J. Plant Production, Mansoura Univ., Vol. 2 (8): 1061 - 1072, 2011

PRODUCTIVITY OF SOME SUMMER FORAGE CROPS UNDER SPRINKLER IRRIGATION IN NEWLY RECLAIMED SOIL CONDITIONS.

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ABSTRACT

Two field experiments were carried out at Al-Hussein Society For Reclaiming And Cultivating land – 64 km. Cairo Alexandria desert road, Giza Governorate. Egypt, during two successive summer seasons , 2006 and 2008, to study the effect of three irrigation rates (1500, 2000 and 2500 m³/ fad. per season) on yield and the water use efficiency expressed as kg dry yield/m³ of water consumed, of some sole and mixture summer forage crops, which were: sorghum (*Sorghum bicolour* ,L.), variety local hybrid 102, pearl millet (*Pennisetum glacum*) local variety Shandweel-1, cowpea (*Vigna unguiculata* L.) local variety buff and local population of Guar (*Cyamopsis tetragonoloba* L.).

Three cuts were taken throughout the growth season at 60, 95 and 130 days after sowing.

The crops grown as pure or mixed of two crops in different proportion (one line legume and two lines cereals or one line legume and one line cereal).

The results revealed that, increasing the irrigating water quantum increased the yields in both seasons.

The irrigation treatment 2500 m³/fad./season obtained the highest total fresh forage as well as the total crude protein yields /fad. The results cleared that, cereals crops as sole cropping out yielded the legumes and all mixed cropping combinations, and mixture treatments were more yield than legumes as sole crops. The combinations of 2/3 cereals + 1/3 legumes under irrigating treatment 2500 m³/fad./ season out yielded other combinations.

Water use efficiency (WUE) values significantly increased by decreasing the irrigation water, in both seasons, the highest WUE obtained at the irrigation treatment 1500 m³/fad./ season with the pure stand of cereal, pearl millet was higher than sorghum, and cowpea was higher than guar in that character .

The results revealed that, growing legume with cereal crops in mixtures at rate of 2/3 cereals + 1/3 legumes under irrigating treatment 2500 m³/fad./ season is important for improving the quality of cereal using sprinkler irrigation system at the experimental area.

INTRODUCTION

In Egypt, there is shortage of fresh fodder materials for livestock feeding during summer season, from May until November. Irrigation is the most effective major factor which limiting increasing productivity of forage crops area as well as effecting fresh ,dry and quality of production i.e. crude protein yield , under newly reclaimed soil conditions . Doorenbos and Kassam (1979) mentioned that, for high production crop, water requirements (110 to 130 days) of sorghum ranged between 45 and 65 cm. (1890-2730 m³), Stoskopf (1985) in India, recorded that pearl millet is the highest water use efficiency among the eight major cereals. Marie (1992) in Egypt, concluded

that, decreasing irrigation Intervals of sorghum plants increased fresh and dry matter yields and crude protein yield, Eid *et al*. (1999) in Egypt found that average water consumptive use for fodder sorghum was 45 .1 cm (1894 m^3 /Fad.) in the newly reclaimed lands. Water use efficiency (WUE) of millet may increase slightly with the increased water stress. Said (1999) reported that as the irrigation intervals increased water consumption use (WCU) of the fodder millet decreased. Osman and Mahmoud (2000) in Egypt ,recorded that water consumptive use by pearl millet and sorghum grown at Nubariya area from 43.51 to 44.56 cm (1827 m^3 to 1872 m^3) and 40.3 to 43.39 (1692 m^3 to 1822 m^3) respectively. Also recorded that , pearl millet and sorghum forage crops proved to perform well under calcareous soil conditions at Nubariya region , as they produced high dry matter yield and nutritive as well as they have greater water use efficiency . Sardina (2001) in Egypt, showed that in most cases water use efficiency (WUE) values were highest under the severe stressed watering treatment. AL – Suhaibani (2006) in Saudi Arabia, found that expanding irrigation interval from 3 to 7 and 11 days decreased the forage yield from 143.6 to 123 and 85.3 ton /ha , respectively . On the other hand there were no significant differences between irrigation every 7 and 14 days on grain sorghum growth and yield, while 21 – day's interval decreased the studied characters. Singh (2006) in India , recorded that the micro irrigation technologies help save large amount of water and enhance water use efficiency , increase the crop yields , reduce environmental hazard and salinity problems , also help in maintaining ecological balance .

