5.0 SUMMARY

Evapotranspiration is the natural loss of water vapor from soil, vegetation, and open water surfaces to the atmosphere. Evapotranspiration from a well-watered, active crop with full ground cover is determined primarily by meteorological processes and is referred to as potential evapotranspiration. Potential ET can be estimated using net radiation, temperature, saturation vapor pressure deficit or dryness of the air, and windspeed. Surface factors also influence ET. Soil water availability, vegetative cover, and the albedo of soil and vegetation interact to complicate the procedures for estimating actual ET.

Potential ET was discussed as a useful concept in understanding the factors affecting actual ET and as a basis for estimating actual ET for various crops. The Penman method for estimating ET_p was described. Different surface albedo values were used to demonstrate the use of the Penman method in estimating evaporation from a free water surface, E_o ($\alpha = 0.05$), and ET_p for a vegetative crop surface ($\alpha = 0.23$). Because of the difficulty in estimating average surface albedo for crops as they emerge, expand to cover the soil, and then mature and die, the approach developed by van Bavel and Verlinden (1956) was presented. In this approach, E_o is estimated by using $\alpha = 0.05$ in the Penman equation, and the result is multiplied by a k_1 value of 0.7 to provide a reference estimate of ET_p. This reference ET_p value can then be modified by an empirical coefficient that varies with time in the season due to the factors discussed above. The use of this approach may result in ET_p estimates lower than actual ET as demonstrated for corn in Figure 6 and corresponding k_c' values that are larger than 1.0. However, as a practical tool, this procedure eliminates the requirement for descriptions of how surface albedos change with crop stage and ground cover. More sophisticated models that estimate actual ET have been developed and show promise. However, unless specific data are available, it is recommended that the Penman method using $\alpha = 0.05$ and $k_1 = 0.7$ be used to estimate a reference ET_p value for Florida conditions. The k_c' crop coefficients presented in this bulletin are based on ET_p estimates using this approach.

A crop water budget method was used to estimate annual monthly ET_p for various watersheds in Florida and for various crops. In addition, field plot and lysimeter data were used to estimate daily ET for various crops in Florida and the humid Southeast region. These water balance estimates of ET were then compared with other methods for estimating ET_p: the Penman, Thornthwaite, pan evaporation, Blaney-Criddle, a solar-radiation modified Blaney-Criddle, and Stephens-Stewart methods. It was demonstrated that the Penman and Stephens-Stewart methods were superior to the other methods tested. However, the Penman method was adopted as a standard because it is based on physical derivations with less