EFFECT OF SKIPPING ONE IRRIGATION AT VEGETATIVE OR FLOWERING GROWTH STAGES AND FOLIAR APPLICATION OF POTASSIUM ON GROWTH AND YIELD OF SESAME

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ABSTRACT

Two field experiments were carried out at the Agricultural Experimental Station of National Research Centre at Shalakan, Kalubia, Governorate during 2002 and 2003 seasons to study the effect of irrigation treatments (irrigation every 15 days and skipping one irrigation at vegetative growth or flowering stages) and foliar application of 0, $^1/_2$ and 1 L/fed. k (38%) on growth, yield, yield attributes and seed oil percentage of sesame variety Giza 32. The results revealed that skipping one irrigation at any of the two studied stages significantly reduced growth characters i.e plant height, number of both leaves, capsules per plant and dry weight per plant (leaves, steam, capsules, recovered root and total), yield i.e seed, straw and biological yields/fed., yield attributes i.e number of capsules, weight of both capsules, seeds per plant and 1000 seed weight and seed oil percentage as compared with the control plots. However, the negative response of sesame plants to skipping one irrigation was more pronounced at flowering stage than the other treatments. On the other hand, increasing the concentration of K up to 1 L/fed. remarkably increased the growth characters i.e plant height, number of both leaves, capsules per plant and dry weight per plant (leaves, steam, capsules, recovered root and total), yield i.e seed, straw and biological yields/fed., yield attributes i.e number of capsules, weight of both capsules, seeds per plant and 1000 seed weight and oil content. The results

suggested that irrigation every 15 days and application of K (38%) with 1 L/fed. could be recommended for maximum yield of sesame plants under similar conditions.

Key words: Growth, Irrigation, Potassium folair application, sesame, yield.

INTRODUCTION

Sesame (*Sesamum indicum* L.) is considered as one of the most important oil crops grown in Egypt. It is a summer crop grown in a wide range of soils especially sandy soils for oil production.

Ayyaswamy & Velu (1992); Majumdar & Roy (1992) and Sener *et al* (1992) found that sesame was sown on sandy loam soil and irrigated at branching (Br) + flowering (F1) produced seed yield, in the respective seasons, of 0.95 and 1.00 t / ha compared with 1.21 and 1.22 t / ha from irrigated at Br + F1 + capsules development stage. **Jana *et al* (1995)** found that the highest yields of seed (1.28 t/ha) and oil (0.52 t/ha) were obtained by 3 irrigation applied at the branching, flowering and seed development stages.

Mahalanobis (1996) and Dutta *et al* (2000) indicated that sesame with three irrigation each applied at branching, flowering and capsule development stages, recorded maximum yield (seed + oil) of sesame, followed by 2 irrigation (branching + flowering).

Many research papers also indicated that spray with potassin cultivating flax genotypes increased all characters under the study **(El-Zeiny *et al* 1994; El-Shimy and Moawed, 2000; Moawed, 2001 and El-Azzouni *et al* 2003). Derrick *et* al (1995)** reported that foliar application of K increased yield of cotton plant.

The aim of the present work is to study the effect of some irrigation treatments and potassium foliar application on growth, yield, yield components and seed oil percentage of sesame.

MATERIALS AND METHODS

Two field experiments were carried out during the two successive seasons of 2002 and 2003 at the Experimental Farm of the National Research Centre in Shalakan Kalubia Governorate, Egypt. The soil texture of the experimental site was clay loam in both seasons. The investigation included nine treatments which were the combination of three irrigation regime and three foliar

potassium 38% treatments produced by El-Nasr Company for fertilizers and pesticides. A split-plot design with three replications was employed. The main plots were devoted to irrigation regimes while the sub-plots were assigned to potassium foliar treatments. The soil was ploughed twice, rigged and divided into plots. Each plot (10.5m2) consisted of 5 ridges of 3.5 m in length and 0.6 m a part. To avoid the effect of lateral movement of irrigation water, the plots were isolated by borders of 1.5 m in width from all sides.

Irrigation treatments were imposed to allow the plants either irrigation every 15 days (control treatment), or skipping one irrigation at vegetative growth and flowering stages i.e. 45 and 60 days from sowing, respectively. In both seasons, sesame plants of each irrigation treatment were sprayed till drip, after 45 and 60 days from sowing, with either tap water (as control), or aqueous solution of potassium ($^1/_2$ and 1 L.fed). On May 19 and 22 in 2002 and 2003 seasons, sesame seeds (Sesamum indicum L.) cv. Giza 32 were sown in hills, 10.0 cm a part. Thinning to two plants per hill was done at 14 days after planting. The normal agricultural practices for growing sesame were followed as recommended in the region. Calcium superphosphate (15.5% P2O5) was added at the rate of 200 kg/fed. during the field preparation. Nitrogen fertilizer at the rate of 45 kg N/fed (as ammonium nitrate 33.5% N) was applied in two equal doses (at the first and second irrigations). At 85 days plant age, random sample from each treatment was taken to determine the vegetative attributes i.e. plant height, number of both leaves, capsules per plant as well as dry weight of both leaves, stem, capsules, root and total dry weight per plant. At harvest, random sample of nine plants, was taken from each treatment to determine number and weight of capsules plant, seed/plant, and weight of 1000 seeds. Seed, straw and biological yields /fed. were calculated from the yield of two central ridges of each plot. Oil percentage was estimated according to the method described by **A.O.A.C. (1982)** using soxhlet apparatus and petroleum ether as solvent. Data were subjected to statistical analysis of variance described by **Snedecor and Cochran (1980)**, and the combined analysis of the two seasons was applied according to the method adopted by **Steel and Torrie (1960).**

