Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

EFFECT OF SALINITY AND NITROGEN BIO-FERTILIZATION ON SOME SUDAN GRASS (*SORGHUM SUDANENSE* (L.) MOENCH) VARIETIES AT RAS SUDR

[50]

Abd El-Rahman[1], S.M.; K.A. El Shouny[2]; M.A. Ashoub[2]; M.A. Abd El-Gawad[1] and M.Sh. Abd El-Maaboud[1]

ABSTRACT

This study was carried out at Ras Sudr Experimental Station, South Sinai during 2001 and 2002 seasons. Four sudan grass varieties (Giza2, Piper, Hybrid102 and Is3214) were tested under five nitrogen fertilizer (Mineral and biofertilizer) treatments under two levels of irrigation water salinity (3700 and 9200 ppm). Growth characters i.e. plant height, number of tillers/plant, stem diameter, number of leaves/plant, leaf area, leaves/stem ratio, and forage yield (fresh and dry weight of stem+sheaths and fresh and dry weight of forage yield) were recorded. In addition, carbohydrates, protein, fibers and ash percentages (in leaves and stems) and proline in leaves were determined. Results demonstrate that the Piper variety had the highest value of forage yield compared with the other varieties. The recommended dose of mineral nitrogen fertilizer gave the highest values followed by mixture of biofertilizers (*Azospirillum* plus *Azotobacter*) under the two salinity levels of irrigation water at both cuts (the first one was harvested after 65 days from sowing date and the second was obtained at the same time interval). Moreover there was a significant decrease in all growth characteristics and the yield of four sudan grass varieties by increasing the level of irrigation water salinity from 3700 to 9200 ppm except proline in leaves which significantly increased by increasing the level of salinity

Key words: Sorghum, (*Sorghum sudanense*), Salinity of irrigation water, Biofertilizers.

INTRODUCTION

Forage sudan grass (*Sorghum sudanense* (L.) Moench) is considered as one of the most important fodder crops in many countries of the world due to its high fodder yielding potential and good better quality. Sudan grass has excellent growing habit, quick growing regrowth after first cut and better palatability, digestibility, ratoonability and various forms of its utilization like green chop,

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

silage and hay **(Karwasra *et al* 1996 and Dahiya *et al* 1997)**. In Egypt there is a great shortage in green forage in summer that considered being one of the main problems for feeding animals. Sudan grass is among the moderate crops to salinity tolerance therefore, it is important to develop new varieties, which are capable to grow under elevated salt levels in the soil and/or irrigation water **(Francois *et al* 1984)**. Teosinte, Maize and Sudan grass are important forage crops which are grown extensively in salt affected semi-arid regions**.** Moreover sudan grass was comparatively more salt tolerant than Maize and Teosinte as far as various morpho-physiological characteristics are concerned **(Kumar *et al* 1991 and Datta *et al* 1996)**.

The soil and ground water salinity generally co-exist and have become a colossal agro-ecological problem associated with declining crop yield as reported by **Hassan (1994) and Nassar *et al* (2000).** Nitrogen fertilizers play an important role in increasing forage production of sudan grass with better nutritive value **(Patel & Rajagopal 2003 and Ramesh & Sammi 2004)**. The cost of nitrogenous fertilizers is very high; hence, it becomes imperative to substitute nitrogen by some other cheaper sources, such as *Azospirillum* and/or *Azotobacter* which promote root growth and nitrogen fixation in soil, which may partially meet the nitrogen requirement of the crop **(Patel *et al* 1992; Desale *et al* 1999 and Patidar & Mali 2004). Subba Rao *et al* (1979)** demonstrated that application of *Azospirillum* and/or *Azotobacter* promoted root growth and more nitrogen fixation in soil, which help in increasing, fodder yield.

The main objective of the present investigation was to study the effect of nitrogen fertilizer (mineral and biofertilizer) treatments on yield and growth of sudan grass under high salinity conditions.

MATERIAL AND METHODS

This study was carried out at Ras Sudr Experimental Station, South Sinai during 2001 and 2002 seasons. Four sudan grass varieties namely; Giza2, Piper, Hybrid102 and Is3214 were chosen for the present study. Grains of the four varieties were provided by the Forage Research Division, Field Crops Research Institute of Agricultural Research Center, Ministry of Agriculture and Land Reclamation, Egypt. Efficient strains of *Azotobacter chroococcum* (AC), and *Azospirillum brasilense* (AB) were supplied by Microbiology unit, Desert Research Center, Egypt. The preceding winter crop was wheat. Sudan grass grains were sown on May 5th at the two seasons. Experimental plot was four ridges, 3 meters long and 50cm width. The size of each plot was 6m^2; the distance between hills was 15cm on one side of the ridges. Split-split plot design

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

with five replications was used. Irrigation water levels of salinity (3700 and 9200 ppm) occupied the main plots and nitrogen fertilizer the sub-plots, whereas, the four sudan grass varieties occupied the sub-sub plots. Mineral nitrogen fertilizer treatments were applied as:

a- Recommended rate; 60 kg N/fed. as ammonium nitrate 33.5 % N added in two equal doses. The first one was applied after 20 and 50 days (half-and-half) and the second was applied after the first cut.
b- Without (control).
c- *Azotobacter chrococcum* (AC), rate of application five liters/fed.
d- *Azospirillum brasilense* (AB), rate of application five liters/fed.
e- Mixture of (AC) and (AB), rate of application five liters/fed.

Two cuts were taken every season, the first one was harvested after 65 days from sowing date and the second was obtained at the same time interval**.** Phosphorus fertilizer as calcium super-phosphate (15.5%) was added at a rate of 100 kg/fed. as a basal application during soil preparation and the other cultural practices were applied as recommended for growing sorghum in the area.

Mechanical and chemical properties of the soil are shown in Table (1) and chemical analysis of irrigation water at the two seasons is shown in Table (2).

Table 1. Mechanical and chemical properties of experimental soil at Ras Sudr in 2001 and 2002 growing seasons.

Season	Physical analysis			
	Particle size distribution %			Class texture
	Sand	Silt	Clay	
2001	58.41	20.23	21.36	Sandy loam
2002	62.34	17.15	20.51	Sandy loam

Season	Chemical analysis										
	Cations (mg/L)						Anions (mg/L)				
	Ph	Ec (ppm)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO3^{-}$	$Hco3^{-}$	Cl^{-}	$SO4^{-}$	$CaCO3^{-}$
2001	7.84	5510	19.01	47.31	18.32	0.67	-	6.51	51.03	27.47	49.37
2002	7.72	5700	21.13	48.92	20.19	0.69	-	8.04	49.5	31.19	52.94

Table 2. Chemical analysis of irrigation water at Ras Sudr in 2001 and 2002 growing seasons

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

Season	Cations (mg/l)						Anions (mg/l)			
	Ph	Ec (ppm)	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO3^{-}$	$Hco3^{-}$	Cl^{-}	$SO4^{-}$
2001	8.56	3700	40	75	33	0.28	-	8.0	65.51	74.01
2002	8.35	9.200	35	70	37.4	0.31	-	9.5	62.02	71.21

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

Free proline in the leaves were determined according to the method described by **Bates *et al* (1973).** Total carbohydrate were determined in leaves and stems at first and second cuts according to the method described by **Smith *et al* (1964).** Total nitrogen was determined in leaves and stems as dry matter by using the modified mico-kieldahl method as described by **Peach and Tracey (1956).** Protein content was calculated by multiplying the total nitrogen by 6.25. Crude fibers and ash contents were determined in leaves and stems according to the method described by **(A.O.A.C. 1990).** At cut, ten guarded plants were taken randomly from each plot of the five replicates to determine the growth characteristics at the two cutting stages. Combined analysis of the two growing seasons data was carried out according to procedure outlined by **Steel and Torrie (1980).** Duncan's multiple range test, **(Duncan, 1955)** was used to verify the significance of mean performance for all traits recorded.