The data also clearly indicated that sprinkler irrigation saved time, water and money, and additional income generation. Zegada *et al (*2006), in Namibia, concluded that cowpea has a higher ability to acquire existing soil water, forcing pearl millet to develop deep roots and shift to the surface irrigation water. Piccinni (2009) in Texas – U S A reported that, accumulated seasonal crop water use ranged between 441 and 641 mm (1850 and 2700 m^3) for maize and between 491 and 533 mm (2000 and 2240 m^3 water) for sorghum. Kholova *et al* (2010) in UK, demonstrated that constitutive traits controlling leaf water loss under well – watered conditions correlate with the terminal drought tolerance of pearl millet. Such traits may lead to more water being available for grain filling under terminal drought.

Improving the quality of forage by growing legumes in mixtures with cereals resulted from improving the cured protein yield, Abd EL-Gawad *et al (*1992) in Egypt , found that intercropping cowpea with sudan grass at 1:3 pattern outyielded higher fresh and dry weights of relatively high quality forage yield compared with sudan grass alone, Sood and Sharma (1992) in India, found that intercropping of sorghum with legume produced significantly higher green and dry fodder yields than sorghum alone. The quality of the forage as indicated by higher crude protein significantly better in sorghum + legume intercropping system, Sharma and Sharma (1994) in India, reported in semi –arid region that 75% of the recommended seed rate of pearl millet + 25% recommended seed rate of each of green gram, cowpea and cluster bean gave higher economic return compared with sole pearl millet , Sudhakar *et al* (1996) revealed that growing grasses with legumes as intercrop increased the crude protein content compared to growing grasses as sole

crop**,** Shareif and Said (1999) in Egypt, revealed that the solid planting exceeded all intercropping systems in forage yield in all cuts and total forage yield in both seasons. Intercropping cowpea with sorghum in alternate triple rows produced highest forage yield of cowpea during cuts and total forage compared with others intercropping systems.

Abd EL-Salam (2002) in Egypt, found that pearl millet and sudan grass as sole cropping outyielded all mixed cropping combinations. Mixture treatments were more yielded than legumes as sole crops. Forage yields of the combinations of 2/3 cereals + 1/3 legumes outyielded other combinations. Also said that, growing legume with cereal crops in mixtures could be recommended for improving the quality of cereals forage because of legumes characterized by higher crude protein.

The aim of this study was to evaluate the effect of the irrigation quantum and the sowing forage mixture pattern on fresh, dry forage and protein yields of sorghum, pearl millet, cowpea and guar, as well as the water use efficiency under three sprinkler irrigation's rates in newly reclaimed soil conditions.

MATERIALS AND METHODES

Two field experiments were carried out at Al- Hussein Society for Reclaiming and Cultivating Land – 64 Km Cairo Alexandria desert road Giza Governorate. Egypt. during two successive growing summer 2006 and 2008 seasons .The objective of this study was to evaluate the effect of the irrigation quantum and the sowing forage mixture pattern on fresh , dry forage and protein yields of sorghum, pearl millet , cowpea and guar , as well as the water use efficiency. under three sprinkler irrigation's rates in newly reclaimed soil conditions.

Table 1: Chemical analysis of the irrigation water for the experimental sites in 2006 and 2008 seasons.

