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EFFECT OF WATER DEFICITS AND INTENSIVE CUTTINGS ON FORAGE PRODUCTIVITY OF *ATRIPLEX NUMMULARIA* LINDL AND ITS QUALITY

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SUMMARY

Atriplex shrubs are essential sources of animal feed, predominantly to dry and semi-dry areas. To overawed feeding shortages, particularly in the summer seasons when Savannah growth is imperfect or dormant. In order to study the effect of water defects, treatments i. e. 1.00, 0.50 and 0.25 ET at four levels of grazing i. e. intensities cutting in winter (CW 1) at the November, non-intensities cutting in winter (CW 2) at the November, intensities cutting in summer (CS 1) at the May and non-intensities cutting in summer (CS 2) at the May and their interaction on forage Atriplex productivity. Irrigation at 1.00 ET significantly shaped the highest plants, the highest fresh and dry forage yield/plant, fresh and dry forage yield/ha, percentages of protein, ether extract, crude protein and fiber yield (kg/ha), ether extract, ash, nitrogen free extract yield (kg/ha) as combined analysis. Irrigation at 0.50 ET significantly recorded the highest percentages of crude fiber. Whilst, irrigation at 0.50 ET created the lowest values of the deliberate restrictions. The highest plants were obtained from non-intensities cutting in summer (CS 2) at May and recorded the highest fresh and dry forage yield/plant, fresh and dry forage yield/ha, the highest values of water use efficiency, ether extract percentage, crude protein and fiber, ether extract, ash and free nitrogen extract yield/ha. Intensities cutting in winter (CW 1) at November formed the lowest standards of the studied parameters. It could be suggested that irrigation at 1.00 ET and cutting in summer (CS 2) at May significantly maximized Atriplex forages yield and its quality.

Key words : Intensities cuttings, irrigation at evaporation rates, dry matter forage yield and its quality, water use efficiency

Fodder shrubs are essential sources of animal feeding, particularly on dry and semi-dry area. This can alleviate the feed shortages or even fill up the feed gaps between the winter and especially in the summer period subsequently grassland growth is limited or dormant, due to unfavourable weather conditions. In Egypt, increase in human population has augmented request for meat, in turn producing a major upsurge in livestock numbers, particularly sheep's. There is no doubt that intensive grazing leads to the deterioration of rangeland production. The expansion of the undergrowth due to full or partial protection was portrayed (Correal *et al.*, 1990). Salinity effects on plants include ion toxicity, osmotic stress, mineral deficiencies, physiological and biochemical perturbations and combinations of these stresses (Munns, 2002). El-Hyatemy *et al.* (1993) described that *Atriplex nummularia* had the uppermost value of crude protein content (17.51%). Accumulative salinity has received more and more attention by research efforts which have been applied to gain a better understanding of the adaptive mechanisms in plants. In the worldwide, approximately 400 million hectares are affected by salinity (FAO, 2005). Atriplex species are excellent to feed livestock due to their high protein content, especially subsequently grasses are not available for grazing. Aganga *et al.* (2003) stated that *Atriplex nummularia* contained high concentrations of nitrogen (N) in winter as compared to summer. In this area and similar zone planting, distance (2 × 2 m) with triennial pruning and complete pruning had a maximum forage yield. Ortiz-Dorda *et al*. (2005) described that Atriplex was perennial shrubs that kept their foliage throughout the year and were commonly used for extending the grazing season because of their nutritional value and chemical composition. Karimi (2006) reported that fresh and dry mass, relative water content and water use efficiency of Atriplex increased in 100 to 200 mm NaCl salinity condition compared to the control, nevertheless they significantly decreased from high concentration of NaCl, especially in optimal fresh and dry mass. Similarly, conclusions were reported by Papanastasis *et al.* (2006), Ayad *et al.* (2010), Meneses *et al.* (2012) and Amouei (2013). Moreover, Mohebby *et al.* (2013) pointed out that grazing had no significant influence on stem height and leaf-stem index, but crown to cover, production, basal diameter, stem biomass, seed production per individual plant, root weight and diameter of the even aged *Atriplex canescens* were significantly greater than those of the un-grazing site. Fodder trees are indispensable sources of animal feed, predominantly on areas with dry to semi-dry Mediterranean weather. Abu-Zanata *et al.* (2004) found that cutting intensity had a significant effect on the amount of browse regrow after severing the shrubs. Cutting shrubs at 45 cm enhanced them regrow considerably (17.3%). Baghestani *et al.* (2006) indicated that the cutting level had significant effect then maximum effect was in the 60 cm height. The plant vulgarity was decreased, when cutting intensity increased. The 0 cm cutting height destroyed most of the plants in the field. Similarly, conclusions were reported by Baghestani *et al.* (2007) and Baghestani (2010). Therefore, the objectives of this exploration were aimed at re-vegetating Atriplex shrubs in the desert sand saline soils and to study the effect of intensive cuttings**,** water deficit besides their interaction on forage yield and water use efficiency.

