

Kansas Agricultural Experiment Station Research Reports

Volume 0
Issue 12 *Keeping up with Research*

Article 5

1977

An Easy Method of Estimating Potential Evapotranspiration

E. T. Kanemasu

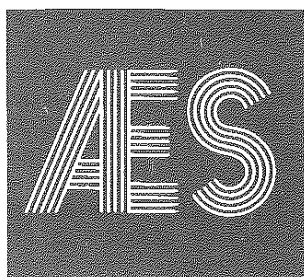
Follow this and additional works at: <https://newprairiepress.org/kaesrr>

Recommended Citation

Kanemasu, E. T. (1977) "An Easy Method of Estimating Potential Evapotranspiration," *Kansas Agricultural Experiment Station Research Reports*: Vol. 0: Iss. 12. <https://doi.org/10.4148/2378-5977.7242>

This report is brought to you for free and open access by New Prairie Press. It has been accepted for inclusion in Kansas Agricultural Experiment Station Research Reports by an authorized administrator of New Prairie Press. Copyright 1977 the Author(s). Contents of this publication may be freely reproduced for educational purposes. All other rights reserved. Brand names appearing in this publication are for product identification purposes only. No endorsement is intended, nor is criticism implied of similar products not mentioned. K-State Research and Extension is an equal opportunity provider and employer.





**Keeping
Up With
Research
30**

APRIL 1977

AN EASY METHOD OF ESTIMATING POTENTIAL EVAPOTRANSPIRATION¹

E.T. Kanemasu²

Stress from lack of moisture reduces crop yields in Kansas more than any other factor. Even irrigation farmers lose potential yields to such stress, particularly by corn, sorghum, and soybeans, usually during July and August.

To help irrigation farmers tell how much moisture is being used and lost by plants, we have developed an easy way to estimate potential evapotranspiration. Potential evapotranspiration (PET) is evaporation from a wet surface that is limited by the energy it can absorb. The more energy it absorbs, the higher evaporation is. So it is much higher on a sunny than on a cloudy day.

PET depends primarily on energy from the sun. Various methods of estimating PET require data on solar radiation, temperature, humidity, and wind speed. Because solar radiation and average temperature are relatively easy to measure, we chose what is called the Priestley-Taylor method of estimating PET.

The National Weather Service and several Agricultural Experimental Stations and Fields measure both solar radiation and temperature—as do other stations around the State

¹Contribution 1638-s, Dept. of Agronomy

²Research Microclimatologist

AGRICULTURAL EXPERIMENT STATION

Kansas State University, Manhattan

Floyd W. Smith, Director

maintained by the Evapotranspiration Laboratory.

Figs. 1-3 show the relationship between daily solar radiation and daily PET at various mean temperatures. The values for solar radiation are given in units used by the National Weather Service: $\text{cal cm}^{-2}\text{day}^{-1}$. For Kansas, a clear summer day would typically have about $650 \text{ cal cm}^{-2}\text{day}^{-1}$; a cloudy day, about 450; an overcast day, about $150 \text{ cal cm}^{-2}\text{day}^{-1}$.

Example Calculations:

Suppose you wanted to know the potential evapotranspiration for corn. The solar radiation was $600 \text{ cal cm}^{-2}\text{day}^{-1}$, maximum temperature was 30°C (86°F) and minimum temperature was 25°C (77°F). You would calculate the average temperature as $(30 + 25)/2 = 27.5^\circ\text{C}$ (81°F). Look on Fig. 1 (wheat-corn) and select the appropriate point between the 30 and 20°C lines. The PET value is approximately 0.24 inch of water. If maximum and minimum temperatures are not available, use the noon temperature.

Actual Evapotranspiration

Under a full crop cover and water not limiting (plants not severely stressed), actual evapotranspiration (ET) and PET are approximately equal. Therefore, under normal cropping conditions ET equals PET for an extended period during the summer—from pre-tasselling to blister stages in corn and from flowering to seed filling in soybeans. Under situations of low crop cover, (e.g. poor stand development, early and late in the growing season, and with winter wheat in western Kansas), actual evapotranspiration can be considerably less than PET. Then, evaporation from the soil surface begins to play an important role. The Evapotranspiration Laboratory has developed a computer program to handle situations of incomplete cover and water stress.

