

The determination of evapotranspiration demands of *Zea mays* and *Sorghum bicolor*

Zábranský Petr; Pivec Jan; Soukup Josef ; Brant Václav

Department of Agroecology and Biometeorology, Faculty of Agrobiolgy, Food and Natural Resources,
Czech University of Life Sciences Prague, Kamýcká 129, 165 21 Prague, Czech republic, e-mail: zabranskyp@af.czu.cz

Introduction

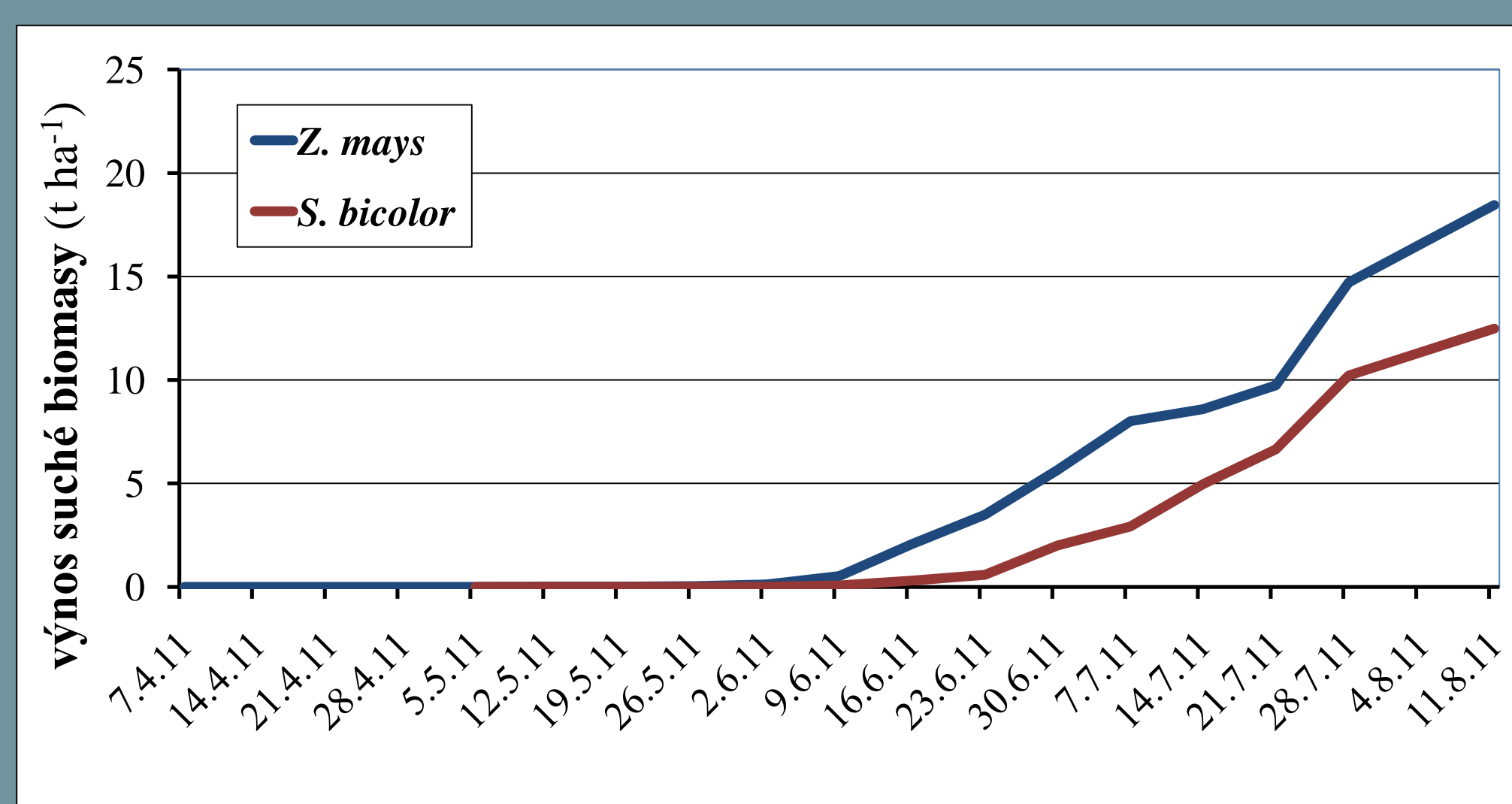
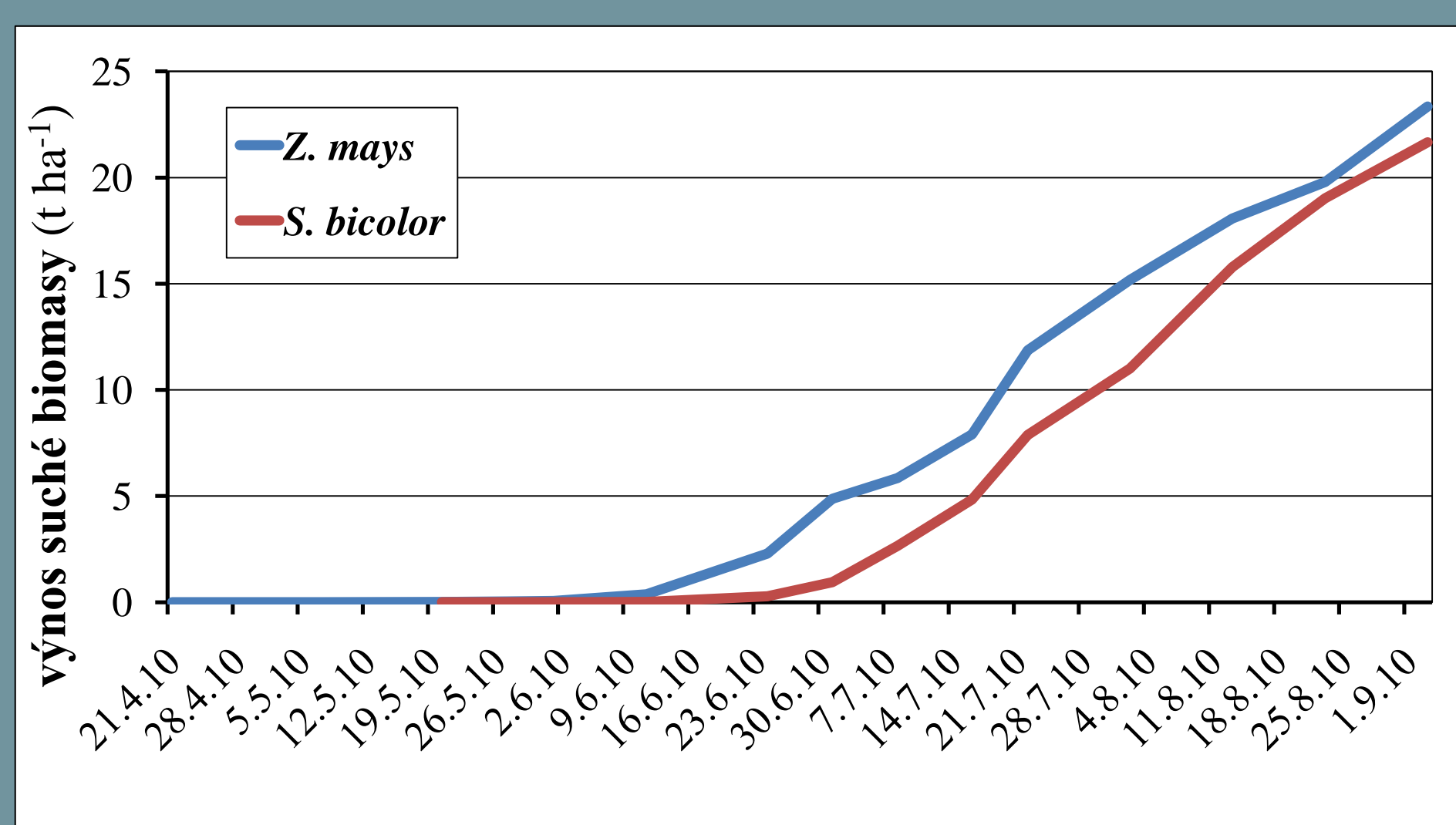
The determination of actual evapotranspiration values of arable crops in areas with lack of rainfall is a prerequisite for understanding how to eliminate its possible influence on landscape water balance. One possibility is the determination of actual evapotranspiration using the BREB system (Bowen Ratio Energy Balance), based on the principle of measuring the gradient of temperature and humidity above the vegetation, which illustrates the dissipation of radiation balance energy in the agroecosystems. The aim of the experiment was to assess the moisture requirements of vegetation in areas with a lack of rainfall in terms of impact on water balance and assess the utilization of water by crops through the determination of Water Use Efficiency (*WUE*).