MATERIALS AND METHODS

Agricultural Practices

Seeds of saltbush exposed to tap water fluent in 24 h to remove the accumulated salts from seed wings, these seeds were sown in plastic bags (8 x 12 x 25 cm) which filled previously with soil besides peat moss mixed in rate of 1 : 1. These bags were arranged in the greenhouse, then irrigated as needed. The healthy seedlings (30-40 cm height) were transplanted to the permanent site in holes of 50 x 50 cm^3 in size. The experimental area was divided into rows of 3 x 3 m apart in the 2013 season. Field experiments were conducted during 2014, 2015 and 2016 seasons. The experimental location lies at the Agriculture Experimental Station at Kalabsho and Zayan, north-west Dakahlia Governorate, 31.5? North and 32.31? East and certainly 3.5 km south from the international highway adjacent to the Mediterranean sea. The annual rainfalls are about 120 mm distributed as 80% in winter, 10% in autumn and 10% in the spring. The evaporation rate was about 182 mm in summer and 69 mm in the winter season. The irrigation water EC was 4.2 dS/m, pH was 7.77 and SO_4 was 0.98. Drip irrigation system was used for daily irrigation with water about 1500 mmhos/cm. Valves followed by a calibrated pressure gauge were fixed at each lateral inlet to control irrigation time for the nominal operating pressure in 1 bar. Emitters tube was a flat internal spiral path of a discharge of 4 l/h under 1 bar operating pressure. The daily atmospherics demand was measured using glass A-evaporation pan which was installed in the experimental site. After full establishment, three water irrigation levels equivalents of 0.25 ET, 0.50 ET and no irrigation as a control (ET=average daily evapotranspiration rate) were applied. ET estimated using the following relation (Doorenbos and Pruitt, 1977), where ET = $K_p \times E_{pan,}$ where E_{pan} = Pan evaporation in mm/day and represents the mean daily value of the period considered and K_p = Pan coefficient (0.7). Time of water was applied for each treatment calculated based on the following empirical equation where WD=0.3+0.12 q, Where, WD is wetting diameter in meter (0.5 m for each planting hole) and q is an emitter discharge in an l/h and time of water application (T_a) was calculated by dividing over the actual dropper discharge in this experiment (4 l/h). Cutting adult plants with 25 and 50 cm stub over ground surface will be starting to apply in the same later date. A strip plot design of four replicates was used, where the above two factors perpendicular randomly distributed among each replication. Four irrigation treatments i. e. 1.00, 0.25 and 0.50 ET were assigned in horizontal plots. Four cutting intensities in vertical plots, intensities cutting in winter (CW 1) at the November, non-intensities cutting in winter (CW 2) at the November, intensities cutting in summer (CS 1) at May and non-intensities cutting in summer (CS 2) at May.

Measured Characters

The following characters were determined for five samples of study character of 2014, 2015 and 2016 seasons. Plant height (cm), green and dry forage yield (kg/plant). Green and dry forage yield per hectare : Mean weight per square meter, then was transferred as yield t/ha. Water use efficiency was estimated = Y/W as mm of equivalent water depth per kg of yield, y is the green or dry yield and w is the equivalent water depth in mm. Nitrogen has determined colorimetrically in the acid digest using the method recommended by