Water analysis	Seasons	
	2006	2008
1) Chemical analysis :		
pH (1 – 2.5)	7.6	7.2
P.P.M.	1920	1280
Ca CO^3	---	---
2) Soluble cations (1:2) (mol / kg soil).		
Ca ++	9.0	5.6
Mg ++	8.0	8,0
Na ++	10.6	6,4
K +	0.34	0.27
3) Soluble anions (1:2) (mol / kg soil).		
CO^3 + HCO^3	3.2	3.4
Cl^-	17.5	12,5
SO^4	7.34	4.37
Sodium Adsorption Ratio (S.A.R.)	3.64	2.46
Residual Sodium Carbone (R.S.C.)	- 13.8	- 10. 2
Sodium Soluble Proportions (S,S,P)	37.9	31.6

Soil texture of the experimental site was sandy. Chemical analysis of the irrigation water at the experimental sites in 2006 and 2008 seasons are shown in Table 1.

Studied factors :

A- Sprinkler irrigation's water quantum per season :

1- 1500 m^3 / fad.
2- 2000 m^3/ fad.
3- 2500 m^3/fad.

B- Forage plant treatments :

Selected four summer forage crops, growing successfully under the Egyptian conditions.

Which were the combinations of two graminaceous (forage sorghum and pearl millet) and two leguminous (cowpea and guar),

grown either as pure or mixed of two crops in different proportions, are shown in Table 2.

The experimental design was split-plot with three replications, the three water – regime treatments were arranged in the main plots and sub- plots were assigned to the various forages treatments. The sup – plot area was 21 m^2. The preceding winter crop was barley.

Grains and seeds were provided by the Forage Research Section, Agricultural Research Center. Egypt.

Seeds of cowpea and guar were inoculated with the appropriate Bradyrhizobiuin sp. shortly before sowing.

Table 2: The tested treatments, varieties and seeding rates.

No	Forage plants	Variety	Seeding rate (kg / fad .)
	Sole crop		
1	Forage Sorghum(*Sorghum bicolor*, L.)	Hybrid- 102	18
2	Cowpea. (*Vigna unguiculata*, L.)	Buff	21
3	Pearl millet *(Pennisetum glacum*)	Shandweel- 1	18
4	Guar(*Cyamopsis tetragonoloba*)	Local population	21
	Mixture		
5	1/3 Cowpea+ 2/3 Sorghum		7 + 12
6	1/3 Cowpea + 2/3 Pearl millet.		7 + 12
7	1/3 Guar + 2/3 Sorghum		7 + 12
8	1/3 Guar + 2/3 Pearl millet.		7 + 12
9	1/2 Cowpea + 1/2 Sorghum.		10.5 + 9
10	1/2 Cowpea + 1/2 Pearl millet.		10.5 + 9
11	1/2 Guar + 1/2 Sorghum.		10.5 + 9
12	1/2 Guar + 1/2 Pearl millet.		10.5 + 9

Calcium super phosphate (15.5% P_2O_5) and Potassium Sulphate (48 % K_2O) were added at the rate of 150 and 50 kg / fad. , respectively, also 20 m^3 organic manure added during land preparation, Nitrogen fertilizer was added as ammonium nitrate (33.5 % N) at the rate of 60 kg. N/ fad.in doses with the irrigation water.

Three cuts were taken in each season after 60, 95 and 130 days from sowing date. All plots were hand – harvested at a cutting height of approximately 10 cm.

Data recorded:

I – Forage yield :

1 – Fresh forage yield/ fad: it was estimated from middle area of (1×1) m^2. in kilogram, and then converted to yield in tons per fad.

2 – Dry forage yield /fad: It was calculated by multiplying the fresh forage weight by dry matter percentage.

II – Protein yield / fad.:

Plant samples (300 gram) were taken from each cut and then oven dried at 60 ºc until constant weight, followed by fine grinding to estimate the Protein yields in kilogram: calculated by multiplying the dry forage yield/fad., by crude protein percentage (CP), which determined using Macro-Kjeldahl technique for estimating nitrogen content and the crude protein was calculated by multiplying the factor 6.25 by the nitrogen content.

III – Water use efficiency (WUE):

Determined according to the following formula:-

WUE = dry matter kg. /used irrigation water m^3.

Statistical analysis:

Finally, all obtained data were subjected to analysis of variance and treatment means were compared by (L.S.D) test at the 5% level of probability in the two experimented seasons according to Gomez and Gomez (1984).