RESULTS AND DISCUSSION

1. Effect on vegetative attributes

Data presented in Table (1) show that the exposing sesame plants to water deficit at each vegetative growth and flowering stages resulted in significant reductions in plant height, number of both leaves, capsules per plant, weight of leaves, stem, capsules and root per plant as well as total dry weight per plant as compared with control treatment (irrigation every 15 days). Similar results were reported by **Jana *et al* (1995); Duraisamy *et al* (1999) and Dutta *et al* (2000).**

The obtained results reveal also that increasing the concentration of K up to 1 L/fed. Significantly increased the aforementioned growth parameters (as compared to the control plants (untreated).

These results are in accordance with the findings of **(Derrick *et al* 1995) , Donald *et al* (1998)** on cotton plant and **El-Sayed *et al* (1999)** on lentil.

The interaction effect between irrigation treatments and K fertilization treatments was not significant except number of branches per plant.

Spraying 1 L/fed. of K under normal irrigation gave the highest number of branches per plant as compared with the other treatments (Table 1).

2. Effect on yield, yield attributes and seed oil percentage

Data presented in Table (2) clearly show that skipping one irrigation at vegetative or flowering growth stages of sesame led to significant reduction in number and weight of capsules per plant, weight of seeds per plant, seed index, Seed, straw and biological yields per feddan as well as oil content as compared with control treatment (irrigation every 15 days). However, the response of sesame plants to water deficit was more pronounced at flowering stage than the vegetative growth stage. These results are in agreement with those obtained by **Jana *et al* (1995); Duraisamy *et al* (1999) and Dutta *et al* (2000).** In this connection, **El-Wakil(1984)** found that oil content increased by increasing soil moisture content.

Table (1) Effect of irrigation treatments, potassium concentration and their interaction on vegetative attributes of sesame plants after 85 days from sowing.(combined analysis of 2002 and 2003 seasons).

Irrigation treatments	Potassium concentration L/fed.	Plant height (c m)	No. of Leaves/ plant	No. of capsules/ plant)	Dry weight (g/plant)				
					Leaves	Stem	Capsules	Recovered root	Total
Irrigation every 15 days (control)	0	164.11	67.00	41.78	11.11	26.22	17.00	8.00	62.22
	½	171.33	75.44	50.00	13.78	29.78	20.33	9.33	73.11
	1	178.78	81.78	56.78	17.11	35.11	25.11	11.11	88.44
	mean	171.41	74.74	49.52	14.00	30.37	20.81	9.48	74.59
Skipping one irrigation at vegetative growth stage	0	157.67	60.33	36.22	9.11	21.11	13.11	6.78	50.11
	½	167.00	69.89	45.00	11.67	26.67	17.44	7.55	63.33
	1	175.00	75.00	49.67	14.00	31.11	20.67	9.78	75.55
	mean	166.56	68.41	43.63	11.59	26.30	17.07	8.04	63.00
Skipping one irrigation at flowering stage	0	151.67	53.44	31.11	7.44	17.00	10.44	6.00	40.89
	½	160.00	61.22	40.67	10.22	21.44	14.11	6.89	52.66
	1	169.11	70.11	45.22	11.89	26.00	17.33	8.55	63.77
	Mean	160.26	61.59	39.00	9.85	21.48	13.96	7.15	52.44
Mean values for potassium concentrations	0	157.81	60.26	36.37	9.22	21.44	13.52	6.93	51.07
	½	166.11	68.85	45.22	11.89	25.96	17.30	7.92	63.03
	1	174.30	75.63	50.55	14.33	30.74	21.04	9.81	75.92
L.S.D at 5% for:	I	1.68	2.20	2.53	0.93	0.55	1.32	0.06	1.94
	K	1.63	2.41	1.00	0.68	1.00	0.73	0.33	1.66
	I x K	N.S	N.S	N.S	N.S	N.S	N.S	N.S	N.S

I = Irrigation treatments K = potassium concentration I X K = Interaction

Table (2) Effect of irrigation treatments, potassium concentration and their interaction on yield, yield attributes and oil content (%) of sesame. (combined analysis of 2002 and 2003 seasons).