Koch and McMeekin (1924). Then crude protein per cent calculated by multiplying total nitrogen per cent x 6.25 as described by Bolton and MCCarthy (1962). Moreover, crude protein in kg/ha was calculated by multiplying crude protein per cent x dry matter yield (kg/ha). Crude fiber was measured by the usual Weened method. Crude fiber in kg/ha was calculated by multiplying crude fiber per cent x dry matter yield in kg/ha. Ether extracts (EE) were determined by Soxhelt apparatus according to the method described by A. O. A. C. (2000). Ether extracts from kg/ha were calculated by multiplying ether extract percent x dry matter yield (kg/ha). Ash content was determined by weighing of five grams of dry matter burnt in the muffled furnace at 600°C for four hours, then ash per cent calculated. Ash in kg/ha was calculated by multiplying ash content x dry matter yield in kg/ha. Nitrogen free extracts were calculated by the formula = 100 – (crude protein per cent+crude fiber per cent+ ether extract per cent+ash per cent). Nitrogen free extract (yield/ha) was calculated by multiplying nitrogen free extract x dry matter yield (kg/ha).

Experimental Analysis

Data were subjected to statistical analysis and means to compare using LSD test for the 5 per cent level according to Gomez and Gomez (1991). A randomized complete block design by way of design by MSTAT-C computer packages developed by Russell (1986) was used for statistical using data onto calculated seasons. At the three seasons a combined analysis was statistically analyzed according to Waller and Duncan (1969).

RESULTS AND DISCUSSION

A. Irrigation Treatment Effects

The results accessible to Tables 1, 2, 3, 4 and 5 that irrigation treatments, intensive cutting significantly exaggerated plant height, fresh and dry forage yield/plant, fresh and dry forage yield/ha, water use efficiency, crude protein and fiber and ether extract percentages, crude protein and fiber, ash, ether extract and free nitrogen extract yields/ha. The results obviously revealed that irrigation at evaporation rate at 100 per cent ET significantly recorded the tallest plants (93.5 cm), the highest fresh and dry forage yield/ plant (1.643 and 0.651 kg/plant, respectively), fresh and dry forage yield/ha (2.260, 0.859 t/ha, respectively), water use efficiency (2.7), protein percentage (21.4%), ether extract percentage (11.50), crude protein yield (197.97 kg/ha), crude fiber yield (165.05 kg/ha), ether extract yield (13.82 kg/ha), ash yield (105.19 kg/ha) nitrogen free extract yield (443.76 kg/ha) as combined averages of two seasons. However, the results evidently indicated that irrigation at

TABLE 1

Means of plant height, fresh and dry forage yield/plant of *Atriplex nummularia* Lindl as affected by irrigation treatments and cutting types intensities during 2014-15 and 2015-16 seasons and combined of both the seasons

Treatment	Plant height (cm)			Fresh forage yield (kg/plant)			Dry forage yield (kg/plant)		
	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined
Irrigation treatments									
Irrigation at 1.00 ET	91.3	95.6	93.5	1.619	1.665	1.643	0.647	0.654	0.651
Irrigation at 0.25 ET	87.0	91.3	89.2	1.314	1.359	1.336	0.526	0.547	0.536
Irrigation at 0.50 ET	79.0	83.0	81.0	0.984	1.025	1.004	0.391	0.411	0.401
F-test	*	*	*	*	*	*	*	*	*
L. S. D. (P=0.05)	0.3	0.4	0.2	0.037	0.033	0.035	0.025	0.049	0.028
Cuttings types									
CW 1	77.3	81.5	79.4	1.166	1.214	1.190	0.492	0.488	0.490
CW 2	91.1	95.4	93.2	1.396	1.437	1.416	0.543	0.571	0.557
CS 1	81.5	86.0	83.8	1.249	1.294	1.271	0.499	0.519	0.509
CS 2	93.2	87.0	95.1	1.412	1.455	1.434	0.551	0.572	0.561
F-test	*	*	*	*	*	*	*	*	*
L. S. D. (P=0.05)	0.5	0.6	0.7	0.034	0.022	0.012	0.038	0.037	0.027
Interaction F-Test	NS	NS	NS	NS	NS	NS	NS	NS	NS

CW 1 =Intensities cutting in winter at November, CW 2=Non-intensities cutting in winter at November, CS 1=Intensities cutting in summer at May and CS 2=Non-intensities cutting in summer at May. NS–Not Significant.