RESULTS AND DISCUSSION

1. Effect of irrigation water salinity and nitrogen fertilizers on some growth characters and forage yield

Results given in Table (3) show that generally increasing salinity level of irrigation water from 3700 to 9200 ppm significantly decreased all of the growth characters of the four sudan grass varieties at the two cuts. Reduced growth levels under salinity conditions may be due to the water deficit as a result of water and osmotic potentials in the growth medium or to water and ionic disequilibrium in the aerial parts of the plant. Moreover, high concentration of salts may reduce the absorption capacity of roots. In this respect **Kramer (1969)** demonstrated that high concentration of salt cause a decrease in the permeability of roots to water, and hence a decrease in the rate of its entry into the plant. **Kaoud and El-Fieshawy (1990)** indicated that the N, P, Ca^{++} and K^{+} concentrations were decreased while Na^{+} and Mg^{++} increased with increasing salt levels.

The interaction effect among salinity of irrigation water and nitrogen fertilizers on some growth characteristics of the four sudan grass varieties indicated that adding the recommended dose of mineral nitrogen fertilizer increased significantly plant height, fresh and dry weight of stem+sheaths/plant and leaves/stem ratio of Piper variety at the two cuts under 3700ppm. On the other hand, the lowest mean values of plant height, was for Is3214 followed by Hybrid102 under treatment without nitrogen fertilization when irrigated with saline water 9200ppm. Such trends were cited by **Hassan (1994) and Karwasra and Dahiya (1997)**. Regarding, number of tillers per plant, Is3214 variety showed the highest mean values at the recommended dose of mineral nitrogen

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

fertilizer followed by the mixture of biofertilizers with salinity of irrigation water 3700ppm at first and second cut. Meantime, there were no significant differences between the four sudan grass varieties at recommended dose of mineral nitrogen fertilizer with saline water 9200ppm. These results could be attributed to the effect of high concentration of salts which caused an osmotic pressure that inhibited soluble nitrogen absorption and consequently prevent the stimulating effect of nitrogen on plant growth. Similar results were obtained by **Ramamurthy (2002); Patel & Rajagopal (2003) and Ramesh & Sammi (2004)**. Concerning, stem diameter, results in Table (3) indicate that the highest mean values were obtained for Is3214 at the recommended dose of mineral nitrogen fertilizer followed by *Azospirillum* and mixture of biofertilizers at 3700ppm of irrigated water. On the other hand, Piper and Giza2 varieties had the higher stem diameter values at the recommended dose of mineral nitrogen fertilizer at salinity of irrigation water 9200ppm. Data presented in Table (3) show also that, *Azospirillum brasilense* (AB) strain was more effective and suitable strain for inoculation to the four sudan grass varieties as compared with *Azotobacter chroococcum* (AC) strain. Similar trends were obtained by **Hassan (1994); Rawat & Hazra (1998); Nassar *et al* (2000); Ramamurthy (2002) and Patidar and Mali (2004).**

Regarding number of leaves/plant, (Table 3) results show that Piper variety had the highest values of number of leaves at the recommended dose of mineral nitrogen fertilizer and mixture of biofertilizers with salinity of irrigation water 3700ppm at the two cuts. While, Hybrid102 variety recorded the highest values of number of leaves with applying the recommended nitrogen fertilizer at the first cut without significant differences. The lowest values were detected for Giza2 variety with salinity of irrigation water 3700ppm at the nitrogen control treatment at the two cuts. Piper variety took the same trend with adding recommended dose of mineral nitrogen fertilizer and mixture of biofertilizers under salinity of irrigation water 9200 ppm at the two cuts. Similar results were obtained by **Hassan (1994); Karwasra & Dahiya (1997) and Nassar *et al* (2000).**

Concerning leaf area, data presented in Table (3) show that the lowest values were detected for Hybrid102 variety under treatment without nitrogen fertilization with water salinity 9200ppm. On the other hand, the highest values were recorded by Is3214 variety with the recommended dose of mineral nitrogen fertilizer followed by mixture of biofertilizers at salinity of irrigation water 3700ppm in the two cuts. These results agree those obtained by **Saffa *et al* (1993) and Patidar & Mali (2004).** Hybrid102 and Is3214 varieties had the lowest values for fresh and dry weight of stem+sheaths under treatment without nitrogen fertilization when irrigated with saline water 3700ppm in the two cuts (Table 4). Meantime, the highest values were recorded by Piper variety with salinity of irrigation water 3700ppm at the recommended dose of mineral nitrogen fertilizer treatment followed by mixture of biofertilizers in the two cuts. On the other hand, the highest values were recorded by Piper variety when irrigated with saline water 9200ppm with adding recommended dose of mineral

nitrogen fertilizer followed by fertilizing with mixture of biofertilizers at the two cuts for fresh weight of stem+sheaths characters. Regarding dry weight of stem+sheaths, (Table 4) Piper variety fertilized with the recommended dose of mineral nitrogen fertilizer followed by mixture of biofertilizers had the highest values under salinity of irrigation water 9200ppm at the two cuts. Similar results were found by **Karwasra & Dahiya (1997) and Nassar *et al* (2000)**.

Mean-time Piper variety had the highest values of leaves/stem ratio under

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

Table 3. Effects of Salinity x N fertilizers x Varieties interaction on some growth characters of four Sudan grass varieties at Ras Sudr over two growing seasons (2001 and 2002).