RESULTS AND DISCUSSION

Fresh and dry forage yields:

Results presented in Tables 3 and 4, show that the irrigation water quantum's were significance effective on the total fresh and dry yields of forages in both seasons.

In the first season, the averages of the total fresh yields were (25.31, 32.38 and 33.73 ton/fad.) and the dry forage yields were (6.38, 8.34, and 8.37 ton/fad.), for the irrigation treatments 1500, 2000 and 2500 m^3/fad, respectively.

It means that, increasing the irrigating water quantum from 1500 to 2000 m3/fad.and up to 2500 m^3/fad. Significantly increased both of fresh and the dry forage yields.

The obtained results are in harmony with those of Zegada *et al* (2006), El Sarag and Abu Hashem (2009), and Piccinn (2009).

Results also revealed that sowing pearl millet in pure stand significantly increased fresh and dry forage yields per fad. compared with all others of sole or mixtures planting in both seasons. The averages of fresh and dry forage yields were 39.91 and 10.46 ton/fad. in 2006 season , while in 2008 season were 44.54 and 11.67ton/fad., respectively.

With regard to the mixture treatments , data cleared that sowing 1/3 cowpea + 2/3 pearl millet gave the highest fresh and dry forage yields in the first season , which were 35.02 and 8.69 ton per fad., respectively. While the highest fresh and dry forage yields in the second season was obtained from 1/3 Guar + 2/3 Pearl millet, which gave 38.71 and 9.67 ton per fad., respectively . The same trend was obtained by Shareif and Said (1999) and Abd El – Salam(2002) .

Table 3: Effect of irrigation rate on the total fresh forage yield, (ton/fad.) of some sole and mixture summer forage crops during 2006 and 2008 summer growing seasons

Forage plants treatments	2006 season				2008 season			
	fad/ Irrigation rate m^3				fad/ Irrigation rate m^3			
	1500	2000	2500	Mean	1500	2000	2500	Mean
Sorghum.	29.39	37.91	40.15	35.82	33.23	42.66	45.68	40.52
Cowpea.	12.51	16.82	17.64	15.66	15.58	20.05	22.58	19.40
Pearl millet.	32.80	41.54	45.39	39.91	36.51	46.42	50.70	44.54
Guar.	10.04	13.55	14.48	12.69	11.96	16.34	17.75	15.35
1/3 Cowpea+ 2/3 Sorghum.	26.79	35.00	35.65	32.48	29.64	37.76	40.39	35.93
1/3 Cowpea + 2/3 Pearl millet.	28.54	37.93	38.58	35.02	30.96	39.81	43.76	38.18
1/3 Guar + 2/3 Sorghum	26.99	35.08	36.22	32.76	29.50	38.30	41.10	36.30
1/3 Guar + 2/3 Pearl millet.	28.89	37.19	38.91	35.00	32.61	40.10	43.43	38.71
1/2 Cowpea + 1/2 Sorghum.	26.66	32.54	33.60	30.93	29.46	36.22	38.94	34.87
1/2 Cowpea + 1/2 Pearl millet.	27.78	35.07	35.86	32.90	30.51	37.14	40.89	36.18
1/2 Guar + 1/2 Sorghum.	25.66	31.70	32.98	30.11	29.34	35.73	37.70	34.26
1/2 Guar + 1/2 Pearl millet.	27.71	34.21	35.24	32.39	30.90	37.22	40.93	36.35
Mean	25.31	32.38	33.73	30.47	28.35	35.65	38.65	34.22
L.S.D. at 5% for :								
Irrigation rate		**0.42**				**0.23**		
Forage plants		**0.26**				**0.46**		
Interaction		**0.42**				**0.42**		

Table 4: Effect of irrigation rate on the dry forage yield, (ton/fad.) of some sole and mixture summer forage crops during 2006 and 2008 summer growing season.