TABLE 2

Means of fresh and dry forage yield and crude protein percentage of *Atriplex nummularia* Lindl as affected by irrigation treatments and cutting types intensities during 2014-15 and 2015-16 seasons and combined of both the seasons

Treatment	Fresh forage yield (t/ha)			Dry forage yield (t/ha)			Water use efficiency			Crude protein (%)		
	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined
Irrigation treatments												
Irrigation at 1.00 ET	2.176	2.343	2.260	0.889	0.960	0.859	2.8	2.7	2.7	20.6	22.2	21.4
Irrigation at 0.25 ET	1.769	1.935	1.852	0.697	0.770	0.733	2.4	2.5	2.4	20.4	22.2	21.3
Irrigation at 0.50 ET	1.290	1.934	1.374	0.530	0.679	0.604	1.6	1.7	1.6	20.2	22.0	21.2
F-Test	*	*	*	*	*	*	*	*	*	*	*	NS
L. S. D. (P=0.05)	0.150	0.390	0.260	0.0.66	0.099	0.042	0.3	0.4	0.4	0.2	0.2	-
Cuttings types												
CW 1	1.595	1.754	1.674	0.656	0.766	0.711	2.0	2.1	2.0	20.5	22.2	21.3
CW 2	1.844	2.020	1.932	0.729	0.840	0.785	2.3	2.3	2.3	20.6	22.2	21.4
CS 1	1.680	1.848	1.764	0.688	0.764	0.726	2.1	2.2	2.1	20.4	22.1	21.3
CS 2	1.861	2.027	1.944	0.745	0.842	0.793	2.3	2.4	2.3	20.4	22.1	21.2
F-test	*	*	*	*	*	*	*	*	*	NS	NS	NS
L. S. D. (P=0.05)	0.188	0.444	0.383	0.010	0.077	0.038	0.3	0.2	0.3	-	-	
Interaction F-test	*	*	*	*	*	*	NS	NS	NS	NS	NS	NS

CW 1=Intensities cutting in winter at November, CW 2=Non-intensities cutting in winter at November, CS 1=Intensities cutting in summer at May and CS 2=Non-intensities cutting in summer at May. NS–Not Significant.

TABLE 3

Means of crude fiber, ether extract and ash of *Atriplex nummularia* Lindl as affected by irrigation treatments and cutting types intensities during 2014-15 and 2015-16 seasons and combined of both the seasons

Treatment	Crude fiber (%)			Ash (%)			Ether extract (%)		
	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined
Irrigation treatments									
Irrigation at 1.00 ET	17.6	17.8	17.7	11.3	11.4	11.4	1.46	1.53	11.50
Irrigation at 0.25 ET	17.7	18.0	17.9	11.2	11.4	11.3	1.46	1.52	11.49
Irrigation at 0.50 ET	17.8	17.8	17.8	11.2	11.5	11.4	1.44	1.50	11.48
F-test	NS	*.	*	NS	NS	NS	*	*	*
L. S. D. (P=0.05)	-	0.2	0.1	-	-	-	0.02	0.02	0.02
Cuttings types									
CW 1	17.7	17.9	17.8	11.2	11.4	11.3	1.45	1.52	1.48
CW 2	17.7	18.0	17.8	11.3	11.5	11.4	1.45	1.52	1.49
CS 1	17.8	17.9	17.9	11.3	11.5	11.4	1.47	1.53	1.50
CS 2	17.8	18.0	17.9	11.2	11.5	11.3	1.47	1.53	1.50
F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS
L. S. D. (P=0.05)	-	-		-	-	-	-	-	-
Interaction F-test	NS	NS	NS	NS	NS	NS	NS	NS	NS

CW 1=Intensities cutting in winter at November, CW 2=Non-intensities cutting in winter at November, CS 1=Intensities cutting in summer at May, CS 2=Non-intensities cutting in summer at May. NS–Not Significant.

evaporation was rated at 0.50 ET significantly obtained the highest percentages of crude fiber (19.9). On the contrary, irrigation at evaporation rate of 0.50 ET recorded the aforementioned parameters of both the seasons, while the lowest percentages of crude fiber were produced from irrigation at evaporation rate of 1.00 ET.