While the above procedure provides only an approximation of daily PET, it allows one to make a quick estimate of daily water loss from several crops during much of July and August in Kansas when irrigation to avoid stress is most important.

Scheduling of irrigation has been determined by the amount of water in the root zone

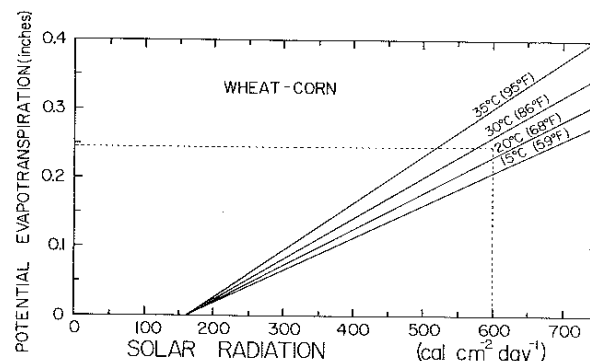


Fig. 1. Potential evapotranspiration for winter wheat and corn as a function of solar radiation and mean temperature.

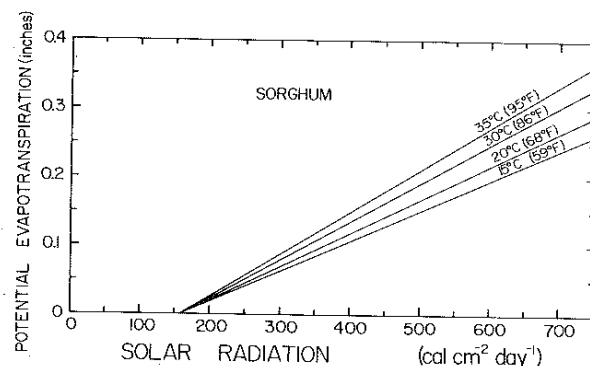


Fig. 2. Potential evapotranspiration for sorghum as a function of solar radiation and mean temperature.

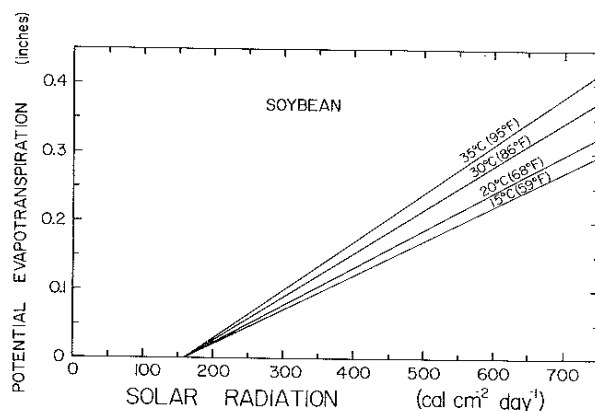


Fig. 3. Potential evapotranspiration for soybean as a function of solar radiation and mean temperature.

and by the growth stage of the crop. Generally, the reproductive stages (heading, pod-forming, tassel-silking) are more sensitive to water stress than the vegetative stage. In Kansas, the amount of water in root zone is primarily controlled by precipitation/irrigation and evapotranspiration. To maintain the root zone at an optimum soil water content, evapotranspiration losses must be matched by rain or irrigation. For example, 2 inch irrigation on corn can be used up in eight hot days (8 x .25 inch).

Publications by the Kansas Agriculture Experiment Station are available to the public regardless of race, color, national origin, sex, or religion.

NOTICE OF NON-DISCRIMINATION

Kansas State University is committed to a policy of non-discrimination on the basis of race, sex, national origin, or other non-merit reasons, in admissions, educational programs, or activities and employment all as required by applicable laws and regulations, including Title IX of the Education Amendment of 1972. Inquiries may be addressed to: Director, Affirmative Action Office, Kansas State University, 207 Fairchild Hall, Manhattan, Kansas 66506, 913-532-6220 or Director, Office of Civil Rights, HEW, Washington, D.C. 20201.