilogical yield (ton/fed)	Harvest index %
Potassium rates	25	76.87	59.69	77.62	30.15	248.11	3.18	17.44	20.68	15.42
	50	81.34	66.48	81.71	31.69	253.78	3.34	17.66	21.00	15.9
	75	83.82	70.44	83.69	33.30	256.58	3.42	18.25	21.67	15.79
L. S. D		2.10	3.00	1.00	1.72	3.27	0.10	0.20	0.30	N.S
Omiting one irrigation	Control	83.23	67.18	80.72	32.11	262.11	3.33	18.11	21.44	15.53
	3rd	77.37	62.25	80.34	31.67	242.35	3.31	18.00	21.31	15.51
	4th	80.32	65.48	81.06	30.47	249.28	3.30	17.40	20.70	15.94
	5th	84.29	68.88	81.62	33.00	265.50	3.33	17.61	20.94	15.92
L. S. D		2.13	2.22	0.20	0.30	2.70	0.03	0.02	1.00	N.S
The interaction effect	25 3rd	73.27	56.11	76.58	30.31	239.11	3.19	17.81	21.00	15.19
	25 4th	77.24	60.44	78.25	29.03	244.41	3.17	17.87	20.04	15.82
	25 5th	80.11	62.52	78.04	31.11	260.81	3.18	16.63	19.81	16.05
	50 3rd	78.34	63.38	80.90	31.29	242.73	3.34	17.93	21.27	15.70
	50 4th	80.31	65.72	81.83	30.51	249.37	3.33	17.22	20.55	16.20
	50 5th	85.37	70.34	82.39	33.28	265.23	3.35	17.83	21.18	15.82
	75 3rd	80.51	67.27	83.55	33.42	245.21	3.39	18.27	21.66	15.65
	75 4th	83.57	70.28	83.10	31.87	254.07	3.40	18.11	21.51	15.81
	75 5th	87.38	73.77	84.42	34.62	270.45	3.47	18.37	21.84	15.89
L. S. D		1.35	1.11	0.41	0.20	4.25	0.07	0.20	0.30	32

B- Yields and its components as affected by omitting one irrigation

Regardless of potassium rates, the combined data in Table 3 show several significant differences in the previous characters. It is obvious that omitting one irrigation, significantly decreased the different values of the previous characters especially at omitting the 3^{rd} or 4^{th} irrigations. However, lower decreased were obtained in the various yield components at 3^{rd} or 4^{th} irrigation. Omitting the 3^{rd}, 4^{th} and 5^{th} irrigations led to a decreas in dry weight and grain weight / panicle as well as shelling %, grain index, and straw yield / plant compared to the normal irrigation.

Grain, straw and biological yields ton / fed, as well as harvest index were significantly decreased by depriving one irrigation at the various growth stages. Higher values of the pervious characters were supported when sorghum plants exposed to omitting the 3^{rd} or 5^{th} irrigations. However, the lower values were obtained when sorghum plants exposed to the depriving the 4^{th} irrigation. This might be due to increased in dry and grain weight / panicle, shelling % and grain index. On the other hand, decreased in straw, biological yields ton/fed might be attributed to the decreased in straw yield / plant, plant height and dry matter accumulation (Table 1).

Since the vegetative growth, as well as the accumulation of dry matter in stover could be sustained earlier in the seasons. Therefore, the determined effect of later omitting of irrigation surpassed early omitting. The differential yield response with respect to omitting one irrigation, could be attributed to the time at which growth and development processes occurred. These results are mostly in harmony with those of Abou El-Defan *et al.* (1998), El-Hattab *et al.* (2000) and Singh *et al.* (2002).

C- The interaction effect between the potassium fertilizer rates and omitting one irrigation

The interaction effect between potassium rates and neglecting the 3^{rd}, 4^{th} or 5^{th} irrigations on the various characters, were significant differences except harvest index. Higher values of the other yield components were registed when sorghum plants were fertilized with 75 kg K_2O / fed and omitting the 5^{th} irrigation, whereas the lower values of all characters were obtained when sorghum plants were fertilized by 25 kg K_2O / fed and omitting 3^{rd} and 4^{th} irrigations.These results are mostly in harmony with those of Borges and Mallorino (2001) and El-Mahi *et al.* (2002).

5- Yield and its components in relation to growth characters

Sorghum plants formed more leaf area and LAI under K fertilization, compared to that of the control, and the expanded leaf area and LAI was proportional to the increase of K fertilizer. This was reflected in the increase of dry weight in (g), accumulated by dm^2 of leaves per week at the growth stages of (60–75) and (75–90) DAP. The higher NAR in favour of potassium fertilized plants was reflected by increase in the dry matter accumulation with the increase in the rate of K fertilizer at all growth stages, from 60 up to 90 DAP. These

results may support the findings of increasing sorghum grain yield and its components, viz, dry and grain weight / panicle, shelling %, seed index, straw yield / plant, with increasing K fertilization. The opposite results more registered, when one irrigation was omitted at the various growth stages particularly when plants were between blooming and soft dough stages. The present data, generally, are in harmony with those obtained by El-Hattab *et al.* (2000), Singh and Sharma (2001) and Ibrahim *et al.* (2002).

6- Chemical composition of sorghum grain as affected by potassium fertilizer rates and omitting one irrigation

A- potassium fertilizer rates

Irrespective of omitting one irrigation, combined data in Table 4 show significant differences between the potassium levels in protein and total carbohydrates percentage, as well as protein and total carbohydrates yield, the all characters increased with increasing potassium rates by (0.49, 1.2 %), (5.7, 8.9 %), (0.01, 0.08 %) and (5.1, 7.6 %) respectively, but crude fiber and ash % show no significant differences.