B. Cutting Intensities Effects

The results from Tables 1, 2, 3, 4 and 5 clearly designated that cutting intensive treatments significantly affected plant height, fresh and dry forage yield/plant, fresh and dry forage yield/ha, crude protein and fiber, ether extract percentages, water use efficiency, crude protein and fiber, ash, ether extract and nitrogen free extract (yield/ha) during 2014-16 seasons. The outcomes clearly showed that tallest plants were obtained from non-intensities cutting in summer (CS 2) at May (95.1 cm), the highest fresh and dry forage yield/plant (1.434, 0.516 kg/plant, respectively), fresh and dry forage yield/ha (1.944 and

TABLE 4
Means of nitrogen free extract, crude protein and fiber yield of *Atriplex nummularia* Lindl as affected by irrigation treatments and cutting types intensities during 2014-15 and 2015-16 seasons and combined of both the seasons

Treatment	Free nitrogen extract (%)			Crude protein yield (kg/ha)			Crude fiber yield (kg/ha)		
	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined
Irrigation treatments									
Irrigation at 1.00 ET	48.9	46.7	47.9	182.97	212.97	197.97	157.32	172.82	165.05
Irrigation at 0.25 ET	49.0	46.8	48.0	142.48	170.98	156.72	123.48	138.64	131.06
Irrigation at 0.50 ET	49.1	46.9	48.0	108.21	150.26	129.24	94.05	122.44	108.17
F-test	NS	*	NS	**	**	**	**	**	**
L. S. D. (P=0.05)	-	0.1	-	2.45	1.64	0.92	1.03	1.38	0.67
Cuttings types									
CW 1	49.0	46.9	47.9	134.88	169.94	152.42	116.13	137.92	127.03
CW 2	48.9	46.9	47.8	150.79	186.55	168.67	129.24	151.34	140.30
CS 1	49.0	47.0	48.0	140.80	169.22	154.99	122.04	137.47	129.76
CS 2	49.2	46.8	48.0	151.77	186.57	169.17	132.36	151.58	141.98
F-test	NS	NS	NS	*	*	*	*	*	*
L. S. D. (P=0.05)	-	-	-	2.67	1.77	0.86	2.10	1.38	0.84
Interaction F-test	NS	NS	NS	*	*	*	*	*	*

CW 1=Intensities cutting in winter at November, CW 2=Non Intensities cutting in winter at November, CS 1=Intensities cutting in summer at May and CS 2=Non intensities cutting in summer at May. NS–Not Significant.

TABLE 5
Means of ether extract, ash, nitrogen free extract yield of *Atriplex nummularia* Lindl as affected by irrigation treatments and cutting types intensities during 2014-15 and 2015-16 seasons and combined of both the seasons

Treatment	Ether extract yield (kg/ha)			Ash yield (kg/ha)			Nitrogen free extract yield (kg/ha)		
	2014-15	2015-16	Combined	2014-15	2015-16	Combined	2014-15	2015-16	Combined
Irrigation treatments									
Irrigation at 1.00 ET	12.93	14.71	13.82	100.36	109.99	105.19	435.07	450.02	443.76
Irrigation at 0.25 ET	10.15	11.73	10.96	78.45	88.22	83.32	341.85	361.44	351.67
Irrigation at 0.50 ET	7.77	10.22	9.00	59.83	78.07	68.95	260.59	318.50	289.58
F-test	*	*	*	*	*	*	*	*	*
L. S. D. (P=0.05)	0.66	0.12	0.65	1.33	9.90	0.51	4.07	4.37	2.19
Cuttings types									
CW 1	9.53	11.66	10.61	74.08	87.74	80.93	321.60	358.87	340.25
CW 2	10.70	12.77	11.74	82.53	96.29	89.40	356.66	393.72	375.19
CS 1	10.11	11.64	10.87	77.81	87.55	82.68	338.04	357.05	348.75
CS 2	10.82	12.79	11.81	83.81	96.77	90.29	367.06	394.75	380.91
F-test	*	*	*	*	*	*	*	*	*
L. S. D. (P=0.05)	0.32	0.10	0.60	1.45	8.70	0.44	4.81	3.57	1.81
Interaction F-Test	NS	NS	NS	NS	NS	NS	NS	NS	NS

CW 1=Intensities cutting in winter at November, CW 2=Non-intensities cutting in winter at November, CS 1=Intensities cutting in summer at May and CS 2=Non-intensities cutting in summer at May. NS–Not Significant.