Salinity of water irrigation	N	Varieties	Plant height (cm)		No. of tillers/plant		Stem diameter (mm)		No. of leaves/plant	
			1st cut	2nd cut	1st cut	1st cut	2nd cut	2nd cut	1st cut	2nd cut
	Recommend 60 kg N/fed.	Giza2	145.50 b	171.00 c	6.73 g	5.88 i	11.10 ab	11.91 ab	11.21 c	10.59 bc
		Piper	167.60 a	184.50 a	11.77 d	10.78 cd	10.25 bc	10.62 ef	13.66 a	12.54 a
		Hybrid 102	132.60 d	129.40 h	13.39 c	12.34 b	11.40 ab	11.98 ab	12.52 b	11.56 ab
		Is 3214	117.40 gh	139.80 f	16.58 a	13.66 a	11.77 a	12.12 a	11.42 c	10.61 bc
	Control (zero N)	Giza2	33.74 u	25.54 q	2.20 mn	1.83 lm	4.68 hi	4.41 pq	5.97 lm	5.78 lm
		Piper	32.04 u	25.31 q	2.18 mn	1.47 lm	4.45 ij	3.88 rs	6.52 jk	6.39 jk
		Hybrid 102	27.89 v	25.99 q	3.35 jk	2.40 l	4.89 hi	4.35 qr	6.40 jk	6.33 kl
		Is 3214	24.99vw	23.00 r	2.43 lm	1.1 no	5.35 hi	5.44 no	6.58 jk	6.50 ij
	Azotobacter	Giza2	110.20 i	128.10 h	4.11 ij	3.61 k	9.42 de	9.79 hi	9.12 fg	8.42 ef
		Piper	121.40 f	134.90 g	7.51 g	6.82 h	8.51 ef	9.05 jk	9.17 fg	8.58 ef
		Hybrid 102	105.50 j	111.70 j	8.72 f	7.48 gh	9.43 de	9.87 gh	9.95 de	9.52 cd
		Is 3214	101.30 k	109.90 j	9.74 e	8.16 fg	10.23 bc	10.81 de	9.01 fg	8.46 ef
	Azospirillum	Giza2	126.00 e	148.30 e	4.77 i	4.11 jk	10.41 bc	10.85 cd	9.50 fg	8.75 ef
		Piper	145.50 b	149.00 e	9.31 ef	8.52 f	9.34 de	9.67 ij	11.44 c	10.63 bc
		Hybrid 102	114.60 h	124.90 i	11.10 d	10.07 de	10.49 bc	11.01 bc	10.88 cd	10.20 cd
		Is 3214	107.40 ij	122.00 i	11.76 d	10.29 de	10.75 ab	11.13 ab	9.16 fg	8.52 ef
	Mixture	Giza2	138.50 c	166.00 d	5.75 h	4.91 j	10.62 ab	11.05 ab	10.61 cd	9.36 de
		Piper	164.40 a	176.90 b	10.77 d	9.85 e	9.68 cd	10.02 fg	13.56 a	12.40 a
		Hybrid 102	121.00 f	134.60 g	12.89 c	11.25 c	11.14 ab	11.49 ab	11.64 bc	10.65 bc
		Is 3214	118.20 fg	135.30 g	14.43 b	12.39 b	11.39 ab	11.87 ab	11.15 c	10.38 cd
Salinity of water irrigation 9200 ppm	Recommend 60 kg N/fed.	Giza2	65.52 m	47.19 m	3.36 jk	1.86 lm	6.53 g	6.71 m	8.32 gh	7.55 gh
		Piper	81.85 l	62.53 k	2.57 kl	1.95 lm	8.46 ef	8.93 kl	9.61 ef	8.94 e
		Hybrid 102	59.29 n	40.88 n	3.21 jk	2.24 lm	5.34 hi	5.56 no	8.07 hi	7.48 gh
		Is 3214	43.70 qr	36.73 o	3.66 jk	2.24 lm	4.64 ij	5.04 op	7.81 i	7.41 gh
	Control (zero N)	Giza2	23.34 w	14.82 t	1.43 qr	1.12 no	2.48 m	2.27 t	5.38 m	5.34 no
		Piper	25.92 vw	21.51 s	1.29 r	0.911 op	3.69 kl	3.67 s	5.56 m	5.47 no

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

Sudan grass yield at Ras Sudr

Azospirillum	Giza2	53.78 o	37.36 o	2.77 kl	1.90 lm	5.34 hi	5.83 mn	7.24 ij	6.67 ij
	Piper	64.70 m	50.43 l	2.06 no	1.40 mn	6.48 g	6.40 mn	8.34 gh	7.65 fg
	Hybrid 102	47.42 p	35.88 o	2.21 mn	1.57 lm	3.82 jk	4.11 qr	7.53 ij	6.90 ij
	Is 3214	37.29 t	29.82 p	1.84 no	1.19 no	3.64 kl	4.11 qr	6.32 kl	5.82 lm
Mixture	Giza2	62.52 mn	43.18 n	2.98 kl	2.26 lm	5.83 gh	6.32 mn	8.13 hi	7.43 gh
	Piper	81.14 l	61.79 k	2.37 lm	1.79 lm	7.79 f	8.24 l	9.16 fg	8.40 ef
	Hybrid 102	53.06 o	44.10 m	2.65 kl	1.86 lm	4.75 hi	5.09 op	8.18 hi	7.42 gh
	Is 3214	41.17 rs	34.53 o	2.07 no	1.68 lm	4.58 ij	4.94 op	7.24 ij	6.69 ij

Table 3. Cont.

Salinity of water irrigation	N	Varieties	Leaf area (cm^2)		Stem + sheaths Fresh weight (g/plant)		Stem + sheaths Dry weight (g/plant)		Leaves / stem ratio	
			1st cut	2nd cut	1st cut	1st cut	2nd cut	2nd cut	1st cut	2nd cut
3700 ppm	Recommend 60 kg N/fed.	Giza2	239.60 g	259.30 f	217.66 c	227.00 c	80.59 de	96.15 b	16.45 c	18.57 c
		Piper	269.40 e	276.60 e	243.80 a	256.80 a	97.50 a	108.6 a	20.64 a	23.51 a
		Hybrid 102	343.20 c	349.20 c	204.40 d	213.90 e	89.57 b	89.51 c	11.69 ef	13.52 f
		Is 3214	449.30 a	455.60 a	186.50 g	194.70 g	81.46 de	81.87 e	10.65 fg	11.54 g
	Control (zero N)	Giza2	81.28 u	75.38 r	53.14 x	48.33 t	20.44 qr	20.30	6.34 mn	6.49 kl
		Piper	73.08 w	63.38 u	47.28 y	42.47 u	21.19 qr	17.30 st	6.55 lm	6.55 kl
		Hybrid 102	64.57 y	60.15 v	39.45 z	34.83 v	16.95 st	13.98 tu	6.42 mn	5.60 no
		Is 3214	75.32 v	64.96 t	39.26 z	35.40 v	17.78 st	13.55 uv	5.96 no	5.71 mn
	Azotobacter	Giza2	170.6 l	175.60 k	166.30 j	169.70 i	61.84 i	69.21 gh	9.55 gh	10.53 h
		Piper	190.60 k	201.20 j	176.00 i	180.20 h	74.21 gh	76.76 f	12.42 e	14.63 e
		Hybrid 102	220.80 i	211.70 i	146.30 l	152.60 k	64.97 i	66.56 h	7.72 jk	8.64 j
		Is 3214	249.70 f	253.80 f	131.90 m	138.40 l	56.45 j	58.78 i	6.59 lm	6.70 k
	Azospirillum	Giza2	211.40 j	220.10 h	182.80 g	192.60 g	76.84 fg	81.41 e	11.52 ef	13.64 f
		Piper	222.00 i	227.10 h	199.10 e	223.10 d	82.87 cd	95.12 b	14.70 d	18.52 c
		Hybrid 102	270.00 e	275.80 e	160.60 k	168.90 i	71.58 h	71.63 g	8.77 hi	10.56 h
		Is 3214	327.70 d	331.90 d	146.80 l	160.50 j	64.14 i	67.35 h	8.65 ij	9.53 i
	Mixture	Giza2	232.90 h	243.70 g	205.20 d	220.90 d	82.35 cd	90.73 c	14.69 d	17.51 d
		Piper	254.50 f	253.20 f	230.70 b	250.10 b	89.21 b	95.6 b	18.67 b	22.54 b
		Hybrid 102	327.20 d	338.30 d	194.30 f	206.20 f	85.63 c	85.81 d	11.60 ef	13.49 f
		Is 3214	428.20 b	436.80 b	180.50 h	191.60 g	77.63 ef	79.67 ef	9.88 gh	11.52 g
Salinity of water irrigation 9200 ppm	Recommend 60 kg N/fed.	Giza2	122.70 p	113.2 op	101.20 p	77.64 o	42.18 l	31.54 kl	7.48 kl	6.56 kl
		Piper	131.70 n	130.7 lm	127.10 n	99.17 m	54.49 jk	40.81 j	8.72 hi	8.59 j
		Hybrid 102	119.30 q	105.4 p	82.51 r	67.05 p	32.35 no	28.59 lm	6.72 lm	6.42 kl
		Is 3214	147.90 m	138.0 l	74.36 t	57.96 r	29.68 op	25.00 op	6.49 lm	6.35 kl
	Control (zero N)	Giza2	62.49 y	59.04 vw	36.72 z	31.62 v	15.53 t	12.48 uv	4.69 rs	3.52 q

