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April 22, 2008

Dr. Gene Nebeker
400 N. Rockingham
Los Angeles, CA 90049

Dear Gene:

In response to your letter of March 25, 2008, the following are offered:

1. Crop Water Requirements for Antelope Valley

Crop evapotranspiration (ET) is by far the largest beneficial use. The potential ET is calculated as the product of crop coefficients and a reference crop ET, obtained from the CIMIS network. Crop coefficients are developed from field studies, either on an agricultural experiment station or in commercial fields, by making direct measurements of the crop ET using lysimeters or meteorological methods and then calculating the ratio of the crop ET to the reference crop ET.

You assembled the document "An Estimate of Crop Water Requirements in the Antelope Valley" dated April 19, 2007 with assistance from University of California farm advisors or former advisors and UC specialists working in crop ET. The document lists estimates of crop coefficients of crops grown in the area in question and historical reference crop ET. After reviewing these data, in our opinion, they are the best available information on this matter and are as accurate as possible for your area. For example, your estimate of the seasonal alfalfa ET is reasonable when compared to estimates for the Imperial Valley or Arizona, both of which have extremely hot summer climates.

2. Relation between Applied Water and Net Water Required for Irrigation

You have described a relation between Applied Water and Net Water as:

Applied Water = Net Water/(Distribution Uniformity – Miscellaneous Unavoidable Losses)

You have defined Miscellaneous Unavoidable Losses to include scheduling difficulties, maintenance, breaks, unexpected pressure losses, and other problems often encountered in the field. In theory, we feel that including the Miscellaneous Unavoidable Losses in the efficiency equation is appropriate, but caution should be used in promoting these losses as necessary adjustments to the water supply. For example, one could argue that losses due to irrigation scheduling difficulties could be avoided if growers paid more attention to water management. Note that in your equation, these losses are expressed as a fraction of the total amount of applied water. Confusion can exist in the appropriate value to be used for distribution uniformity (DU) because of the different definitions of DU. One definition is the catch can uniformity which accounts for the nonuniform water applications due to the sprinkler spacings. However, the field-wide DU not only includes the catch can uniformity (which is usually the dominate factor in the field-wide DU in the valley), but also nonuniformity due to pressure losses throughout the field, leaks, non-vertical risers, and mixed nozzle sizes (which should be avoided).

The field wide DU should be used in your equation. The article, “Practical Potential Irrigation Efficiencies”, (B. Hanson, Proceedings of the First International Conference, American Society of Civil Engineers, August 14-18, 1995) lists estimates of practical maximum irrigation efficiencies based on the practical maximum attainable field-wide uniformities (sometimes called the global uniformity) for different irrigation methods. These estimates are based on irrigation system evaluations conducted by mobile irrigation evaluation laboratories throughout the state.

A reasonable estimate of the field-wide DU of portable solid set sprinkler systems is about 75% under low wind conditions. This means that about 25% of the water reaching the ground surface would be deep percolation assuming no other losses, which in your case, you feel that there are other losses that do not become deep percolation. However, as the wind speed increases above about 5 miles per hour, the catch can DU decreases rapidly, as does the field wide DU.

3. Net Water

We agree that the Net Water in the above equation is the sum of all beneficial uses of water not simply water for evapotranspiration. Other beneficial uses include water to control soil erosion when the plants are small and all water used during the non-growing time periods that include water preceding field preparation, fumigation and “water capping.” These additional beneficial uses can reflect the site specific conditions of your area and grower experience. In our opinion, these additional beneficial uses are reasonable.

4. Fate of the Difference between Applied Water and Net Water

It is frequently assumed that the difference between Applied Water and Net Water is deep percolation. However, you feel that this difference needs to be divided between at least four sinks including losses between the sprinkler nozzles and the soil, pooling in the fields, runoff, and return flows or deep percolation. As you stated, quantifying these values is a challenge, and some cases can only be based on grower experience. Your estimates of these values for the Antelope Valley are:

Return Flow	4% to 25% [1]
Losses between the Sprinkler Nozzles and the Soil	3% to 15% [2]
Pooling in the Fields	0% to 3%
Runoff	0% to 3%

1 Minimum Leaching Requirements are estimated at 4%
2 These losses may be 2 to 5% greater during the hot, dry winds in Antelope Valley

We feel that these sinks are reasonable descriptions of the partitioning. However, the return flow minimum value (based on a leaching requirement of 4%) needs to be adjusted upward. No irrigation method can apply water such that 4% of the applied water is return flow unless the field is severely under irrigated. Basing irrigation water management on minimum leaching requirements is not very practical, in our opinion. A rough guess for the minimum return flow is 15 to 20%. The values for evaporation losses can be justified from research results. A commonly used value is 10% (based on research results); however, it could be more under the Antelope Valley conditions. No research data exists on the other sinks, and thus, grower experience is the only source of these estimates.

Sincerely,

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