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Water Stress and N-Fertilizer Effects on *Acacia cyclops* A. Cunn. Under Saline Conditions

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ABSTRACT. The effect of irrigation intervals; 10, 20, 30 days and N fertilizer levels; 70, 140 and 210 Kg N/ha on vegetative growth of *Acacia cyclops* A. Cunn. during 1990-1993 were studied at South-Sinai, Egypt. Salinity concentration in irrigation well water and the experimental soil were 6.8 and 9.7 mmhos/cm, respectively. Results revealed that irrigating plants by saline water every 10 days, significantly increased plant weight before full establishment. However, older plants (over 2 years age) produced the highest dry weight by expanding irrigation interval to 20 days. Gradual increasing in salt accumulation hindered growth development. Adding 210 Kg N/ha in the form of ammonium sulfate, significantly enhanced plant height, foliage diameter and both fresh and dry weight of individual shrub.

In arid deserts, the extreme conditions of high temperature, saline soil and brakish irrigation water, restrict plant growth and development (Tomar and Yadav 1980). Such conditions occur in South-Sinai, Egypt, where vast expanses of land are sparsely vegetated and have low carrying capacity (El-Lakany 1987). In the South-Sinai peninsula, annual precipitation averages 50-70 mm. Hence, the animal herds, are usually undernourished, particularly during prolonged dry seasons. These droves rely on scarced fodder shrubs as well as annual forbs, which depend on badly distributed rainfall (Topps 1992). Planting drought and salt tolerant perennial arboreal legumes has been suggested for soil improvement, wind erosion protection as well as improving and stabilizing range resources (Stewart *et al.* 1993).Genus of acacia includes various species,which have wide range of adaptability to such

marginal lands (Allen and Allen, 1981 and Chaudhary 1983). *Acacia cyclops* was planted around the tombs during 1945's war in Al-Alamin region. These plantings have attracted the attention of many investigators for their feasibility under such mediterranean arid conditions (Pasternak *et al.* 1986). Muthana and Jain, 1984 and Stephens and Whitford 1993 found that prolonging the irrigation interval with saline water decreased fodder shrub survival. Providing arboreal legumes with essential nutrients encourages both biomass and lateral roots development (Franco *et al.* 1984 and Maasdorp and Gutteridge 1986). This work was conducted to study the effect of saline irrigation water interval and N fertilizer on survival and vegetative growth of *Acacia cylops* under desert conditions.

Materials and Methods

A field experiment was conducted from May 1990 through March 1993 at Ras Sudr Reserach Station, Desert Research Center, South-Sinai, Egypt. The soil of the experimental site is loamy and classified as calcareous with an EC of 9.7 mmohs/cm. Soluble cations and anions of Ca^{++}, Mg^{++}, Na^{+}, K^{+}, HCO_3^-, Cl^- and SO_4^{--} were 2.20, 0.007, 0.48, 0.01, 0.9, 0.70 and 0. 67 meq/100gm, respectively. Calcium carbonate and saturation percent were 44.3 and 28%. Furthermore, the salinity concentration and pH of the irrigation water were 6.8 mmhos/cm and 7.9. Additionally, cations and anions concentration of Ca^{++}, Mg^{++}, Na^{+}, K^{+}, HCO_3^-, Cl^- and SO_4^{--} were 405, 169, 800, 10, 167, 1555 and 1000 ppm with sodium chloride as dominant salt (Abou-Deya 1991).

Seeds were collected from older shrubs grown at Al-Alamin tombs, north-western coast of Egypt in 1989 and planted in plastic bags, filled with loamy soil in May 1990. The bags were irrigated day by day by tap water (0.45 mmhos/cm) in the greenhouse until December 1990. No fertilizers were added to the seedlings. The seedlings were transplanted in January 1991 into holes 3 m apart. Rows were 4 m apart.

Split-plot design with 4 replications was used. Irrigation intervals of 10, 20 and 30 days were the main plots with yearly application of three N fertilizer levels of 70, 140 and 210 kg N/ha and distributed randomly in the sub-plots. Every two contiguous plants were considred as a basic unit, Nitrogen fertilizer was added as ammonium sulfate (20%). Each dose was divided into two equal parts and added in Marh and November starting in 1991.

The studied parameters were plant height, foliage diameter, number of main branches, leaf/plant and leaf/stem. These parameters were measured in July and November of 1991 and 1992 and finally in March 1993. Shrubs were individually cut at 10 cm stubble height in November 1991 and in March 1993. During each cut,

fresh weight of individual plant was determined. Samples of 100 gm green materials were dried at 70 °C up to constant weight and used to detrmine dry weight.

Data was subjected to the statistical analysis and the means were compared using LSD (5% level) according to Gomez and Gomez 1983.

Results and Discussion

Table 1 shows the effects of irrigation intervals and N fertilizer levels on acacia growth traits in 1991. Except for foliage diameter in Novembr 1991, no markable effects for irrigation intervals on all studied traits were detected. Moreover, varying N level from 70 to 210 Kg/ha had only significant effects on foliage diameter in both sampling dates as well as on plant height in the first date. Irrigating with saline water in shorter interval and adding higher N-levels to *Acacia cyclops* during the initial growth stages encouraged growth development. These results are in agreement with Stewart *et al.* 1993.