Forage plants treatments	2006 season				2008 season			
	fad/ Irrigation rate m3				fad/ Irrigation rate m3			
	1500	2000	2500	Mean	1500	2000	2500	Mean
Sorghum.	8.16	10.74	10.79	9.90	8.99	11.81	12.12	10.97
Cowpea.	2.46	3.33	3.44	3.08	3.12	3.92	4.30	3.78
Pearl millet.	8.50	11.18	11.70	10.46	9.88	12.36	12.76	11.67
Guar.	2.19	2.96	3.18	2.78	2.64	3.53	3.72	3.29
1/3 Cowpea+ 2/3 Sorghum.	6.93	9.32	9.14	8.46	7.48	9.43	9.79	8.90
1/3 Cowpea + 2/3 Pearl millet.	7.09	9.70	9.27	8.69	7.46	10.05	10.66	9.39
1/3 Guar + 2/3 Sorghum	6.91	9.21	9.35	8.49	8.04	9.74	10.16	9.31
1/3 Guar + 2/3 Pearl millet.	7.16	9.49	9.48	8.71	8.30	10.05	10.66	9.67
1/2 Cowpea + 1/2 Sorghum.	6.83	8.64	8.62	8.03	7.31	9.14	9.57	8.67
1/2 Cowpea + 1/2 Pearl millet.	6.88	8.83	8.69	8.13	7.69	9.08	9.76	8.84
1/2 Guar + 1/2 Sorghum.	6.61	8.18	8.29	7.69	7.22	8.88	9.28	8.46
1/2 Guar + 1/2 Pearl millet.	6.79	8.45	8.48	7.91	7.96	8.92	9.63	8.84
Mean	6.38	8.34	8.37	7.69	7.17	8.91	9.37	8.48
L.S.D. at 5 % for :								
Irrigation rate	**0.14**				**0.11**			
Forage plants	**0.09**				**0.13**			
Interaction	**0.13**				**0.14**			

Effect of the interaction between irrigation quantum's and cereals – leguminous mixtures or sole planting on fresh and dry forage yields was significant in both seasons (Tables 3 and 4). The highest fresh and dry forage yields were obtained from planting pearl millet as pure stand when irrigated with 2500 m^3 per fad. in both seasons. Which were 45.39 and 11.70 in 2006

season, while in 2008 season were 50.70 and 12.76 ton per fad., respectively.

Regarding to the mixtures, data recorded that , the highest fresh and dry forage yields per fad. was obtained from 1/3 Cowpea +2/3 Pearl millet when irrigated with 2500 m^3 per faddan in 2008 season , which gave 43.76 and 10.66 ton per faddan , respectively . the results are in agreement with those obtained by Abd El – Gawad *et al*(1992) , Sharma and Sharma (1994) , Abd El – Salam (2002) and Piccinnic (2009) .

Water use efficiency (WUE):

The effect of irrigation quantum and forage plant treatments on water use efficiency (WUE), expressed as kg dry forage yield per cubic meter of water consumed in evapotranspiration during 2006 and 2008 summer seasons are shown in Table 5 .

Table 5: Effect of irrigation rate on the water use efficiency of some sole and mixture summer forage crops during 2006 and 2008 summer growing seasons

