Using alternate Water Resources for Cultivation of Salt Tolerant Perennial Grasses under Marginal Environment

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INTRODUCTION

- Water scarcity is affecting agriculture production in the arid and semi-arid parts of world.
- The identification and development of salt tolerant forage crops and alternate water resources helps to address the fresh water scarcity.
- Buffel grass (*Cenchrus ciliaris* L.) is a drought tolerant, C_4 perennial grass that can be grown in marginal soils under water scare conditions.

OBJECTIVES

✓To assess the salinity tolerance in the collections of *C. ciliaris* held in ICBA genebank to select better genotypes for use as livestock feeds in UAE.

✓To evaluate the impact of salinity on biomass yield and quality attributes.

MATERIALS & METHODS

- Site: Experimental Station, ICBA, Dubai, UAE
- Soil Type: Sandy (typic torripsamment)
- Row-Row distance: 0.5 m
- Plant density: 4 plants per linear meter
- Plot size: 0.5 m × 4 m (sub plot 2 m^2)
- Replications: 3
- Irrigation: ET_c plus 10% leaching
- Fertilizer NPK (20-20-20%): 100 kg ha^{-1}
- After each harvest (Urea): 60 kg ha^{-1}
- Experimental Duration: 2006-2013 (average 5 cuts/year)

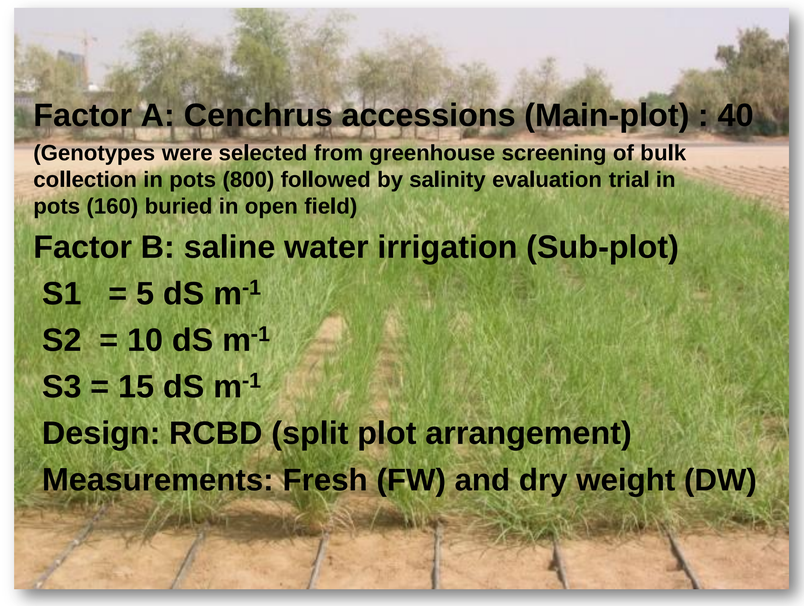


Fig. a. *C. ciliaris* field

Fig. b. *C. ciliaris*

Fig. c. *C. ciliaris* heading stage

Fig. d. *C. ciliaris* harvesting

RESULTS & DISCUSSION

Genotype ranking (Ward's minimum cluster analysis):

❖ Accessions with lowest values: Salt tolerant
- Acc. 37 (Grif 1639: Pakistan)
- Acc. 2 (PI161633: South Africa)
- Acc. 3 (PI161637: South Africa)
- Acc. 12 (PI279596: Philippines)
- Acc. 15 (PI365650: Tanzania)
- Acc. 30 (PI414452: South Africa)

❖ Accessions with highest values: Salt sensitive
- Acc. 4, 20, 21, 23, 24, 25 : South Africa
- Acc. 40 (MAK 9: UAE) (Al-Dakheel et al. 2015)

Table 1.

