Estimation of Basal Crop Coefficient Using Remotely Sensed Vegetation Indices for Center Pivot Irrigated Maize in Southern Brazil

Victoria Bariani C J*[1], Victoria Bariani N M_2, Petry M T[1], Carlesso R[1], Schons de Ávila V[1], Thais Menegaz S[1], Cossetin Antonello M[1]

[1]Agriculture Engineering Department, Federal University of Santa Maria, Av. Roraima, Nº1000, Cidade Universitária - Bairro Camobi 97105-900, Santa Maria - RS. Brazil.
[2]Federal University of Pampa - Bairro Promorar 97650-000, Itaqui - RS. Brazil.
E-mail: cassiane.victoria@gmail.com

Abstract

The partitioning between basal crop coefficient (K_{cb}) and soil evaporation coefficient (K_e) of the crop coefficient (K_c) during the crop cycle is lately been used to develop a more reliable and precise irrigation management. A currently approach under development is estimating K_{cb} using vegetation indices, obtained from remote sensors. This approach allows an alternative and independent procedure in comparison with the classical methodological approach described in FAO 56 or models that simulate the soil water balance using land information; one model that uses this approach is SIMDualKc. This estimation could also be done using surface energy balance models, however, these models present greater complexity and greater number of input data than the conventional K_c-ET_o approach. The objective of this study was to determine the initial, mid-season and late-season basal crop coefficients ($K_{cb\ ini}$, $K_{cb\ mid}$, $K_{cb\ end}$) using historical records of the red and near infrared reflectance of central pivots, to calculate the normalized vegetation index (IV), adjusted for the entire maize growth, in conjunction with soil field and phenology data of seven center pivot fields in Southern Brazil. Eight Landsat5/TM satellite images of 222 and 223 orbits in point 80, and information from these seven maize monitoring fields during 2004/2005 growing season were used. Crop height and crop growth stages, as well as meteorological weather data collected from a weather station installed in the area were used. A density coefficient (K_d) determined using the fraction of vegetation ground cover (f_c) was used for the Kcb estimation through VI, incorporating the impact of both the vegetation density and the plant height. The estimated values were: $K_{cb\ ini} = 0.20 \pm 0.09$, $K_{cb\ mid} = 0.20 \pm 0.95$ and $K_{cb\ end}$ 0.52 ± 0.22, considering 95% of probability. The results showed good agreement with K_{cb} values obtained using SIMDualKc model in a previous study of this research group for the southern region of Brazil, which were $K_{cb\ ini} = 0.20$, $K_{cb\ mid} = 1.12$ and $K_{cb\ end} = 0.80$.

Keywords: remote sensing, NDVI, crop coefficient, SIMDualKc