Forage plants treatments	2006 season				2008 season			
	fad/ rate m3 Irrigation				fad/ m3 Irrigation rate			
	1500	2000	2500	Mean	1500	2000	2500	Mean
Sorghum.	5.62	5.37	4.32	5.10	6.07	5.91	4.85	5.61
Cowpea.	1.64	1.67	1.38	1.56	2.05	1.97	1.73	1.92
Pearl millet.	5.67	5.59	4.68	5.31	6.53	6.20	5.14	5.96
Guar.	1.47	1.48	1.28	1.41	1.92	1.77	1.49	1.72
1/3 Cowpea+ 2/3 Sorghum	4.62	4.66	3.66	4.31	5.07	4.72	3.83	4.54
1/3 Cowpea + 2/3 Pearl millet.	4.73	4.85	3.71	4.43	5.13	5.03	4.26	4.81
1/3 Guar + 2/3 Sorghum	4.65	4.61	3.74	4.33	5.13	4.88	4.07	4.69
1/3 Guar + 2/3 Pearl millet.	4.77	4.75	3.80	4.44	5.70	5.03	4.26	5.00
1/2 Cowpea + 1/2 Sorghum.	4.55	4.31	3.44	4.10	4.90	4.58	3.83	4.44
1/2 Cowpea + 1/2 Pearl millet.	4.59	4.42	3.48	4.16	5.10	4.54	3.90	4.51
1/2 Guar + 1/2 Sorghum.	4.40	4.08	3.53	4.00	4.84	4.45	3.71	4.33
1/2 Guar + 1/2 Pearl millet.	4.54	4.21	3.40	4.05	5.00	4.47	3.85	4.44
Mean	4.27	4.17	3.37	3.93	4.79	4.46	3.74	4.33
L.S.D. at 5 % for :								
Irrigation rate.	**0.20**				**0.15**			
Forage plants.	**0.14**				**0.18**			
Interaction.	**0.25**				**0.30**			

Results presented in Table 5 indicate that, increasing the irrigation water significantly decreased the WUE in both seasons.

The averages of (WUE) for the different rates of the irrigating water (1500, 2000 and 2500 m3/fad.) were 4.27, 4.17 and 3.37 and 4.79, 4.46 and 3.74 in the first and the second season, respectively. So, it cleared that the treatment (1500 m^3/fad.) obtained the highest (WUE) while the treatment (2500 m^3/fad.)gave the lowest (WUE).

Results also revealed that, sowing pearl millet as pure stand, obtained the highest WUE, (5.31 and 5.96 kg. dry yield/m^3) during the first and the second seasons respectively. These results are in agreement with those obtained by Stoskopf (1985), Said (1999), Sardina (2001) and Kholova *et al*. (2010).

With regard to forage treatments, results cleared that sowing 1/3 guar + 2/3 pearl millet exceeded the other mixture treatments in both seasons, the WUE were 4.44 and 5.0 kg dry yield/m3 irrigation in the first and the second season, respectively

The interaction between irrigation quantum's and forage treatments on WUE was significant in both seasons Table 5. The highest WUE were obtained from planting pearl millet as pure stand when irrigated with 1500 m^3 per faddan in both seasons. Which were 5.67 and 6.53 in the first and the second season, respectively.

Regarding to the interaction between the irrigation treatments and the mixtures of forages, results recorded that, the highest WUE was obtained from 1/3 Guar + 2/3 Pearl millet when irrigated with 1500 m3 per faddan which were 4.77 and 5.7 in the first and the second season, respectively. The results are in agreement with those obtained by Said (1999),Osman and Mahmoud (2000) ,Sardina (2001), Singh (2006) and Piccinni (2009), They recorded that in most cases water use efficiency values were highest under the severe stressed watering treatment.

Protein yield:

Results presented in Table 6 show that increasing the irrigation rate increased the total protein yield for all the studied forage crops in both seasons.

Table (6) : Effect of irrigation rate on the total protein yield(kg./fad.) of some forage plants treatments during 2006 and 2008 summer growing seasons

Forage plants treatments	2006 season				2008 season			
	fad/ Irrigation rate m3				fad/ Irrigation rate m3			
	1500	2000	2500	Mean	1500	2000	2500	Mean
Sorghum.	674.56	948.70	953.12	858.79	695.48	964.21	1018.36	892.69
Cowpea.	328.82	459.54	490.77	426.38	387.92	512.13	603.90	501.32
Pearl millet.	733.83	1028.56	1099.80	954.06	734.41	1034.40	1088.57	952.46
Guar.	275.21	383.81	431.42	363.48	325.19	453.76	484.41	421.12
1/3 Cowpea+ 2/3 Sorghum	584.43	848.12	862.21	764.92	573.72	766.70	845.49	728.64
1/3 Cowpea + 2/3 Pearl millet.	614.47	915.03	905.37	811.62	599.29	864.01	919.74	794.35
1/3 Guar + 2/3 Sorghum	589.65	841.18	916.30	782.38	637.58	821.69	903.94	787.74
1/3 Guar + 2/3 Pearl millet.	630.08	895.22	922.72	816.01	691.39	884.40	991.07	855.62
1/2 Cowpea + 1/2 Sorghum.	573.72	783.36	839.01	732.03	575.32	773.85	851.43	733.53
1/2 Cowpea + 1/2 Pearl millet.	584.80	797.64	842.93	741.79	628.02	792.70	874.85	765.19
1/2 Guar + 1/2 Sorghum.	544.22	733.47	793.08	690.26	562.90	740.00	797.79	700.23
1/2 Guar + 1/2 Pearl millet.	599.78	783.03	819.73	734.18	647.68	749.56	863.79	753.68
Mean	591.00	821.31	861.09	757.80	620.96	819.34	896.81	779.04