Sudan grass yield at Ras Sudr

	Piper	72.25 x	66.59 stu	44.22 y	33.18 v	17.30 st	13.73 tu	4.55 rs	3.59 q
	Hybrid 102	54.46 z	49.51 w	32.99 z	27.16 w	11.59 u	11.24 uv	4.42 st	3.08 qr
	Is 3214	57.98 z	52.31 w	30.89 z	24.39 w	11.80 u	10.63 v	3.93 t	2.63 r
Azotobacter	Giza2	79.18 v	71.84 rst	70.66 u	53.65 s	30.48 no	20.91 qr	4.85 qr	4.54 p
	Piper	86.03 u	80.36 r	91.15 q	63.08 q	32.62 no	25.63 no	5.51 op	4.63 p
	Hybrid 102	74.85 w	69.00 stu	48.57 y	35.17 v	19.68 qr	14.84 tu	4.63 rs	3.72 q
	Is 3214	101.30 t	92.19 q	44.49 y	35.33 v	18.55 rs	14.71 tu	4.50 st	3.59 q
Azospirillum	Giza2	100.40 t	90.84 q	79.66 r	67.32 p	34.42 mn	27.70 mn	5.80 no	5.56 o
	Piper	111.00 s	105.7 p	103.10 p	78.09 o	43.42 l	34.11 k	6.54 lm	6.18 kl
	Hybrid 102	85.53 u	77.46 rs	61.03 w	46.75 t	22.56 qr	19.91 rs	5.35 pq	4.70 p
	Is 3214	116.70 r	106.3 p	55.21 x	45.54 t	23.41 q	19.38 rs	5.52 op	4.54 p
Mixture	Giza2	113.90 r	108.2 p	94.10 q	74.30 o	36.68 m	30.80 kl	6.99 lm	6.60 k
	Piper	127.70 o	119.8 no	121.90 o	92.03 n	52.14 k	38.22 j	8.53 ij	8.13 j
	Hybrid 102	103.50 t	94.16 q	76.68 s	62.84 q	27.73 p	22.22 pq	6.64 lm	5.74 lm
	Is 3214	135.50 n	127.3 mn	68.43 v	55.34 r	29.38 op	24.22 op	6.35 mn	5.61 no

Table 4. Effects of Salinity x N fertilizers x Varieties interaction on yield, carbohydrate percentage of four sudan grass varieties at Ras Sudr over 2001 and 2002 growing seasons.

Salinity of water irrigation	N	Varieties	Fresh forage yield kg/fed.		Dry forage yield kg/fed.		Carbohydrate in stems (%)		Carbohydrate in leaves (%)	
			1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
3700 ppm	Recommend 60 kg N/fed.	Giza2	5367 b	6053 b	2003 b	2056 b	36.73 bc	35.69 cd	40.83 gh	36.58 de
		Piper	5694 a	6594 a	2109 a	2309 a	41.01 a	40.36 a	46.75 a	41.63 b
		Hybrid 102	3380 d	5060 c	1340 e	1654 c	37.92 b	37.31 bc	47.52 a	43.47 a
		Is 3214	3303 d	4373 d	1181 fg	1415 de	36.44 bc	35.10 de	41.80 ef	39.59 c
	Control (zero N)	Giza2	341.9 no	291.1pq	133.2 q	110.2 kl	28.75 pq	27.63 st	34.98 no	31.45 kl
		Piper	525.3mn	521.5mn	200.4pq	192.5 kl	33.74 ef	32.73 ij	36.19 m	32.41 jk
		Hybrid 102	333.4 no	423.4 no	124.8 qr	156.6 kl	29.94 no	28.90 qr	33.46 pq	28.49 no
		Is 3214	326.1 no	397.4 op	115.8 qr	132.7 kl	28.80 pq	27.70 rs	37.50 l	34.59 fg
	Azotobacter	Giza2	1244 hi	2561 h	422.2mn	995.4gh	31.98 ij	31.17mn	37.59 kl	32.53 jk
		Piper	1557 fg	2621 g	571.0 jk	1085 fg	36.28 bc	35.24 cd	41.35 fg	34.60 fg
		Hybrid 102	1205 hi	2354 hi	465.8lm	878.3 hi	34.02 ef	33.22 hi	42.11 ef	34.93 fg
		Is 3214	1317 gh	2533 hi	495.5 kl	923.7 hi	33.24 fg	32.40 jk	38.38 jk	33.41 hi
	Azospirillum	Giza2	3324 d	3310 f	1212 fg	1218 ef	33.88 ef	32.95 ij	39.05 ij	33.79 gh
		Piper	3467 d	4392 d	1279 ef	1495 de	37.87 b	36.85 cd	43.11 cd	35.53 ef
		Hybrid 102	2170 e	3408 f	796.9 h	1214 ef	36.71 bc	36.12 cd	43.85 c	37.26 d
		Is 3214	2008 e	3217 f	752.7 hi	1271 ef	36.05 bc	35.20 cd	39.46 i	35.69 ef
	Mixture	Giza2	4663 c	5274 c	1604 d	1797 bc	36.49 bc	35.56 cd	40.58 h	35.56 ef
		Piper	5391 b	6216 b	1996 b	2050 b	40.18 a	39.10 ab	45.80 b	40.03 c
		Hybrid 102	3209 d	4438 d	1206 fg	1558 cd	37.48 bc	36.57 cd	47.07 a	42.57 ab
		Is 3214	3227 d	4119 e	1150 g	1341 de	36.51 bc	35.53 cd	41.69 ef	39.35 c
Salinity of water irrigation 9200 ppm	Recommend 60 kg N/fed.	Giza2	1430fg	1843 j	589.8 jk	715.3 ij	33.83 ef	32.85 ij	34.79 no	29.73mn
		Piper	1714 f	2289 i	679.4 ij	916.7 hi	37.75 b	36.95 cd	39.55 i	32.54 jk
		Hybrid 102	1494 fg	1826 j	561.6 kl	692.4 j	35.03 de	34.20 fg	42.66 de	35.44 ef
		Is 3214	978.5 ij	1058 k	348.6 no	392.3 k	34.04 ef	33.38 hi	35.70mn	29.42 no