0.842 t/ha, respectively), the highest values of water use efficiency (2.3), ether extract percentage (1.50), crude protein yield (169.17 kg/ha), crude fiber yield (141.98 kg/ha), ether extract yield (11.81 kg/ha), ash yield (90.29 kg/ha) and nitrogen free extract yield (380.91 kg/ha) as combined of both the seasons. Nevertheless, intensities cuttings in winter (CW 1) at November recorded the altogether studied parameters.

C. Interaction Effects

With reference to the interaction effect of irrigation treatments and cutting intensities on fresh green and dry forage yield/ha, crude protein and fiber yield/ha, the outcomes presented in Tables 2 and 4 obviously showed a significant interaction on these traits during studied seasons and combined data. The results graphically illustrated with Figs. 1 and 2 clearly indicated that the highest fresh green and dry forage yield/ha (2.686 and 1.08 t/ha, respectively) due to the interaction between irrigation treatments and cutting intensities as combined analysis of 2014-15 and 2015-16 seasons. Whereas the lowest fresh green and dry forage yield in t/ha was produced from irrigation at evaporation rate of 0.50 ET and intensities cutting in winter (CW 1) at November. Regarding the interaction effect of irrigation treatments and cutting intensities on crude protein and fiber yield/ha, the results from Figs. 3 and 4 clearly illustrated that highest value of crude protein yield (229.17 kg/ha) and crude fiber yield (193.15 kg/ha) was produced from irrigation at evaporation rate at 0.50 ET and intensities cutting in winter (CW 1) at November. Whereas the lowest crude protein and crude fiber yield/ha was produced from irrigation at evaporation rate of 0.50 ET and intensities cutting in winter (CW 1) at November.

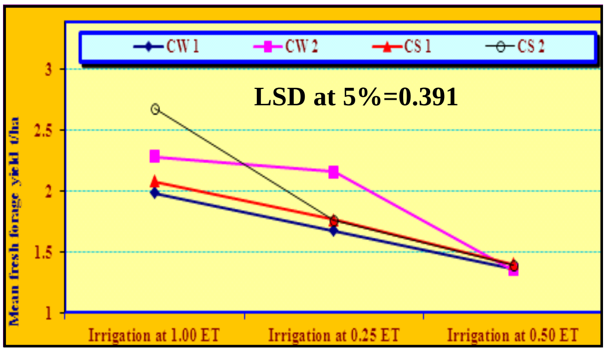

Fig. 1. Mean green forage yield (t/ha) of *Atriplex nummularia* Lindl as affected by the interaction between irrigation treatments and cutting intensities as combined analysis of 2014-15 and 2015-16 seasons.

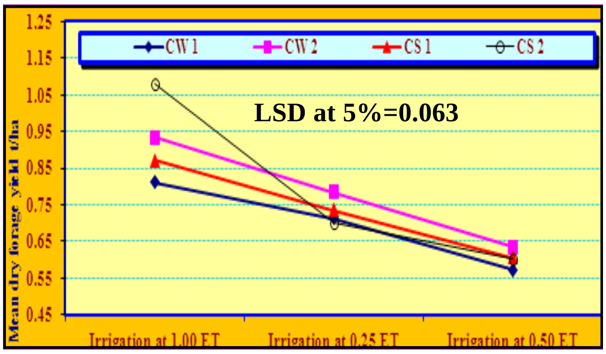

Fig. 2. Mean dry forage yield (t/ha) of *Atriplex nummularia* Lindl as affected by the interaction between irrigation treatments and cutting intensities as combined analysis of 2014-15 and 2015-16 seasons.

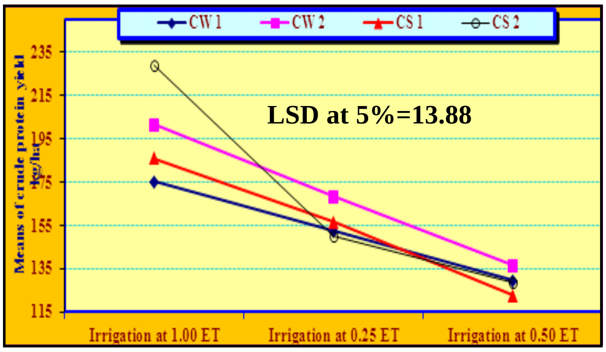

Fig. 3. Mean of crude protein yield (kg/ha) of *Atriplex nummularia* Lindl as affected by the interaction between irrigation treatments and cutting intensities as combined analysis of 2014-15 and 2015-16 seasons.