Irrigation treatments	Potassium foliar treatments	No. of capsules/ plant	Wt. of capsules/ plant	Wt. of seeds/ plant	Seed index (1000- seed wt.)	Seed yield/ fed.	Straw yield/ fed.	Biological yield/ fed.	Oil content (%)
			(g)			(kg)			
Irrigation every 15 days (control)	0	67.22	23.11	10.44	3.42	763.33	1473.67	2237.00	59.34
	½	75.11	25.44	12.44	4.33	868.33	1617.00	2485.33	60.65
	1	80.33	28.44	14.00	4.92	993.33	1747.00	2740.33	61.68
	mean	74.22	25.67	12.30	4.22	875.00	1612.56	2487.56	60.61
Skipping one irrigation at vegetative growth stage	0	60.67	19.22	9.11	2.92	668.33	1375.67	2044.00	56.25
	½	68.44	22.55	10.78	3.88	811.67	1482.33	2294.00	57.36
	1	76.78	26.00	12.44	4.49	895.33	1583.67	2479.00	58.56
	Mean	68.63	22.59	10.78	3.77	791.78	1480.56	2272.33	57.39
Skipping one irrigation at flowering stage	0	53.44	16.11	7.44	2.44	609.00	1239.00	1848.00	55.01
	½	62.55	19.00	9.44	3.22	742.00	1354.33	2096.33	56.28
	1	70.11	23.55	10.78	3.97	818.00	1491.33	2309.33	57.19
	Mean	62.04	19.55	9.22	3.21	723.00	1361.56	2084.56	56.16
Mean values for potassium concentrations	0	60.44	19.48	9.00	2.93	680.22	1362.78	2043.00	56.87
	½	68.70	22.33	10.89	3.81	807.33	1484.56	2291.89	58.09
	1	75.74	26.00	12.41	4.46	902.22	1607.33	2509.56	59.20
L.S.D at 5% for:	I	1.04	0.65	0.35	0.20	41.41	43.58	30.14	0.24
	K	0.92	0.44	0.46	0.14	37.64	33.76	40.09	0.20
	I x K	1.60	0.77	N.S	N.S	N.S	N.S	N.S	N.S

I = Irrigation treatments K = potassium concentration I X K = Interaction

The obtained results reveal also that foliar application of K significantly affected the yield, yield attributes and oil content. Increasing the concentration of K fertilization up to 1 L/fed. caused a significant increasing in the aformentioned parameters. Similar results were obtained by **Derrick *et al* (1995)** on cotton, **Donald *et al* (1998)** on cotton, **El-Shimy and Moawed (2000)** on **flax, Moawed (2001)** on flax and **El-Azzouni *et al* (2003)** on flax.

The interaction effect between water deficit and K fertilization treatments was not significant except number of capsules per plant and weight of capsules per plant. Spraying 1 L/fed. of K under normal irrigation gave the highest number of capsules per plant and weight of capsules per plant as compared with the other treatments (Table 2).

Generally the obtained results suggest that foliar application of K (1 L/fed.) to sesame plants could be recommended to rise to productivity.

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الملخص العربى

تأثير الحرمان من ريه واحدة فى مرحلة النمو الخضرى أو الزهرى والرش الورقى بالبوتاسيوم على نمو ومحصول السمسم

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أقيمت تجربتان حقليتان بمزرعة المركز القومى للبحوث بشلقان (محافظة القليوبية) خلال موسمى ٢٠٠٢، ٢٠٠٣ بهدف دراسة تأثير معاملات الرى (الرى كل ١٥ يوم، منع ريه واحدة عند كل من مرحلة النمو الخضرى والإزهار) والرش بالبوتاسيوم ٣٨% بمعدل صفر، ½ ، ١ لتر / فدان وذلك علي النمو، المحصول ومكوناته وكذلك نسبة الزيت في بذور السمسم صنف جيزة – ٣٢.

ويمكن إيجاز أهم النتائج فيما يلى

أدى تعريض النباتات للإجهاد المائى نتيجة منع الرى في أى من المرحلتين المشار إليهما إلي نقص معنوى في صفات النمو (ارتفاع النبات – عدد الاوراق للنبات – عدد الكبسولات للنبات – الوزن الجاف لكل من الأوراق والساق والكبسولات والجذور والكلى للنبات)

والمحصول (محصول كل من البذور والقش والبيولوجى للفدان) ومكوناته (عدد الكبسولات للنبات – وزن الكبسولات للنبات – وزن البذور للنبات –وزن الألف بذرة) ونسبة الزيت بالبذور مقارنة بالنباتات المروية ريا عاديا. والاستجابة السالبة لنباتات السمسم كانت أكثر وضوحا عندما تتعرض للحرمان من الرى في مرحلة الإزهار.

أدى رش نباتات السمسم بالبوتاسيوم ٣٨% بمعدل ١ لتر/ فدان إلي زيادة معظم الصفات المدروسة للنمو (ارتفاع النبات – عدد الاوراق للنبات – عدد الكبسولات للنبات – الوزن الجاف لكل من الأوراق والساق والكبسولات والجذور والكلى للنبات) والمحصول (محصول كل من البذور والقش والبيولوجى للفدان) ومكوناته (عدد الكبسولات للنبات – وزن الكبسولات للنبات – وزن البذور للنبات –وزن الألف بذرة) ونسبة الزيت بالبذور.

يمكن التوصيه برش نباتات السمسم بالبوتاسيوم ٣٨% بمعدل ١ لتر / فدان مع استمرار الرى كل ١٥ يوم وذلك لتحقيق أعلى محصول من نباتات السمسم.