Primary productivity and water use of the perennial grass, *Cenchrus ciliaris*, in arid environments

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Introduction *Cenchrus ciliaris* is a perennial grass that may be suitable for the restoration of *Rhanterium* steppes (Chaieb *et al*., 1991). In this study, four *Cenchrus ciliaris* accessions from Tunisia from a range of climate and soil conditions, likely to vary in their adaptation to drought, were evaluated for productivity, rain-use-efficiency and reproductive output at Sfax in southern Tunisia. The suitability of these accessions for the restoration of *Rhanterium* steppes is considered.

Material and methods Four *Cenchrus ciliaris* accessions were collected from different regions in southern Tunisia : Bou Hedma (A1), Tozeur (A2), Raâs Jedir (A3) and Sidi Toui (A4). In October 2002 twenty four 6x3 m plots were established and assigned randomly to each of the four accessions under study (i.e. six replicates). Sixteen seeds of each accession were sown in each plot. The experiment was carried out throughout the 2002-2003 growing season. Plots received supplementry irrigation. The number of spikes in each plant were counted and the above-ground parts harvested to estimate the standing biomass, after drying at 105°C for 24 h. Rain-use-efficiency (RUE) was calculated by dividing the above ground biomass by the volume of rainfall plus irrigation water supplied to each plot. Differences between accessions in numbers of spikes per plant and biomass accumulation were tested for significance by one way ANOVA.

Results Aboveground dry matter accumulation by the end of growing period differed significantly between accessions. Accessions from Sidi Toui (A4) and Bou Hedma (A1) were the most productive. This variability emphasises the importance of polymorphism in phytomass production in this species. The differences in average biomass between accession (Table 1) were not significant ($p>0.05$). Spike production was highly variable. It was greater for accession A3 and A4 than for A1 and A2. The number of spikes per plot was not correlated with biomass accumulation ($r^2 = 0.075$). Accession A3 showed the highest biomass allocation to spikes. Differences in rain-use-efficiency between *Cenchrus ciliaris* accessions were substantial (Table 1). Accessions A4 and A1 were the most efficient. Similar results were found by Mseddi *et al.* (2003) in a three years study: dry matter production ranging from 0.91± 0.26 g dry matter/m^2 per mm to 1.63 ± 0.55 g dry matter/m^2 per mm.

Table 1 Mean biomass and spike production per plant and rain-use-efficiency of *C ciliaris* accessions

	A1	A2	A3	A4
Biomass (g dry matter/m^2)	126.9± 37	65.7±25	78.4±16	139±42
RUE (g dry matter/m^2 per mm)	0.39± 0.014	0.21±0.02	0.22±0.05	0.45±0.02
Number of spike per plant	84.3±9	94.5±6	160.0±17	162.0±18

Conclusions Accessions A1 (Bou Hedma) and A4 (Sidi Toui), which were the most productive and utilise rainwater most efficiently, are worth developing for reintroduction into degraded *Rhanterium* steppes. They are very promising for reseeding into depleted grazing lands and may help to meet the grazing needs of livestock in south Tunisia. This study supports previous studies carried out in the arid bioclimate of Tunisia, and confirms the relationship among the variability, the genetic polymorphism and the biological performance of *Cenchrus ciliaris*, a species threatened with extinction in Tunisian ecosystems.

References

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