Results presented in Table 2 indicate that significant differences due to irrigation interval were detected for plant height and foliage diameter at both dates in 1992. Superior averges of all measured traits were associated with adding 140 and 210 Kg N/ha in 1992, respectively. These N levels significantly effected plant height in both sampling dates and both foliage diameter and number of branches/plant merely, in the second sampling. Visible increments in plant height, foliage diameter and number of branches/plant were associated with shortening irrigation interval (10 day) before July, 1992. However lengthening irrigation interval to 30 day produced the greatest effect by November 1992. This may be attributed to the distribution of shrub roots at a shallow depth during the initial stages of establishment, therefore requiring frequent irrigation to avoid the harmful salinity effects. However, roots of older plants are more deeply distributed away from higher salt accumulation area. Moreover, decreasing the total amount of saline water odd by lenghthening irrigation interval encourages vertically and horizontally root permeation and reduce salt harmful effects in the deep root distribution zone (Burdett *et al.* 1983 and Vodyanitskii 1981).

Significant effects of irrigation interval and N fertilizer on plant height, foliage diameter and number of branches were detected in March 1993 (Table 3). The interaction between irrigation interval and N fertilizer significantly effected all growth traits, except leaf/stem in March, 1993.

Table 1. Growth characters of *Acacia cyclops* as affected by irrigation interval and N level in 1991

Irrigation Interval (I), day / N level (N), Kg/ha	Plant height (cm)					Foliage diameter (cm)					No. branches/plant					Leaf/plant, ratio					Leaf/stem, ratio				
	10	20	30	Mean	(I)LSD*	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD
July 1991																									
70	50	49	48	49		44	60	57	54		8	12	8	9		.83	.84	.80	.82		4.9	5.3	4.0	4.7	
140	74	55	67	65		79	54	73	69		10	9	15	11		.75	.80	.81	.79		3.0	4.0	4.3	3.8	
210	71	64	59	65		72	91	74	79		7	11	10	9		.83	.76	.83	.81		4.9	3.2	4.9	4.3	
Mean	65	56	58		NS**	65	68	68		NS	8	11	11		NS	.80	.80	.81		NS	4.3	4.2	4.4		NS
(N) LSD				9					19					NS					NS					NS	
(IxN) LSD				12					NS					NS					NS					NS	
November 1991																									
70	54	77	60	64		82	112	71	88		11	9	16	12		.76	77	.67	.73		3.2	3.3	2.0	2.8	
140	78	73	89	80		115	64	99	93		11	19	16	15		.68	.72	.79	.73		2.1	2.6	3.8	2.8	
210	65	85	62	71		117	148	92	119		7	18	21	15		.81	.72	.68	.74		4.4	2.6	2.1	3.0	
Mean	66	78	70		NS	105	108	87		11	10	15	18		NS	.75	.74	.71		NS	3.2	2.8	2.6		NS
(N) LSD				NS					17					NS					NS					NS	
(IxN) (LSD)				NS					29					8					.13					NS	

* LSD at 0.05 level.
** NS = No significant.

Table 2. Growth characters of *Acacia cyclops* as affected by irrigation interval and N level in 1992

Irrigation Interval (I), day / N level (N), Kg/ha	Plant height (cm)					Foliage diameter (cm)					No. branches/plant					Leaf/plant, ratio					Leaf/stem, ratio				
	10	20	30	Mean	(I)LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD
July 1992																									
70	45	61	74	63		28	29	62	40		6	6	8	7		.71	.76	.75	.74		2.4	3.2	3.3	3.0	
140	124	77	48	83		85	72	42	66		13	13	7	11		.73	.81	.80	.78		2,7	4.3	4.0	3.7	
210	81	67	63	70		60	5	53	53		11	5	8	8		.77	.74	.73	.75		3.3	2.8	2.7	2.9	
Mean	76	68	62		11	58	49	52		5	10	8	8		NS	.74	.77	.76		NS	2.8	3.4	3.3		NS
(N) LSD					11					NS					NS					NS					NS
(IxN) LSD					19					NS					NS					NS					NS
November 1992																									
70	36	69	74	60		23	84	80	62		5	6	13	8		.75	.77	.76	.76		3.0	3.3	3.2	3.2	
140	53	60	60	58		61	84	74	73		7	10	11	9		.78	.76	.80	.78		3.5	3.2	4.0	3.6	
210	75	66	96	79		86	104	154	115		9	9	16	11		.83	.82	.73	.79		4.9	4.6	2.7	4.1	
Mean	55	65	77		6	57	91	103		17	7	8	13		2.4	.79	.78	.76		NS	3.8	3.7	3.3		NS
(N) LSD					8					14					1.4					NS					NS
(IxN) (LSD)					13					25					NS					.05					.65

Table 3. Growth characters of *Acacia cyclops* as affected by irrigation interval and N level in 1993

