Drinking water intake of grazing steers – a role for environmental factors controlling canopy wetness?

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1 Introduction

Grazing cattle obtain water by ingesting moist forage. Drinking compensates for lack of water in grazed forage ([1] [4]), particularly in thermo-neutral conditions [3].
Forage moisture includes (internal) tissue water and surface moisture, such as intercepted rain, guttation water, dew from dewfall (atmospheric origin) or dewrise (soil). Guttation [2] and dewrise are potentially important under moist soil conditions.

2 Materials and Methods

Site
Permanent pasture at Grünschwaige [5], dominated by *Lolium perenne* and *Poa pratensis*, with abundant opportunities for shade, maintained at compressed sward height of 5 cm (± 0.9 cm SD).
Grazing experiment
All-day pasture during entire grazing seasons of 2010 and 2011, with ten (2010) and nine (2011) Limousin steers, aged 16 ± 4 months, with initial body weight 411 ± 91 kg, having *ad libitum* ac

Climate
Annual mean air temperature: 9.0 ^{o}C (± 0.8 ^{o}C); annual precipitation: 775 mm (± 130 mm).
Plant available soil water (PAW, mm) was estimated for every day according to [5].
Dry days and wet days
Wet days > 2 mm rain on corresponding day and previous day
Dry days < 0.2 mm of rain on corresponding and previous day.

3 Results

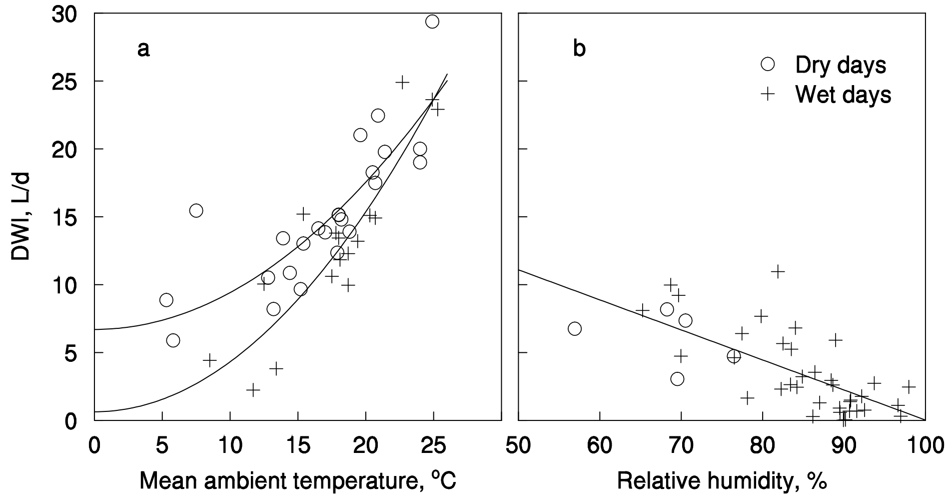

Fig. 1: Drinking water intake (DWI) of dry days and wet days for
(a) dry soils (PAW < 30% of PAW capacity) related to daily mean ambient temperature of dry days and wet days
(b) wet soils (PAW > 95 % of PAW capacity) related to relative humidity of dry days and wet days.

With dry soil (PAW < 30% PAW capacity), DWI correlated closely with daily mean ambient temperature on both dry days and wet days (Fig. 1a). At same temperature, the DWI was always lower on wet days than on dry days, if temperature was >25 °C. The largest difference between dry and wet days of 4.4 L/d occurred when temperature was <10 °C. On hot days (>25 °C), rain had virtually no effect on DWI (Fig. 1a).
On wet soil (PAW > 95% PAW capacity), DWI decreased linearly with increasing relative humidity, and reached zero at a relative humidity near 100 % (Fig. 1b).