S.No.	Accessions	Entry numbers	Country of Origin	S.No.	Accessions	Entry numbers	Country of Origin
1	PI 153671	2	Kenya	21	PI 409267	393	South Africa
2	PI 161633	6	South Africa	22	PI 409295	417	South Africa
3	PI 161637	9	South Africa	23	PI 409429	507	South Africa
4	PI 185564	18	South Africa	24	PI 409556	565	South Africa
5	PI 225012	48	Ghana	25	PI 409585	576	South Africa
6	PI 225583	49	South Africa	26	PI 409669	600	South Africa
7	PI 271206	88	India	27	PI 409689	619	South Africa
8	PI 271208	90	India	28	PI 409704	632	South Africa
9	PI 271209	91	India	29	PI 414447	653	South Africa
10	PI 271214	96	India	30	PI 414452	658	South Africa
11	PI 271219	101	India	31	PI 414499	702	South Africa
12	PI 279596	111	Philippines	32	PI 414513	714	South Africa
13	PI 294595	124	Australia	33	PI 442096	750	Japan
14	PI 295659	130	Zimbabwe	34	PI 443507	754	Mexico
15	PI 365650	220	Tanzania	35	PI 516516	760	Morocco
16	PI 365651	221	Tanzania	36	Grif 1619	764	Australia
17	PI 365720	252	Tanzania	37	Grif 1639	784	Pakistan
18	PI 385321	287	Tanzania	38	MAF 74		UAE
19	PI 409174	315	South Africa	39	MAK 7		UAE
20	PI 409216	349	South Africa	40	MAK 9		UAE

Table 2.

Accessions	Crude Protein (CP) Salinity levels (5 dS m^{-1}	10 dS m^{-1}	15 dS m^{-1})	Acid detergent fiber (ADF) 5 dS m^{-1}	10 dS m^{-1}	15 dS m^{-1}	Neutral detergent fiber (NDF) 5 dS m^{-1}	10 dS m^{-1}	15 dS m^{-1}	Ash 5 dS m^{-1}	10 dS m^{-1}	15 dS m^{-1}
2	4.70	6.50	4.90	42.6	40	43.4	75.5	75.3	77.6	10.6	9.4	11.3
5	7.40	7.90	7.70	37.1	39.6	36.8	69.7	71.3	70.7	12.5	14	12.8
6	7.40	7.40	7.20	39.2	36.6	37.9	70	67.7	69.7	14.8	16.7	13.6
8	5.00	5.50	6.00	41.1	43.9	42.2	75.3	76	73.2	12	11.2	10.1
13	5.70	5.60	4.00	39	43	46.10	67.2	71	75.5	14.2	11.9	11.6
15	6.50	7.40	6.40	39.2	40.3	40.4	70.8	71.4	71.6	13.9	15.1	12.6
21	5.40	7.60	5.90	46.5	40	42.2	74.6	75.8	72.7	11.9	10.8	13.7
37	4.80	6.40	5.50	40.9	38.9	44.8	72.8	75	75	12.5	9.9	11.3
38	4.70	6.00	6.20	44	47.7	43	73.7	73.5	66.5	12.3	14.3	15.2
40	6.00	7.40	5.60	43.4	41.8	40.7	72.3	72.1	73.9	13.9	13.1	12.5
Mean	5.76	6.77	5.94	41.30	41.18	41.75	72.19	72.91	72.64	12.86	12.64	12.47
S.E.	1.05	0.88	1.06	2.84	3.09	2.89	2.73	2.68	3.19	1.29	2.39	1.47

Principal Component analysis:

❖ First Principal Component (PC1) depicted 89.7% of total variation among the fresh biomass trait. The PC2 explained an additional 8.04% of the total variation among various traits. (Fig. 1).

❖ PC1 reported 90.3% of the observed variation in dry weight while PC2 showed 7.23% of total variation (Fig. 2).

Seasonal variation:

➢The mean fresh and dry weight in the highest production season (late summer harvest) were 44.06 and 15.20 t ha^{-1} respectively, followed by early summer (37.49 and 11.59 t ha^{-1}) and autumn harvest (37.41 and 10.53 t ha^{-1}) (Fig. 3).

Conclusion:

✓Accession 37, 2, 3 12 and 15 were identified as salt-tolerant, high-yielding and stable genotypes at various salinity levels.

✓Accession 37 (Grif 1619) was found the best genotype in terms of biomass yield at all salinity levels during all cropping seasons and had adequate nutritional value.