Although the legumes crops achieved higher crude protein % comparing to the cereals
crops, the cereals obtained higher total crude protein yield. These increases due to the increases in total fresh and dry forage yields of cereals.

The averages of the total crude protein yields for the irrigating water 1500, 2000 and 2500 m3/fad. were (591.0, 821.31and 861.09 kg/fad.) and (620.96, 819.34 and 896.81 kg/fad.) in the first and the second seasons, respectively .

Results also showed that sowing pearl millet as pure stand gave the highest crude protein yield in both seasons, the averages were 954.10 and 952.46 kg/fad. in the first and the second season , respectively. Sorghum came in the second rank, and Cowpea came in the third rank while Guar gave the lowest yield of this character.

With regard to the mixture treatments results cleared that the highest total crude protein yield was obtained from sowing 1/3 Guar + 2/3 pearl millet which gave 816.0 and 855.6 kg/fad. in the first and the second season respectively .The same trend was obtained by Abdel – Aal *et al* (1991), Sudhakar *et al* (1996), Abd El – Salam(2002) and Kholova *et al* (2010) .

Effect of the interaction between irrigation rates and forage plants treatments on total crude protein yields was positive in both seasons.

The highest yields were obtained from sowing pearl millet as pure stand when irrigated with 2500 m^3 per faddan in both seasons. Which were 1099.8 and 1088.6 kg / fad. in 2006 and 2008 season respectively. These results agree with those reported by Sardina (2001) and Kholova *et al* (2010).

Regarding to the mixtures, results recorded that the highest crude protein yield per faddan was obtained from sowing 1/3 Guar +2/3 Pearl millet when irrigated with 2500 m3 per faddan in both seasons, which gave 922.7 and 991.07 kg. per faddan , in the first and the second season, respectively . These results are in agreement with those obtained by Sharma and Sharma (1994), Mahmoud and Osman.(2000), El Sarag and Abu Hashem (2009) and Suliman and Ahmed (2010).

Conclusion

Increasing sprinkler irrigation water consumptive use by sorghum, pearl millet, cowpea and guar, from 1500 to 2000 and up to 2500 m^3/fad. per season , significantly increased the total fresh and dry forage yields as well as the total protein yield per fad. , on the other hand it decreased the water use efficiency in both seasons. It could be recommended to sowing 2/3 cereals + 1/3 leguminous and irrigate it with 2500 m^3 water/fad. to obtain high forage yields with high quality, or irrigating it with 2000 m^3 water/fad. for saving water under the conditions of this work.

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إنتاجية بعض محاصيل العلف الصيفية تحت ظروف الري بالرش في الأراضي الجديدة

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أجريت تجربتان حقليتان في مزرعة جمعية الحسين لاستصلاح الأراضي بالكيلو ٦٤ طريق مصر الإسكندرية الصحراوي - محافظة الجيزة . مصر خلال الموسمين الصيفيين ٢٠٠٦, ٢٠٠٨ لدراسة تأثير ثلاثة معدلات لمياه الري بنظام الرش (١٥٠٠ , ٢٠٠٠ , ٢٥٠٠ م^3 / للفدان / للموسم) علي بعض محاصيل العلف الصيفية النجيلية (هجين السورجم - ١٠٢ و الدخن صنف شندويل - ١) و البقولية (لوبيا العلف صنف بف و الجوار)

