The Potential for Summer-Dormant Perennial Grasses in Mediterranean and Semi-Arid Pastures

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The potential for summer-dormant perennial grasses in Mediterranean and semi-arid pastures

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Introduction In rain-fed Mediterranean and semi-arid areas, herbage production of perennial grasses depends on their ability to grow efficiently during the rainy seasons and to persist over the dry summer. A key survival strategy in these harsh conditions is summer dormancy (Volaire, 2002). Within the species *Dactylis glomerata* L., two cultivars (cvs.), contrasting in this trait, were compared in order to analyse their suitability in terms of yield and survival in these environments.

Materials and methods The drought-resistant, non-dormant cv. Medly (Southern France origin) and the drought-resistant, summer-dormant cv. Kasbah (Moroccan origin) were compared at Montpellier, France. In two field experiments (A & B), plots were fully irrigated except from June to October (summer water deficits of 400-600 mm). Aerial biomass was measured regularly and plant survival was counted after autumn rehydration. In Experiment B, soil cores were taken by auger to 160 cm depth at the beginning, middle and end of the drought. A similar experiment (Experiment T) was conducted in 2 m-long soil columns within transparent plastic tubes (3 plants/tube). Soil water use was assessed by weighing the tubes and root depth was measured.

Results In Experiment A, in both years (Table 1), cv. Medly exhibited a higher spring yield potential. Due to its endo-dormancy, cv. Kasbah ceased growing at the end of spring and senesced irrespective of the environmental conditions and its summer yield under irrigation was negligible. In contrast, under a severe drought (year 2003), its survival and recovery after autumn rehydration were significantly greater than that of cv. Medly. In Experiment B, tiller density of cvs Medly and Kasbah recovered to 90-100% of initial density in the autumn. In Experiments B and T, the overall soil water use over droughts was significantly different between cultivars (Table 2) due to greater uptake of cv. Medly while it was still growing during the first part of the drought. In Experiments B and T, at the end of the drought, a substantially higher amount of transpirable soil water remained under cv. Kasbah than under cv. Medly (+34 mm, +40 mm) even though cv. Kasbah`s rooting depth (135 cm) was similar to that of cv. Medly (Experiment T).

Table 1 Seasonal biomass production (g m^{-2}) of 2 cvs. of cocksfoot in field experiment A. Year 2002: moderate summer drought; year 2003: intense summer drought. L.s.d. (5%) given when significant differences at $P<0.05$

Cultivar	Spring 2002	Summer 2002		Autumn 2002	Spring 2003	Summer 2003		Autumn 2003
	Irrigated	Irrigated	drought	after drought	Irrigated	Irrigated.	drought	after drought
Kasbah	340	39	0	160	428	7	0	265
Medly	455	437	0	188	586	246	0	149
L.s.d.	-	127	-	25	72	110	-	71

Table 2 Soil water use under drought (mm water per period) for 2 cvs of cocksfoot (Kasbah and Medly) in a tube experiment (T) . and a field experiment (B). L.s.d. (5%) given when significant differences at $P<0.05$

Expt T	Period	Kasbah	Medly	l.s.d.	Expt B	Period	Kasbah	Medly	l.s.d
	10/07-30/07	37	83	13		30/06-30/07	63	82	-
	31/07-10/10	42	38	-		30/07-28/09	34	49	-
	10/07-10/10	79	121	25		30/06-28/09	97	131	31

Conclusions The summer-dormant cocksfoot exhibited a lower yield potential, particularly under summer irrigation. Nevertheless, this adaptative strategy conferred superior survival under intense drought, by reducing water consumption during the usually critically dry summer. To improve perennial forage plants by combining higher water use efficiency (production) and summer dormancy (persistence) is now an objective of breeding programs in the Mediterranean (Euro-project PERMED '2004-2008').

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References

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