Materials and Methods

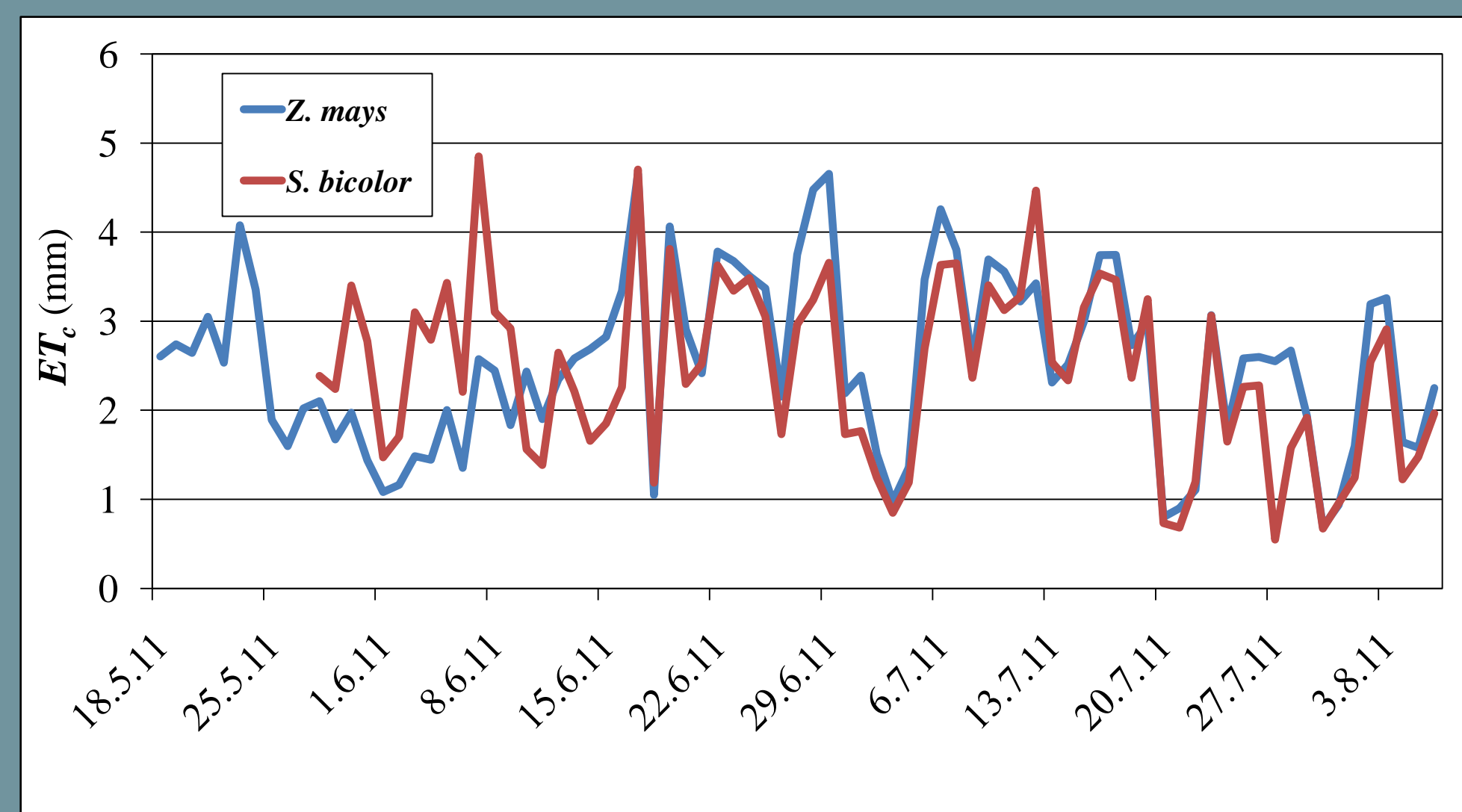
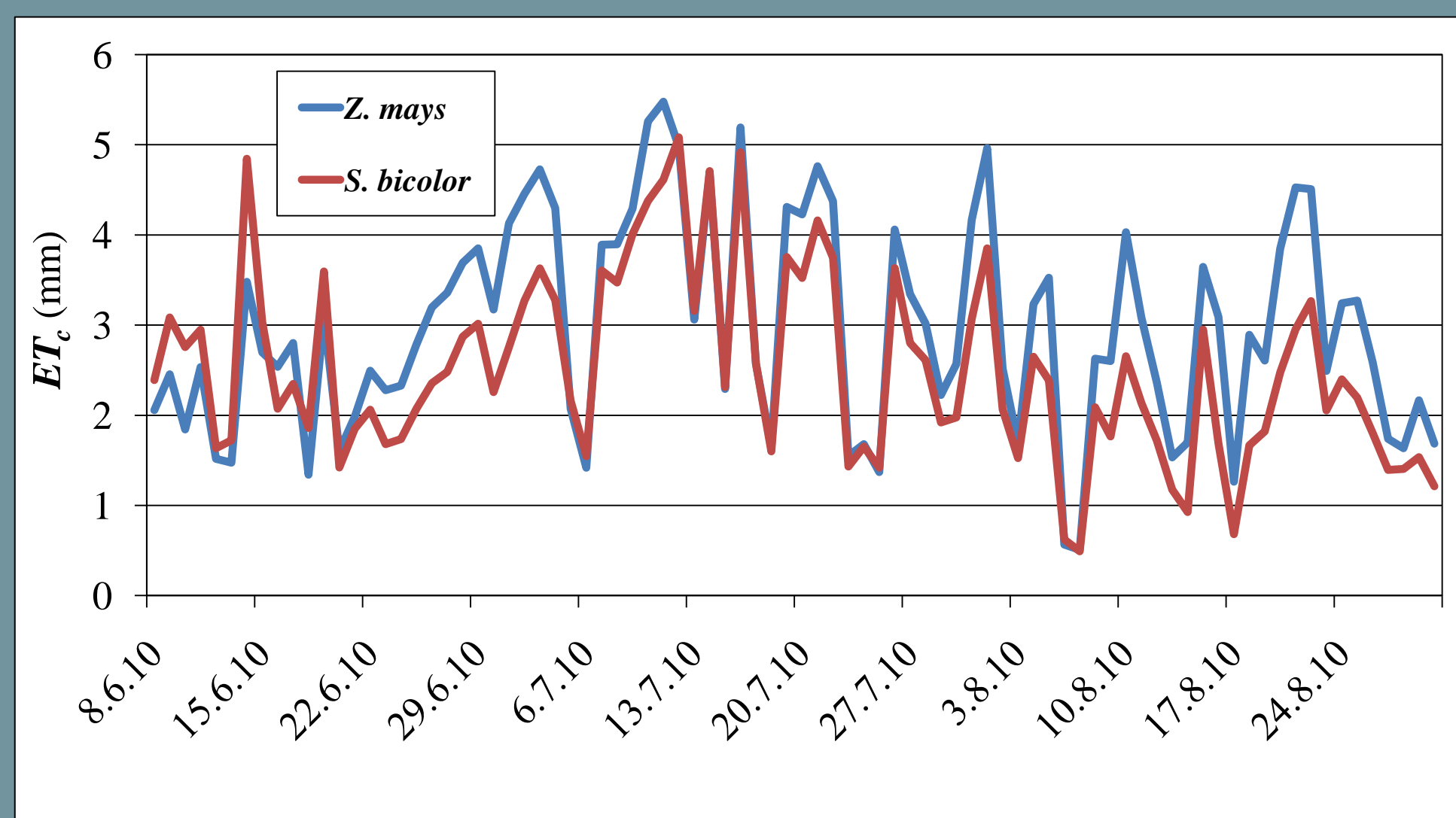
Crop moisture demands of *Zea mays* and *Sorghum bicolor* were evaluated in the field on Budihostice area (Central Bohemia) between 2010 and 2011. The minimum field size was 1 hectare. The both crop plants were cultivated in the rows widths 0.72 m. Actual evapotranspiration values were measured continuously in 10 minute intervals from sowing to harvest. Dry shoot biomass production and growth phase was also evaluated. The result of measurements was to determine daily values of actual evapotranspiration (ET_C , mm day⁻¹) and calculate water use efficiency values (*WUE*, g kg⁻¹ water) by using an increase of the dry biomass production (g m⁻² per period).