Sudan grass yield at Ras Sudr

Control (zero N)	Giza2	104.3 o	94.50 q	40.53 s	38.1 l	26.88 rs	25.71 uv	30.71 u	24.72 rs
	Piper	124.8 o	109.9 q	55.79 rs	40.8 l	27.83 qr	26.93 tu	29.65 v	24.44 rs
	Hybrid 102	99.13 o	93.25 q	40.35 s	38.42 l	27.03 qr	25.90 uv	31.62 st	23.69 s
	Is 3214	96.99 o	97.77 q	42.46 s	39.5 l	25.85 s	24.90 v	30.99 tu	24.42 rs
Azotobacter	Giza2	497.6mn	603.8mn	173.5 po	235.8 kl	30.74 lm	29.70 op	31.48 tu	25.12 r
	Piper	632.3lm	693.5lm	234.0 op	260.0 kl	31.96 ij	31.24mn	32.51 qr	26.45 p
	Hybrid 102	405.0 no	478.6mn	144.4 qr	165.5 kl	30.09mn	29.24 pq	36.47 m	28.73 no
	Is 3214	334.1 no	345.9 op	117.9 qr	148.1 kl	29.82 op	28.87 qr	31.90 rs	25.24 qr
Azospirillum	Giza2	595.8lm	708.3lm	233.2 op	284.8 kl	31.18 kl	30.07 no	32.61 qr	26.48 p
	Piper	759.0 kl	869.0 kl	280.6 op	348.4 kl	35.67 cd	34.65 ef	33.76 p	28.76 no
	Hybrid 102	505.5mn	582.8mn	192.2 pq	222.2 kl	31.85 jk	31.15mn	38.57 ij	30.83 lm
	Is 3214	432.4 n	489.9mn	167.1 pq	177.7 kl	31.17 kl	30.29 no	33.41 pq	26.33 pq
Mixture	Giza2	880.3 kl	1071 k	321.7 no	405.7 k	32.75 gh	31.69 lm	34.14 op	28.36 o
	Piper	1430 fg	1950 j	575.5 jk	730.1 ij	37.10 bc	36.11 cd	37.75 kl	32.65 ij
	Hybrid 102	945.6 jk	923.5 kl	349.6 no	333.8 kl	34.73 de	33.96 gh	41.84 ef	35.72 ef
	Is 3214	748.3 kl	922.0 kl	286.2 op	348.0 kl	32.63 hi	32.00 kl	35.68mn	29.64mn

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

salinity of irrigation water of 3700ppm with the recommended dose of mineral nitrogen fertilizer followed by mixture of biofertilizers at the two cuts (Table 3). Whereas, the lowest values were recorded by Is3214 variety with using salinity of irrigation water 9200ppm under treatment without nitrogen fertilization. Similar results were obtained by **Hassan (1994)** and **Nassar *et al* (2000)**. Data in Table (4) demonstrated that the high values of fresh and dry weight of forage yield/fed., were recorded by Piper variety under salinity of irrigation water of 3700ppm at the recommended dose of mineral nitrogen fertilizer, followed by mixture of biofertilizers of the same variety at the two cuts. Meantime, Piper variety had the maximum mean values of fresh and dry weight of forage yield/fed., at the recommended dose of mineral nitrogen fertilizer followed by mixture of biofertilizers with adding saline water 9200ppm of the same variety at the two cuts. The minimum values of fresh and dry weight of forage yield/fed., were obtained by Is3214, Hybrid102, Giza2 and Piper varieties under treatment without nitrogen fertilization at salinity of irrigation water 9200ppm in both cuts. Such results confirm those of **Patel *et al* (1992); Barik *et al* (1998); Panwar *et al* (1999) and Kaoud & El-Fieshawy (1990),** who indicated that sorghum is a moderately salt tolerant plant. The N, P, Ca^{++} and K^{+} concentrations were decreased while Na^{+} and Mg^{++} increased with increasing salt levels.

2. Effect of irrigation water salinity and nitrogen fertilizers on some chemical components

The average values of total carbohydrates, protein, proline, fibers and ash percentages are shown in Tables (4 and 5). Data show that, high level of salinity (9200ppm) decreased the mean values of all these chemical contents except of proline percentage in leaves at first cut whereas, insignificant increase in such chemical components has been recorded by decreasing the level of salinity from (9200 to 3700 ppm). On the other hand, proline percentage in leaves increased by increasing the salinity of irrigation water from (3700 to 9200 ppm), similar results were mentioned by **Hassan (1994) and Nassar *et al* (2000)** who indicated that proline helps in osmoregulation and protects the cells against salinity stress**.** The highest mean values of total carbohydrates percentages in stem was found in Piper variety at the recommended dose of mineral nitrogen fertilizer followed by treatment mixture of biofertilizers on salinity of irrigation water (3700ppm). Hybrid102 had the highest mean values of total carbohydrates percentages in leaves with adding the recommended dose of mineral nitrogen fertilizer and mixture of biofertilizers at the two cuts and Piper variety at the recommended dose of mineral nitrogen fertilizer in the first cut. However Is3214 variety had the lowest significant values of total carbohydrates percentages in stems and leaves under

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

treatment without nitrogen fertilizer on salinity of irrigation water (9200ppm) in the both cuts, as shown in Table (4). These results are in harmony with those obtained by **Mustafa & Shaheen (1984); Abbas *et al* (1993); Hassan (1994); Nassar *et al* (2000) and Ram & Bhagwan (2003).**

Data in Table (5) show that the protein and fiber percentages in leaves and stems of the four sudan grass varieties significantly differed in there response to

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

Table 5. Effects of Salinity x N fertilizers x Varieties interaction on some chemical properties of four Sudan grass varieties at Ras Sudr over 2001 and 2002 growing seasons.