Quality traits:

➢ The highest crude protein content (7.9%) was obtained in genotype 5 at medium salinity (10 dS m^{-1}) while lowest CP (4.0%) was analyzed in genotype 13.

➢ Crude protein content (CP) was higher in low biomass yielding *C. ciliaris* genotypes (6 and 40) that produced 7.4% CP following treatment at 10 dS m^{-1} (Table 2). The lower dry weight (DW) producing accessions were higher in nutritive value and high DW producing accessions had lower nutritive value in terms of CP.

References
Al-Dakheel, A.J., Hussain, M.I., and Al-Gailani A. Q. M. 2015. Impact of irrigation water salinity on agronomical and quality attributes of *Cenchrus ciliaris* L. accessions. Agricultural Water Management 159: 148-154.

Fig.1

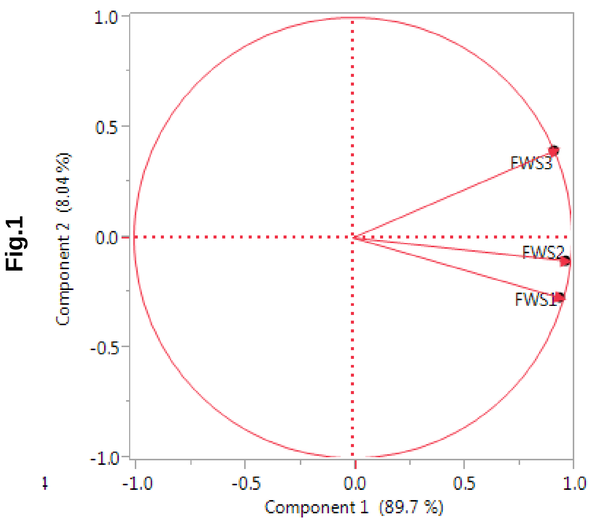
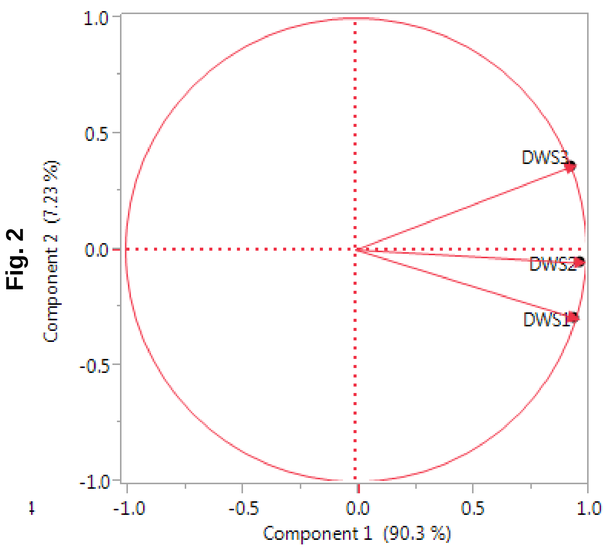


Fig. 2



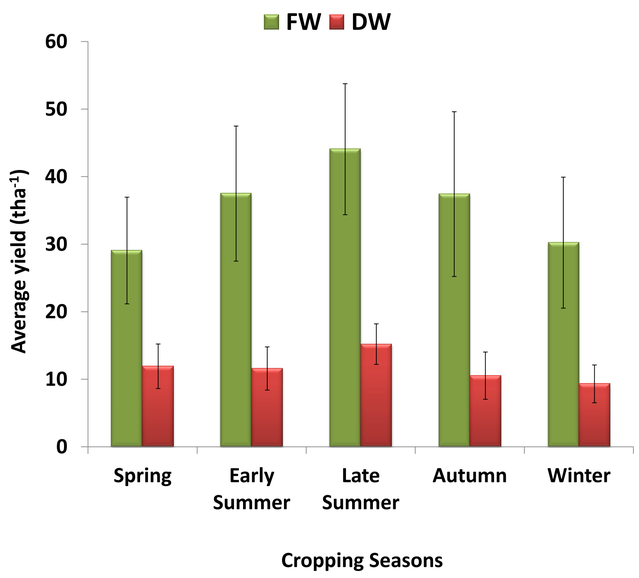


Fig. 3