Results

From previous results, it is apparent initial slow development of *S. bicolor* crops compared with *Z. mays* due to lower *S. bicolor* shoot biomass production. *S. bicolor* showed lower ET_C values in both years, since the second half of June. On average, the ET_C values of *S. bicolor* were lower by 15% than that of *Z. mays* during the growing period in 2010, in August even by 30%. In July 2011, the ET_C values of *S. bicolor* were lower than that of *Z. mays* by 10% on average (Graph 2). The comparison of *WUE* values is interesting for the first half of July. In this period, *WUE* value for *Z. mays* was 5.1 g kg⁻¹ (2010) and 7.5 g kg⁻¹ (2011). In case of *S. bicolor* the mean values of *WUE* were higher, i.e. 7.2 g kg⁻¹ (2010) and 8.5 g kg⁻¹ (2011) - Graph 1.



Graph 1: Dry shoot biomass yields of maize and sorghum (t ha⁻¹) in the observed periods in 2010 and 2011.



Graph 2: Actual evapotranspiration of crops (ET_C , mm day⁻¹) in 2010 and 2011.

Conclusion

The hitherto results confirmed that *S. bicolor* has lower water demand and can use it efficiently in the main growth period. This fact implicates the conclusion that *S. bicolor* can be suitable as an alternative to *Z. mays* crops (as feeding crops and for usage as energy crops) in the areas with precipitation shortage in the Czech Republic.