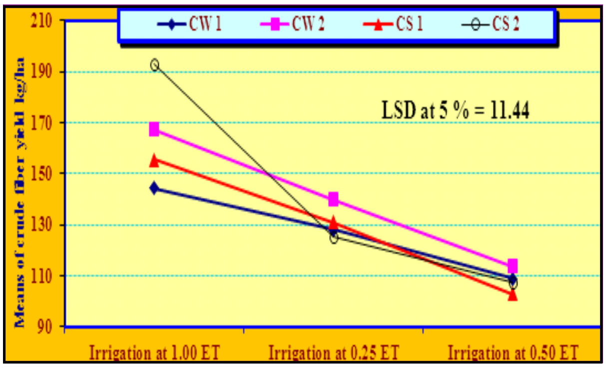

Fig. 4. Mean of crude fiber yield (kg/ha) of *Atriplex nummularia* Lindl as affected by the interaction between irrigation treatments and cutting intensities as combined analysis of 2014-15 and 2015-16 seasons.

Combined analysis of both the seasons clearly revealed that irrigation at evaporation rates at 100 per cent ET significantly produced the tallest plants, the highest fresh and dry forage yield/plant, fresh and dry forage yield/ha, water use efficiency, protein percentage, ether extract percentage, crude protein yield, crude fiber yield, ether extract yield, ash yield and nitrogen free extract yield compared with irrigation at evaporation rate at 0.50 and 025 ET. Fresh and dry mass, relative water content and water use efficiency of *Atriplex verucifera* increased in 100 to 200 mM NaCl salinity condition compared to the control, nevertheless they significantly decreased from high concentration of NaCl, especially at optimal fresh and dry mass (Karimi, 2006). The variation in water deficit stress tolerance in terms of biomass production and water uptake of Mediterranean saltbush (*A. halimus*) and Australian saltbush (*A. nummularia*) was investigated in this study, reducing the water level below 75 per cent ET0 reduced dry matter yield. *Atriplex nummularia* had higher biomass. Water use efficiency was increased from increasing water deficit. *Atriplex halimus* had a higher water use efficiency than *A. nummularia* especially at high stresses, 25% ET (Ayad *et al.*, 2010). These results were from good arrangement with those labelled by Meneses *et al.* (2012), Amouei (2013) and Mohebby *et al.* (2013). The combined analysis clearly showed that tallest plants were obtained from non-intensities cutting in summer (CS 2) at May, the highest fresh and dry forage yield/plant, fresh and dry forage yield/ha, the highest values of water use efficiency, ether extract percentage, crude protein yield, crude fiber yield, ether extract yield, ash yield and nitrogen free extract yield compared with other cutting intensive treatments. The highest fresh green and dry forage yield/ha due to the interaction between irrigation treatments and cutting intensities as combined analysis of both the seasons. The highest value of crude protein and crude fiber yield/ha was produced from irrigation at evaporation rate at 0.50 ET and intensities cutting in winter (CW 1) at November. *Atriplex nummularia* contained high concentrations of nitrogen (N) in winter as compared to summer. The potentials were for forage in arid areas with saline ground water (Aganga *et al.,* 2003). In this area and similar zone planting, distance (2 × 2 m) with triennial pruning and complete pruning had a maximum forage yield. Atriplex species, known in Arabic as Qataf, are a major group of forage shrubs. They are persistent perennial shrubs that keep their foliage throughout the year and are commonly used for extending the grazing season because of their nutritional value and chemical composition (Ortiz-Dorda *et al.*, 2005). Similarly, conclusions were obtained with those described by Karimi (2006), Baghestani *et al.* (2006) and Baghestani *et al.* (2007). The smallest impermanence percentages of cutting height treatments were observed in no cutting shrubs and had no significant difference between 40 and 60 cm cutting height. In conclusion, annual grazing or cutting in mentioned shrubs above 40 cm cutting height had advantageous effects on growth (Baghestani, 2010).

CONCLUSION

It might be established that irrigation at 1.00 ET and cutting in summer (CS 2) at May significantly produced total fresh and dry forage yield/ha, protein and fiber yields (kg/ha).

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