Salinity of water irrigation 3700 ppm	N	Varieties	Protein in leaves%	Protein in stems (%)	Fiber in leaves (%)		Proline in leaves (µm/g)		
			1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut	1st cut
	Recommend 60 kg N/fed.	Giza2	12.06 ab	12.41 ab	6.85 ab	7.09 ab	23.55 bc	22.72 bc	1.873 hi
		Piper	12.56 a	12.92 a	7.49 a	7.59 a	26.10 a	25.72 a	2.259 de
		Hybrid 102	11.30 bc	11.60 bc	6.38 bc	6.52 bc	22.42 cd	21.99 cd	1.126 mn
		Is 3214	10.21 d	10.51 d	6.44 bc	6.59 bc	20.67 de	20.34 de	1.224 lm
	Control (zero N)	Giza2	9.10 ef	9.44 ef	3.51 kl	3.64 op	16.80 mn	16.72 lm	0.428 r
		Piper	8.20 gh	8.52 gh	3.77 kl	3.91 no	18.33 jk	17.99 jk	0.502 r
		Hybrid 102	7.30 ij	7.58 hi	3.01 op	3.10 rs	16.97 mn	16.61 mn	0.346 r
		Is 3214	6.27 mn	6.50 lm	3.42 mn	3.48 pq	15.11 op	14.64 op	0.350 r
	Azotobacter	Giza2	9.22 e	9.72de	5.20 fg	5.36 gh	18.93 hi	18.49 ij	0.793 p
		Piper	9.26 e	9.51 ef	5.46 ef	5.56 fg	20.30 fg	19.96 ef	1.118 mn
		Hybrid 102	8.30 fg	8.54 gh	4.53 hi	4.72 jk	19.39 fg	19.04 gh	0.559 qr
		Is 3214	7.34 hi	7.62 hi	4.46 ij	4.59 kl	17.91 kl	17.55 kl	0.763 pq
	Azospirillum	Giza2	10.21 d	10.55 d	6.15 cd	6.31 bc	20.08 fg	19.67 fg	1.138 m
		Piper	10.24 d	10.53 d	5.87 cd	6.01 de	21.08 de	20.75 de	1.385 kl
		Hybrid 102	9.29 e	9.49 ef	5.91 cd	6.02 de	20.93 de	20.60 de	0.878 no
					5.61		19.72	19.46	0.855

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

Sudan grass yield at Ras Sudr

		Hybrid 102	10.23 d	10.49 d	6.78 ab	6.87 ab	23.02 bc	22.66 bc	1.083 mn
		Is 3214	9.29 e	9.50 ef	6.51 bc	6.69 ab	20.62 de	20.28 de	0.996 mn
Salinity of water irrigation 9200 ppm	Recommend 60 kg N/fed.	Giza2	9.29 e	9.35 fg	6.42 bc	6.57 bc	20.61 de	20.21 de	2.790 c
		Piper	10.14 d	10.33 de	6.88 ab	6.99 ab	22.18 cd	21.74 cd	3.371 a
		Hybrid 102	8.17 gh	8.35 hi	5.18 fg	5.24 hi	20.92 de	20.61 de	2.619 c
		Is 3214	8.14 hi	8.39 hi	4.46 ij	4.51 lm	20.24 fg	19.87 ef	2.229 de
	Control (zero N)	Giza2	6.22 n	6.38 n	2.94 op	3.00 st	15.05 op	14.56 op	1.400 kl
		Piper	7.07 kl	7.31 kl	3.64 kl	3.84 no	16.98 mn	16.63 mn	1.463 kl
		Hybrid 102	4.16 p	4.34 p	2.27 pq	2.36 bc	16.26 no	15.94 no	1.210 lm
		Is 3214	4.04 p	4.26 p	1.96 q	2.05 u	14.38 p	13.93 p	1.080 mn
	Azotobacter	Giza2	6.30 mn	6.57 lm	3.96 jk	4.08 mn	17.61 lm	17.22 kl	1.612 jk
		Piper	7.15 jk	7.37 jk	4.36 ij	4.40 lm	20.09 fg	19.75 fg	1.798 hi
		Hybrid 102	5.21 o	5.45 o	3.09 no	3.16 qr	18.87 ij	18.99 gh	1.638 ij
		Is 3214	5.21 o	5.40 o	2.98 op	3.07 rs	17.93 kl	17.57 kl	1.460 kl
	Azospirillum	Giza2	7.20 jk	7.38 jk	4.42 ij	4.49 lm	19.12 gh	18.43 ij	1.983 gh
		Piper	8.21 gh	8.37 hi	4.92 gh	5.04 ij	20.35 ef	19.99 ef	2.392 d
		Hybrid 102	6.36 lm	6.58 lm	3.46 lm	3.56 op	19.88 fg	19.55 fg	1.999 fg
		Is 3214	6.23 n	6.43 mn	3.26 no	3.37 qr	19.07 gh	18.65 hi	1.808 hi
	Mixture	Giza2	8.08 hi	8.29 hi	5.59 de	5.69 ef	20.07 fg	19.71 fg	2.327 de
		Piper	9.17 ef	9.37 fg	6.33 bc	6.46 bc	21.27 de	20.97 de	3.045 b
		Hybrid 102	7.21 jk	7.45 ij	4.46 ij	4.57 kl	20.80 de	20.43 de	2.347 de

	Is 3214	7.12 jk	7.33 kl	4.09 jk	4.16 mn	20.04 fg	19.56 fg	2.124 ef

Table 5. Cont.

Salinity of water irrigation 3700 ppm	N	Varieties	Fiber in stems (%)		Ash in leaves (%)		Ash in stems (%)	
			1st cut	2nd cut	1st cut	2nd cut	1st cut	2nd cut
	Recommend 60 kg N/fed.	Giza2	27.98 de	27.62 bc	10.81 bc	11.37 bc	13.85bc	12.65 b
		Piper	30.96 a	30.42 a	12.32 a	12.78 a	15.27 a	14.09 a
		Hybrid 102	29.17 ab	28.43 ab	10.08 cd	10.55 de	13.05 d	11.64 cd
		Is 3214	27.72 ef	27.34 cd	8.45 f	8.85 f	11.35fg	10.32 ef
	Control (zero N)	Giza2	18.82 q	18.49 p	7.33 g	7.72 hi	9.74 ij	8.42 ij
		Piper	21.44 no	21.04mn	8.13 fg	8.57 fg	10.80gh	9.58 fg
		Hybrid 102	18.88 q	18.42 p	5.95 kl	6.42 lm	8.87 kl	7.37 kl
		Is 3214	19.45 pq	18.85 op	4.50 r	4.96 rs	7.47 no	6.24 no
	Azotobacter	Giza2	23.89 kl	23.41 jk	8.43 f	8.83 f	11.32fg	9.92 fg
		Piper	26.28 gh	25.83 ef	9.60 de	10.20 de	12.70de	11.15 de
		Hybrid 102	22.73 mn	22.25 lm	7.29 gh	7.81 gh	10.32hi	8.95 gh
		Is 3214	22.74 mn	22.35 kl	6.04 kl	6.51 lm	9.00 jk	7.95 jk
	Azospirillum	Giza2	25.84 hi	25.40 fg	9.45 e	9.92 e	11.91ef	10.43 ef
		Piper	28.52 cd	28.04 bc	10.07 cd	10.55 de	13.01d	11.61 cd
		Hybrid 102	26.35 gh	25.97 ef	8.13 fg	8.61 fg	11.12fg	9.62 fg
		Is 3214	25.29 ij	24.89 hi	6.96 ij	7.44 ij	9.94 i	8.63 hi
	Mixture	Giza2	27.69 ef	27.15 cd	10.42 cd	10.83 cd	13.22cd	11.81 bc
		Piper	30.65 ab	30.25 a	11.33 b	11.79 b	14.17 b	12.47 bc
		Hybrid 102	29.41 ab	28.48 ab	9.61 de	10.07 de	12.55de	11.20 de
		Is 3214	26.69 fg	26.20 de	8.08 fg	8.53 fg	11.03gh	9.68 fg