Irrigation Interval (I), day / N level (N), Kg/ha	Plant height (cm)					Foliage diameter (cm)					No. branches/plant					Leaf/plant, ratio					Leaf/stem, ratio				
	10	20	30	Mean	(I)LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD	10	20	30	Mean	LSD
March 1993																									
70	34	59	70	54		106	109	92	102		37	44	37	39		.75	.73	.77	.75		3.0	2.7	3.3	3.0	
140	71	65	68	68		50	93	84	76		16	59	37	37		.73	.77	.72	.74		2.7	3.3	2.6	2.9	
210	78	79	76	78		106	142	94	114		51	83	49	61		.79	.74	.73	.75		3.8	2.8	2.8	3.1	
Mean	61	68	71		4	87	115	90		9	35	62	41		12	.76	.75	.74		NS	3.2	2.9	2.9		NS
(N) LSD				5					13					9					NS					NS	
(IxN) LSD				9					21					17					.03					NS	

Data presented in Table 4 indicate that the individual fresh and dry weights significantly varied with irrigation interval and N application in November 1991. In March 1993, only N addition had significant effects on these two characters, Irrigating *Acacia cyclops* evey 20 days and adding 210 Kg N/ha resulted in superior individual plant fresh and dry yields (4.129 and 1.486 Kg/plant in November 1991 and 1.302 and 0.610 Kg/plant in March 1993, respectively).

The reduced biomass weight in 1993 may be attributed to cutting all foliage branches in November 1991 and/or increased accumulation of salts during the second and third year. Higher levels of N application in the form of ammonium sulfate encouraged plant survival. Growth increased not only due to the role of nitrogen but also to sulfate effects, which plays an important role in salinity reduction (Abou-Deya and Nassar 1994).

Eventually, under harsh environment, lands should be utilized for supplying animals by green fodder, particularly during seasons of lack as well as controlling erosion. Detecting suitable arboreal shrub, having high adaptability to the available local facilities is necessary for desert plantation. *Acacia cyclops* is considered one of these shrubs. It grews vigorously under severe conditions.

In conclution the highest green and dry fodder yields were obtained by adding 210 kg N/ha, in the form of ammonium sulfate, and irrigating every 20 day interval (after full establishment) under South Sinai conditions.

Table 4. Fresh and dry plant weight as affected by irrigation interval and N level in 1991 and 1993

Irrigation Interval (I), day / N level (N), Kg/ha	Fresh weight (Kg/plant)					Dry weight (Kg/plant)				
	10	20	30	Mean	(I)LSD	10	20	30	Mean	LSD
	November 1991									
70	.400	1.729	1.329	1.153		.129	.600	.386	.37	
140	.685	1.971	1.257	1.304		.271	.643	.443	.45	
210	1.186	4.129	.857	2.057		.414	1.486	.343	.75	
Mean	.757	2.610	1.15		.346	.271	.910	.391		.132
(N) LSD				.231					.110	
(IxN) LSD				0.811					.262	
	March 1993									
70	.541	.274	.817	.544		.132	.135	.301	.189	
140	.569	.309	.606	.495		.233	.143	.291	.222	
210	.580	1.303	.887	.923		.267	.610	.266	.381	
Mean	.563	.628	.770		NS	.211	.296	.286		NS
(N) LSD				.361					.173	
(IxN) (LSD)				NS					NS	

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دراسة تأثير الإجهاد المائي والتسميد الآزوتي على نبات *Acacia cyclops* تحت ظروف الملوحة

إبراهيم بيومي أبو دية

قسم المراعي - مركز بحوث الصحراء - القاهرة - مصر

أجريت تجربة لدراسة تأثير ثلاثة فترات للري (١٠ ، ٢٠ و٣٠ يوم بين الريات) ، وثلاثة معدلات من التسميد الآزوتي (٧٠ ، ١٤٠ و٢١٠ كجم/ هكتار) على نباتات *Acacia cyclops* المنزرعة بمحطة بحوث رأس سدر - ٦٥ كم جنوب السويس بسيناء- التابعة لمركز بحوث الصحراء بمصر ، خلال أعوام ١٩٩١ ، ١٩٩٢ و١٩٩٣م ، وقد بلغ تركيز الأملاح في مياه الآبار المستخدمة في الري ، وفي أرض التجربة ٨ ,٦ و ٧ ,٩ ميللموز/ سم^{3} على التوالي . وقد أفادت نتائج التجربة أن الري كل ١٠ أيام في المراحل الأولى من حياة النبات أدت إلى زيادة في وزن النبات الغض ، ولكن مع تقدم النباتات في العمر (أكثر من ٢ سنة) فان زيادة فترار الري إلى ٢٠ يوم أدت إلى زيادة في وزن النبات الجاف . كما أن زيادة تراكم الأملاح بالتربة نتيجة لإستخدام مياه مالحة في الري لفترات طويلة أدى إلى تعويق النمو السريع للنباتات . وعند اضافة ٢١٠ كجم نيتروجين/ هكتار في صورة سلفات أمونيوم فانه تحدث زيادة في وزن النبات الغض والجاف ، وأرتفاع النبات ، وقطر المجموع الخضري للشجيرات .