POTENTIAL OF NATIVE DESERT GRASSES FOR FORAGE PRODUCTION

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Alfalfa (*Medicago sativa*) and Rhodes grass (*Chloris gayana*) are the main fodder crops grown in the United Arab Emirates (UAE). Both these species are exotic and require large quantities of water (up to 48,000 $m^3\ ha^{-1}\ yr^{-1}$), often drawn from nonrenewable groundwater sources. Large-scale cultivation of these species has resulted in drastic reduction in groundwater levels and an increase in salinity due to intrusion of seawater, especially in the coastal areas.

Indigenous rangeland grasses such as *Cenchrus ciliaris*, *Pennisetum divisum*, *Panicum turgidum*, *Stipagrostis plumosa* and *Coelachyrum piercei* have long been important sources of feed for grazing camel and sheep. These grasses survive with very little water and have excellent adaption to the harsh desert environment, which make them ideal choices for sustainable forage production, thus reducing the use of scarce fresh water resources. Recent studies show that buffel grass (*C. ciliaris*) has significantly lower water requirement compared to Rhodes grass (Osman *et al.*, 2008). The nutritional quality of *C. ciliaris* was found to be equal to Rhodes grass, but inferior in *C. piercei* (Peacock *et al.*, 2003). In terms of salinity tolerance, *C. ciliaris* and *C. piercei* were found to be less tolerant than Rhodes grass (Nadaf *et al.*, 2008). However, there are only limited systematic studies to evaluate the forage potential, water use efficiency, salinity tolerance and nutritional quality of other desert grasses.

The International Center for Biosaline Agriculture (ICBA) has recently initiated collecting the rangeland species for conservation and sustainable use, especially for possible replacement of the 'thirsty' exotic species in forage production systems and to enhance the productivity of rangelands through restoration. If indigenous forage species are to be utilized, the genetic variation existing within species must be explored and utilized to optimize productivity. In this paper, we report the forage yields of 25 accessions of five desert grasses collected from natural habitats in the UAE (Table 1).

The seeds of the grass species were germinated in Jiffy packs and six weeks old seedlings were transplanted into the field in November 2008 at ICBA research station. Each accession was planted in a single row of 3 m, spaced 1 m apart. The distance between plants within each row was about 25 cm. The plants were irrigated with low-salinity water of about 3 $dS\ m^{-1}$ using the drip-irrigation system. During growth, a single dose of urea one month after planting and two split doses of NPK fertilizer (20-20-20) were applied, each at the rate of 5 g $plant^{-1}$ by banding along the rows. Fresh and dry weight observations were based on three plants, randomly selected in each accession. The plants were cut to a height of 5 cm above the ground level. In all of the species, except *C. piercei*, two harvests were taken between January and June 2009.

An analysis of the data showed significant differences among the species in biomass production ($P<0.001$). Averaged over accessions, biomass potential indicated by fresh and dry matter yields was highest in *P. divisum*, followed by *C. ciliaris* and *P. antidotale* (Table 1). *S. iocladus* and *C. piercei* had the lowest biomass among the five species. The fresh and dry matter yields differed significantly among the accessions of *C. ciliaris* ($P<0.001$). Dry matter yield was highest in RMS-180 (1.1 kg $plant^{-1}$), followed by RMS-184 (0.92 kg $plant^{-1}$) and lowest in RMS-142 (0.21 kg $plant^{-1}$). However, differences in biomass yield among accessions of the other species were not significant (Table 1).

Depending on soil fertility and growing conditions, the dry matter yields of Rhodes grass generally range from about 10-25 t ha^{-1} and that of *C. ciliaris* between 2-9 t ha^{-1} (Cook, 2005). In *C. ciliaris*, variable yields were reported from trials conducted in the UAE . Thus, while the highest dry matter yield obtained at Dhaid Research Station in the

Pennisetum divisum

Panicum antidotale

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central region was 15 t ha^{-1} (Osman *et al.*, 2008), yields varying between 20 and 90 t ha^{-1} were obtained at ICBA Research Station in Dubai (ICBA, 2008). In Pakistan, fresh biomass yields of up to 10 t ha^{-1} were observed for *P. antidotale* and *C. ciliaris* (Khan *et al.*, 2006). In this study, with two harvests under minimal management, dry matter yields (extrapolated from single plant yield) ranging between 6-10 t ha^{-1} were observed in some accessions of *C. ciliaris* and *P. divisum* and *P. antidotale*. Thus, the results demonstrate the potential of these native grasses to replace the exotic Rhodes grass in local forage production systems. The results also indicate that significant intra-specific variation exists within these species, which could provide the basis for improving productivity through selection. For successful development of new forages for production systems or rangeland rehabilitation, it is also essential to determine whether there are significant differences in these accessions in their water use efficiency, nutritive value and ability to grow on salt-affected soils. Further collecting of germplasm of indigenous grasses from a wide range of habitats would indeed provide an expanded genepool for exploitation. Finally, development of new forages and transfer of technology for large-scale adaptation by the farmers also requires considerable agronomic research, followed by extension work to translate the research results into practical recommendations. These objectives can be best achieved through the establishment of a 'forage improvement program' in an institutional framework with a team of breeders, agronomists and extension specialists.

Table 1. Mean fresh and dry matter yields of five native desert grasses

Species	Accession number	Fresh Weight (kg $plant^{-1}$)	Dry Weight (kg $plant^{-1}$)
Cenchrus ciliaris	RMS-107	1.30 abc	0.48 b
	RMS-121	0.76 c	0.30 b
	RMS-142	0.80 c	0.21 b
	RMS-145	1.14 bc	0.41 b
	RMS-164	1.07 bc	0.28 b
	RMS-179	1.31 abc	0.37 b
	RMS-180	2.00 a	1.09 a
	RMS-184	1.87 a	0.92 a
	RMS-194	0.80 c	0.29 b
Mean		1.23	0.48
Coelachyrum piercei	RMS-90	0.29 a	0.15 a
	RMS-109	0.59 a	0.21 a
	RMS-113	0.44 a	0.19 a
	RMS-120	0.49 a	0.18 a
	RMS-151	0.43 a	0.17 a
Mean		0.45	0.18
Panicum antidotale	RMS-95	0.97 a	0.35 a
	RMS-119	1.10 a	0.38 a
	RMS-131	0.59 a	0.17 a
	RMS-141	1.53 a	0.63 a
Mean		1.05	0.38
Pennisetum divisum	RMS-94	2.38 a	1.04 a
	RMS-103	2.02 a	0.80 a
	RMS-104	2.45 a	0.73 a
	RMS-111	1.11 a	0.34 a
	RMS-122	1.93 a	0.56 a
Mean		1.97	0.68
Sporobolus ioclados	RMS-158	0.74 a	0.38 a
	RMS-186	0.78 a	0.30 a
Mean		0.76	0.34

For each species, means within a column followed by the same letter are not significantly different ($P = 0.05$)

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Cenchrus ciliaris

Sporobolus ioclados

Coelachyrum piercei