TABLE 4. Chemical components of sorghum grain as affected by potassium fertilizer rates and omitting one irrigation (combined of two seasons).

Characters / Treatments			protein		carbohydrate		CF %	Ash %
			%	yield "ton/fed"	%	yield "ton/fed"		
Potassium rates		25	12.59	40.04	83.82	267.47	1.14	2.54
		50	12.65	42.34	83.83	281.04	0.89	2.65
		75	12.24	43.60	83.89	287.80	0.75	2.69
L. S. D			0.02	1.20	0.05	4.62	N.S	N.S
Omitting one irrigation		Control	12.75	42.46	83.67	278.62	1.1	2.45
		3rd	12.56	41.54	83.79	277.08	1.33	2.57
		4th	12.66	41.75	83.87	276.77	0.82	2.65
		5th	12.76	42.53	83.92	279.73	0.563	2.77
L. S. D			0.12	1.02	0.02	2.03	N.S	0.11
The interaction effect	25	3rd	12.52	39.94	83.78	267.26	1.18	2.52
		4th	12.60	39.94	83.80	265.65	1.00	2.60
		5th	12.66	40.26	83.87	266.71	0.81	2.66
	50	3rd	12.57	41.98	83.8	279.89	1.03	2.60
		4th	12.67	42.19	83.88	279.32	0.80	2.65
		5th	12.72	42.61	83.92	281.13	0.59	2.77
	75	3rd	12.60	42.71	83.80	284.08	1.00	2.60
		4th	12.72	43.25	83.92	285.33	0.66	2.70
		5th	12.89	44.73	83.96	291.34	0.28	2.87
L. S. D			0.20	0.30	0.20	1.30	0.30	0.12

It could be concluded that protein and TC yields / fed in Table 4 might be due to increase in protein and TC % as well as grain yield (Table 3).

B- Omitting one irrigation

Regardless of potassium levels, Table 4 shows significant differences, decreased, between the omitting irrigation in previous characters when sorghum plants exposed the 3^{rd} or 4^{th} irrigations compared to the control treatment. Protein and total carbohydrates yield were significantly decreased by (2.2, 1.6, 0.6 and 0.7 %), respectively, when sorghum plants exposed to neglected the 3^{rd} and 4^{th} irrigations compared to the normal treatment. This might be due to decreased in grain yield ton/fed (Table 3).

Also, ash percentage significantly increased by (27.4 and 50.4 %), respectively, when sorghum plants exposed to omitting 4^{th} or 5^{th} irrigations , but crude fiber significantly increased by (4.9, 8.2 and 13.1%), respectively, compared to the control treatment. These results are in accordance with those obtained by El-Hattab *et al.* (2000) and Singh *et al.* (2002).

C- The interaction effects between potassium rates and omitting one irrigation

The interaction effects between potassium rates and omitting one irrigation on protein, total carbohydrate percentages and yields as well as ash percentage were significantly increased by increasing potassium rates in all various omitting irrigations, but crude fiber significantly decreased. Higher values in all pervious characters were obtained at omitting the 4^{th} or 5^{th} irrigations and fertilized by 50 and / or 75 kg K_2O / fed.

It could be concluded that potassium application up 75 kg/feddan as well as omitting the 5^{th} irrigation could be recommended for higher sorghum yield under similar growing condition.

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استجابة الذرة الرفيعة للحبوب لمعدلات التسميد البوتاسى وإسقاط رية واحدة

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أجريت تجربتان حقليتان عام ٢٠٠٢ ، ٢٠٠٣ بأبشواى – محافظة الفيوم بهدف دراسة تأثير إضافة معدلات مختلفة من البوتاسيوم وإسقاط رية واحدة على الصفات الخضرية والمحصول ومكوناته لحبوب الذرة الرفيعة وتتلخص أهم النتائج المتحصل عليها فيما يلى :

١- زيادة معدلات التسميد البوتاسى من ٢٥ إلى ٧٥ كجم بوتاسيوم/فدان أدى إلى زيادة معنوية فى طول النبات والوزن الجاف للنبات ومساحة الأوراق ودليل مساحة الأوراق ونسبة مساحة الأوراق والوزن النوعى للورقة والكفاءة التمثيلية والسرعة النسبية للنمو وسرعة نمو المحصول والمحصول ومكوناته وكذلك البروتين والكربوهيدرات نسبة مئوية ومحصولية ولكن الوزن النوعى للورقة ودليل الحصاد ونسبة الرماد لا يوجد فروق معنوية .

٢- أدى إسقاط الرية الثالثة أوالرابعة إلى نقص معنوى فى طول النبات والوزن الجاف ومساحة الأوراق ودليل مساحة الأوراق ونسبة مساحة الأوراق وسرعة نمو المحصول والسرعة النسبية للنمو والكفاءة التمثيلية وكذلك المحصول ومكوناته والصفات الكيمائية للذرة الرفيعة ماعدا الوزن النوعى للورقة ودليل الحصاد .

٣- أما التفاعل بين مستويات البوتاسيوم وإسقاط الريات فإن التسميد بمعدل ٧٥ كجم بوتاسيوم للفدان مع إسقاط الرية الخامسة أدى إلى زيادة معنوية فى طول النبات – الوزن الجاف ومساحة الأوراق ودليل مساحة الأوراق والوزن النوعى للورقة ونسبة مساحة الأوراق والكفاءة التمثيلية والسرعة النسبية للنمو وسرعة نمو المحصول والمحصول ومكوناته وكذلك الصفات الكيميائية.