Sudan grass yield at Ras Sudr

Salinity of water irrigation 9200 ppm	Recommend 60 kg N/fed.	Giza2	26.10 gh	25.51 fg	7.21 hi	7.67 ij	8.91 kl	7.63 jk
		Piper	30.10 ab	29.65 ab	7.54 gh	8.03 fg	9.04 jk	8.07 ij
		Hybrid 102	29.99 ab	29.22 ab	6.78 ij	7.26 ij	8.27 kl	7.67 jk
		Is 3214	29.38 ab	28.03 bc	6.69 ij	7.14 ij	8.13 lm	7.19 kl
	Control (zero N)	Giza2	17.78 q	17.21 p	3.46 u	3.90 u	4.91 v	4.02 t
		Piper	18.67 hi	18.15 p	4.03 tu	4.44 tu	5.49 uv	4.55 st
		Hybrid 102	17.97 q	17.40 p	5.02 pq	5.46 pq	6.44 rs	5.44 pq
		Is 3214	17.88 q	17.18 p	4.42 st	4.84 st	5.81 tu	4.90 rs
	Azotobacter	Giza2	21.12 op	20.51 no	5.07 op	5.48 pq	6.48 rs	5.25 qr
		Piper	25.57 ij	25.05 hi	5.35 no	5.85 op	6.88 qr	5.65 pq
		Hybrid 102	24.76ij	24.27 hi	5.21 no	5.71 op	6.67 qr	5.69 pq
		Is 3214	23.23 lm	22.54 kl	4.77 qr	5.21 qr	6.21 st	5.26 qr
	Azospirillum	Giza2	24.31 jk	23.82 ij	5.88 lm	6.24 mn	7.26 po	6.13 op
		Piper	27.71 ef	27.20 cd	5.52 no	6.04 no	7.07 pq	6.07 op
		Hybrid 102	28.32 cd	27.82 bc	5.96 kl	6.38 lm	7.39 op	6.47 mn
		Is 3214	26.01 gh	25.41 fg	5.68 mn	6.11 mn	7.14 pq	6.18 op
	Mixture	Giza2	25.76 q	25.27 gh	6.86 ij	7.45 jk	8.47 kl	7.25 kl
		Piper	29.81 ab	29.24 ab	7.06 ij	7.50 ij	8.52 kl	7.30 kl
		Hybrid 102	29.66 ab	28.94 ab	6.44 jk	6.85 kl	7.83mn	6.83 lm
		Is 3214	28.71 bc	28.18 bc	6.49 jk	6.94 jk	7.88mn	7.23 kl

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

nitrogen form. Giza2 and Piper varieties fertilized with the recommended dose of mineral nitrogen gave the highest mean values of protein percentage in leaves and stems at the two cuts. Whereas, Piper and Hybrid102 varieties with mixture of biofertilizers had the highest mean values of protein percentage in leaves and stems at the second cut. On the other hand Hybrid102 and Is3214 varieties had the lowest mean values of protein percentage in leaves and stems under no nitrogen fertilization. Concerning fiber percentages, Piper variety gave the highest mean values of fiber percentages in leaves followed by Giza2 after treatment with the recommended dose of mineral nitrogen. Whereas, Piper and Hybrid102 with the mixture of biofertilizers recorded the highest mean values of fibers percentages in leaves under salinity of irrigation water (3700 ppm). On the other hand, Is3214 variety had the lowest mean values under the treatment without nitrogen fertilization at salinity of irrigation water (9200ppm). It is clear from results presented in Table (5) that Piper and Hybrid102 varieties gave the highest mean values of fibers percentages in stems with adding the recommended dose of mineral nitrogen followed by the mixture of biofertilizers treatment under salinity of irrigation water (3700ppm). While Giza2 and Is3214 varieties gave the lowest mean values of fiber percentages in stems under no nitrogen fertilization under saline water (9200 ppm). Similar results were obtained by **Panwar *et al* (1999); Parasuraman *et al* (2000) and Patidar & Mali (2004).**

Data in Table (5) show that Piper variety gave the highest mean values of ash percentages in leaves and stems followed by Giza2 on the recommended dose of mineral nitrogen fertilizer and Piper on the mixture of biofertilizers under saline water 3700ppm in the both cuts. Whereas, Giza2 had the lowest mean values of ash percentages in leaves and stems followed by Piper under treatment without nitrogen fertilization of irrigation water 9200ppm. **Patel *et al* (1975); Patel & Rajagopal (2003) and Ramesh & Sammi (2004)** demonstrated that chemical composition of leaves in addition to familiar dilution effects and ion competition revealed increased accumulation of Ca, Na, and Cl related to high level of P supply at high salinity conditions only.

REFERENCES

A.O.A.C., Association of Official Analytical Chemists, (1990). ***Methods of Analysis, 15th Ed., pp. 1045-1106.*** Washington D.C.,USA.

Abbas, M.T.; A. Rammah; M. Monib; E.H. Ghanem; M.A.M. Eid; M.F.Z. Emara and N.A. Hegazi (1993). ***International Symposium N2-Fixation*****,** ***pp. 485-487.*** Cairo. Univ. Press, Egypt.

Barik, A.K.; A.K. Mukherjee and B.K. Mandal (1998). Growth and yield of

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

sorghum (*Sorghum bicolor*) and groundnut (*Arachis hypogaea*) grown as sole and intercrops under different nitrogen regimes**.** ***Indian J. of Agron., 43(1): 27-32*****.**

Bates, L.S.; R.P. Waldren and I.D. Teare (1973). Rapid determination of free proline for water stress studies. ***Plant and Soil, 39: 205-207*****.**

Datta, K.S.; A. Kumar; S.K. Varma and R. Angrish (1996). Studies on salt tolerance of three tropical forage crops on the basis of mineral ion uptake**.** ***Forage Res., 22 (2&3): 129-138.***

Dahiya, O.S.; B.S. Dahiya; R.C. Punia and C. Ram (1997). Respiration rate as a measure of seedling establishment in forage sorghum (*Sorghum bicolor* (l.) Moench)**.** ***Forage Res.,23(3&4):149-152*****.**

Desale, J.S.; R.M. Babar; S.H. Pathan and R.L. Bhilare (1999). Effect of bio-fertilizers with various nitrogen levels on green forage yield of sorghum. ***Forage Res., 24 (4): 195-198*****.**

Duncan, D.B. (1955). Multiple range and multiple "F" tests. ***Biometrics, pp. 1-42*****.**

Francois, L.E.; T. Donovan and E.V. Maas. (1984). Salinity effects on seed yield, growth and germination of grain sorghum. ***Agron. J., 76: 742-754*****.**

Hassan, S.A. (1994). ***Studies on Some Sorghum Mutation Types Induced by Gamma-ray and Ethylamine Treatments under Stress Conditions.*** **pp. 22-23 & 53-59.** Ph.D. Thesis Moshtohor, Egypt.