وتأثير ذلك علي المحصول العلفي وصفات جودته مع معرفة انسب كمية من مياه الري لتحقيق أعلي كفاءة لاستخدام المياه تحت نظام الري بالرش في الأراضي المستصلحة حديثا. استخدم تصميم القطع المنشقة في ثلاث مكررات , حيث خصصت القطع الرئيسية لمعاملات الري بينما زرعت محاصيل الأعلاف في القطع المنشقة حيث زرعت المحاصيل منفردة أو مخلوطة (نجيلي مع بقولي بنسب ١:٢ أو ١:١) . وقد تم الحصول علي ثلاث حشات خلال موسم النمو بعد ٦٠, ٩٥, ١٣٠ يوما من الزراعة.

أظهرت النتائج أن اعلي قيم لجميع الصفات المدروسة (محصول العلف الطازج والجاف وكذلك محصول البروتين الخام) قد تحققت عند الري بمعدل ٢٥٠٠ متر مكعب مياه رشا خلال موسمي النمو.

وأوضحت النتائج زيادة معنوية في محصولي العلف الطازج والجاف في كلا الموسمين بزيادة كمية مياه الري وتفوقت النجيليات علي البقوليات في تلك الصفات وخاصة الدخن منفردا علي الإطلاق , حيث كان انتاجه اعلي من السورجم , كما تفوقت لوبيا العلف علي الجوار في تلك الصفات, كما كان أفضل إنتاج للمخاليط العلفية كان للمعاملة (٣/١ لوبيا علف + ٣/٢ دخن) والري بمعدل ٢٥٠٠ م٣ ماء للموسم .

وبالرغم ان زيادة معدلات الري من ٢٠٠٠ م٣ إلي ٢٥٠٠ م^{٣} / للفدان لم تؤدي إلي زيادة معنوية في نسبة المادة الجافة في الموسم الأول فقد تحقق اعلي محصول علف جاف في كلا الموسمين عند مستوي مياه ري بمعدل ٢٥٠٠ م٣ للفدان في الموسم نظرا لارتفاع المحصول الطازج عند تلك المعاملة .

كما أن محصول البروتين الخام ارتفع بزيادة كمية مياه الري , حيث كان اعلي محصول للبروتين تحقق عند الري بمعدل ٢٥٠٠ م^{٣} للفدان في الموسم, وقد تفوق الدخن علي السورجم في تلك الصفة وكانت اللوبيا اعلي من الجوار في تلك الصفة , كما اعطي المخلوط (٣/٢دخن + ٣/١ جوار) عند معاملة الري ٢٥٠٠ م٣ للفدان في الموسم أعلي محصول بروتين خام مقارنة بباقي معاملات المخاليط الاخري في كلا الموسمين.

أما بالنسبة لكفاءة استخدام المياه , فقد كانت علي عكس الصفات السابقة , حيث انخفضت كفاءة استخدام المياه معنويا بزيادة معدلات الري في كلا الموسمين , حيث كانت أعلي كفاءة لاستخدام المياه عند الري بمعدل ١٥٠٠ م٣ للفدان في الموسم , وقد أوضحت النتائج تفوق النجيليات علي البقوليات في تلك الصفة وحقق الدخن اعلي كفاءة لاستخدام المياه في كلي الموسمين يليه السورجم ثم لوبيا العلف واقلهم الجوار .

وأشارت النتائج إلي اهمية تحسين جودة محاصيل العلف النجيلية بزراعتها مختلطة مع المحاصيل البقولية بنسبة (٣/١ بقولي , ٣/٢ نجيلي) تحت معدل ري عالي ٢٥٠٠ م^{٣} للفدان خلال موسم النمو بنظام الري بالرش في منطقة تنفيذ التجربة والمناطق المماثلة لها من حيث ظروف التربة والمناخ .

قام بتحكيم البحث

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