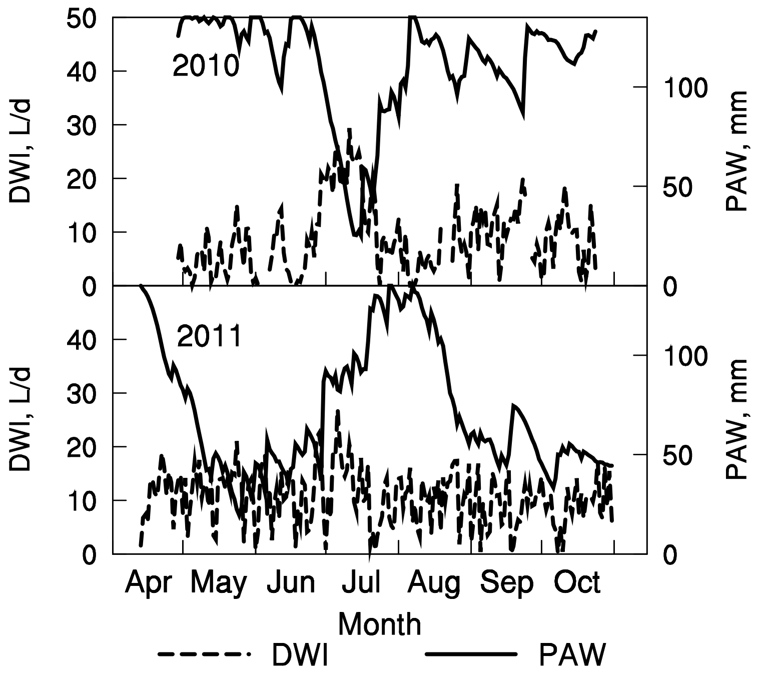

Fig. 2: Plant available soil water (PAW) and daily drinking water intake (DWI) during the grazing seasons of 2010 and 2011.

Variations in PAW covered a large range in both years, from 20 mm to field capacity at 135 mm, but with very different seasonal patterns (Fig. 2). In both years, the fluctuations of DWI displayed an inverse pattern relative to PAW, especially at short time-scales (Fig. 2).

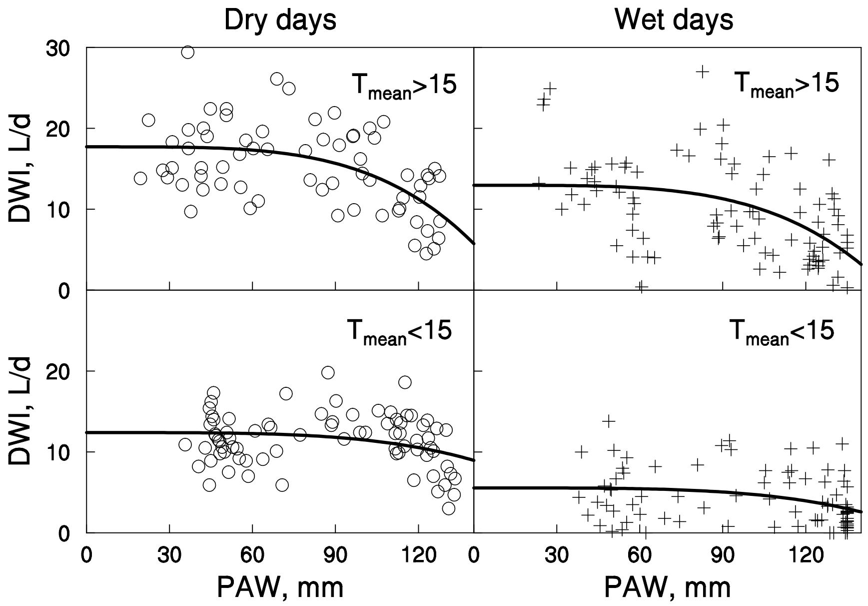

Fig. 3: Relationship between the daily drinking water intake (DWI) and plant available soil water (PAW) for dry days and wet days at high (> 15 oC) and low (< 15 oC) mean ambient temperature (Tmean).

In general, PAW exerted a negative effect on DWI (Fig. 3). DWI decreased little until PAW increased up to about 70 mm, and then decreased sharply. This effect of PAW on DWI was particularly evident when mean ambient temperature exceeded 15 ^{o}C. DWI on wet days was lower than that on dry days under similar weather conditions (mean ambient temperature either above or below 15 ^{o}C).

4 Conclusion

The results are consistent with the notion that DWI balances the water intake with the grazed grass and thus depends on internal and external moisture content. Thus, drinking water intake of individual steers at pasture correlated with soil and weather factors that affect plant water status and surface-moisture formation and persistence. The most striking effects on DWI resulted from (combinations or contrasts of) dry or wet soil conditions, rainfall events (yes or no), and relative humidity of the air.

5 Literature

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