Kaoud, E.E. and M.A.B. El-Fieshawy (1990). Influence of soil salinity on growth and mineral composition of sorghum (*sorghum bicolor,* L.)**.** ***Egypt. J. Appi. Sci., 5 (2): 256-271*****.**

Karwasra, R.S. and D.R. Dahiya (1997). Performance of forage sorghum (*Sorghum bicolor*) varieties under nitrogen fertilization. ***Forage Res., 23 (1&2): 121-123*****.**

Karwasra, R.S.; R.S. Kadian and D.R. Dahiya (1996). Effect of varieties and nitrogen on yield and yield attributes in forage sorghum**.** ***Forage Res., 22 (2&3): 203-206*****.**

Kramer, P.J. (1969). ***Plant and Soil Water Relationships: A Modern Synthesis. pp. 102-168.*** McGraw-Hill Book, Co., Inc., New York.

Kumar, A.; K.S. Datta; J. Gorham; R.G. Wyn Jones and P.A. Hollington (1991): Influence of salinity levels at two growing stages on the performance of three tropical forge crops. ***J. Indian Soc. Coastal Agric. Res., 9: 493-502*****.**

Mustafa, S.M.I. and N. Shaheen (1984). Physiological and physiochemical evaluations of four sorghum cultivars. ***J. Agric. Res. Tanta Univ., 10 (1): 1-11*****.**

Nassar, Z.M.; M.N. Nour El-Dein and A.A. El-Houssini (2000). Effect of moisture stress and presoaking with IAA on forage yield of *Sorghum bicolor* (L.) Moench grown in salt affected soils at Wadi-Sudr. ***Annals Agric. Sci., Ain Shams Univ., Cairo, 45 (1): 201-214*****.**

Panwar, V.S.; Tewatin, B.S. and Lodhi, G.P. (1999). Chemical composition and in vitro dry matter digestibility of some varieties of Sorghum fodder harvested at different stages. ***Forage Res., 24(4): 209-211*****.**

Parasuraman, P.; P. Duraisamy and A.K. Mani (2000). Effect of organic, inorganic and bio-fertilizers on soil fertility under double-cropping system in rainfed red soils. ***Indian J. of Agron., 45 (2): 242-247*****.**

Patel, P.M.; A. Wallace and E.F. Wallihan (1975). Influence of salinity and N-P fertility levels on mineral

content and growth of sorghum in sand culture. ***Agron. J., 67: 622-625.***

Patel, P.C.; J.R. Patel and A.C. Sadhu (1992). Response of forage sorghum (*Sorghum bicolor*) to biofertilizer and nitrogen levels**.** ***Indian J. Agron., 37 (3): 466-469.***

Patel, J.R. and S.J. Rajagopal (2003). Nitrogen management for production of sorghum (*Sorghum bicolor*) and cowpea (*Vigna unguiculata*) forage under intercropping system. ***Indian J. Agron., 48 (1): 43-37.***

Patidar, M. and A.L. Mali (2004). Effect of farmyard manure, fertility levels and boi-fertilizers on growth, yield and quality of sorghum (*Sorghum bicolor*). ***Indian J. Agron., 49 (2): 117-120.***

Peach, K. and M. V. Tracey (1956). ***Modern Methods of Plant Analysis. Vol. 1, pp. 13-19***, Springer Verlag Berlin.

Ramamurthy, V. (2002). Effect of nitrogen and *Azospirillum* inoculation on growth and green forage yield of *Pennisetum* trispecific hybrid**.** ***Indian J. Agron., 47 (4): 566-570.***

Ram, S.N. and Bhagwan Singh (2003). Physiological growth parameters, forage yield and nitrogen uptake of sorghum (*Sorghum bicolor*) as influenced with legume intercropping, harvesting time and nitrogen level. ***Indian J. Agron., 48 (1): 38-41.***

Ramesh, P. and K.R. Sammi (2004). Productivity and nutrient-use efficiency of soybean (*Glycin max*) and sorghum (*Sorghum bicolor*) intercropping at different levels of nitrogen in rainfed deep vertisols**.** ***Indian J. Agron., 49 (1): 31-33.***

Rawat, C.R. and C.R. Hazra (1998). Effect of nitrogen and *Azotobacter* on forage yield of oats**.** ***Forage Res., 23 (3&4): 241-243.***

Saffa, M. Ismaeil; Om Mohamed A. Khafagi and Samya M. Sohsah (1993). Effect of some seed hardening treatments on germination, growth and yield of Sudan grass grown under saline conditions. ***Desert Inst. Bull., 43 (2): 221-242.***

Smith, D.; G. M. Paulsen and C. A. Roguse (1964). Extraction of total available carbohydrates from grass and legume tissues. ***Plant Physiol., 39: 960-962.***

Steel, R. G. D. and J. H. Torrie (1980). ***Principles and Procedures of Statistics, 2nd Ed. 633 pp.,*** McGraw-Hill Book Co., Inc., New York.

Subba Rao, N.S.; K.V.R. Tilak and M.L. Kumari (1979). Effect of bio-fertilizers with various nitrogen levels on root growth and forage yield of sorghum. ***Curr. Sci., 48: 133-134.***

مجلة اتحاد الجامعات العربية للدراسات البحوث الزراعية جامعة عين شمس، القاهرة 13(3)، 755-769، 2005

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

تأثير ملوحة مياه الري على الإنتاجية لبعض أصناف حشيشة السودان (السورجم) بوادى سدر

]50[

سميحة محمد السيد[1] ، كامل عبد العزيز الشوني[2] ، محمود عبد الرحمن عشوب[2]
محسن شحاتة عبدالمعبود[1] ، محمود احمد عبد الجواد[1]
1- مركز بحوث الصحراء - المطرية - القاهرة - مصر
2- قسم المحاصيل - كلية الزراعة - جامعة عين شمس - شبرا الخيمة - القاهرة - مصر

أجري هذا البحث بمحطة بحوث راس سدر - جنوب سيناء خلال الموسمين 2000 و2001 لدراسة تأثير مستويين من ملوحة مياه الري (3700، 9200 جزء/مليون) وخمسة معاملات من التسميد النيتروجيني المعدني وثلاث مستويات من التسميد الحيوي (الأزوتوباكتر والأزوسبيريلوم وخليطهما) على النمو والمحصول الأخضر والجاف وبعض الصفات الكيميائية لثلاثة أصناف حشيشة السودان (السورجم).

وفيما يلي أهم النتائج المتحصل عليها

1- أظهرت النتائج أن هناك نقص معنوي في كل من صفات النمو الخضري والمحصول الغض والجاف لأصناف السورجم بزيادة تركيز الأملاح بمياه الري من 3700 إلى 9200 جزء/مليون.

2- تفوق صنف ... على باقي الأصناف في صفة المحصول الغض للعلف الأخضر وذلك بإضافة السماد النيتروجيني (60 كجم نيتروجين/فدان) مع التسميد الحيوي بخليط من الأزوتوباكتر ...

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)

Arab Univ. J. Agric. Sci., Ain Shams Univ., Cairo, 13(3), 755-769, 2005

تحكيم: أ.د. محمد رمضان عبد الله
أ.د. محمد عبد العزيز مرسي

1- Desert Research Center, Matariya, Cairo, Egypt
2- Department of Agronomy, Faculty of Agriculture, Ain Shams University, Shoubra El-Kheima, Cairo, Egypt.

(Received May 25, 2005)
(Accepted June 6, 2005)