Volume 16 No. 2 March- April 2005

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IRRIGATION NEWS

Efficiency Is Also Vital In Big Years

Even with the promise of an above average water year, every grower should continue to improve the irrigation efficiency within their operation. The lessons learned when water is in short supply serve a grower well when supplies are plentiful. After all, unused water becomes carryover for the next year, when supplies can become short again.

Every grower wants to use water efficiently. This means a grower must maximize the beneficial usage of the applied water, and work to insure that the water is applied evenly across the field.

The concept of irrigation efficiency is defined as the amount of water beneficially used divided by the amount applied, multiplied by 100. The amount of water utilized by a crop (crop water use) has been researched to a point that predictive models now exist for many crops, using a reference crop and seasonally adjustable coefficients.

The other component of beneficial use is the leaching fraction, which is determined directly by the grower, based on the actual conditions of the soil. Typically, this is set at 5 to 10 percent of the crop requirement, and is governed by the quality of the water used. Leaching can be done continuously throughout the season or at the end of the year, whichever proves to be more convenient for the grower.

The amount applied is the total acre-feet of water applied minus any runoff, converted to inches (because crop water use is in inches). The remainder is considered non-beneficial usage. In the past, this was considered to be a form of groundwater recharge, especially if the water source was a surface supply. This fraction must be minimized in areas where poor drainage conditions exist. Table One has some common flow rate conversions for calculating the volume applied.

Table One: Common Volume Conversions

Have	To
Gallons per Minute (GPM)	Acre-Feet per Day (AF/day) Divide GPM by 226.27
Gallons per Minute (GPM)	Cubic Feet per Second (CFS) Divide GPM by 448
Cubic Feet per Second (CFS)	Acre Feet per Day (AF/day) Multiply CFS by 1.98
Simply multiply by 12 to convert acre-feet to acre-inches	

Crop water use data, like the weather, can vary considerably from season to season. An example of this variation is shown in Table Two. Crops respond to changes in the weather like anything else, up to a point. For any given climatic condition, the water use of the crop is fixed; meaning that applying more water will not increase the crop water usage. Water is not taken up the same way some mineral nutrients are, where the plant will continue to absorb the nutrient even if its biological needs are satisfied. The physical limitations of water absorption within a plant include solute (dissolved nutrient) balances (both within the plant and between the plant and soil), physical space, and leaf surface evaporation rates.

Table Two: Variations in Crop Water Use for Selected Crops 2000 – 2004 Data

Crop	Average ET	Minimum ET	Maximum ET
Alfalfa	49.8	48.2	50.8
Cotton*	27.9	26.8	29.0
Tomatoes**	21.8	20.3	23.5
Almonds***	39.6	38.1	40.5
Citrus	34.1	33	34.7
Olives	39.	38.1	40.1
Pistachios	42.0	41.1	43.0
Walnuts***	41.3	38.9	43.7

*Averaged between early and mid-April plantings.
**Averaged between March and April plantings.
***Averaged between early and late varieties.

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AgLine Phone Service Returns

AgLine, the KRCD's irrigation scheduling service, is again accessible by telephone. By calling (559) 237-4800, you can obtain the following information: Actual water usage by the Reference Crop, as measured at Parlier, Predicted Water Usage, Last Weeks Water Usage, and Season to Date for 31 Tree and Vine or Field and Row crops. Software limitations allow only one message per call at present, but a future upgrade will support multiple messages per call. The messages are updated on Fridays, as before.

The data is still available at www.krcd.org/water/water_management/agline.

Efficiency Is Also Vital In Big Years *(continued)*

Since the total consumptive use of any crop will not be known until the end of the year, irrigation decisions must be made within smaller windows of time. An efficient time scale for such decisions is on a weekly basis. This allows for the accumulation of sufficient data to see a trend from the previous period and a reasonably accurate prediction of the coming one. The KRCD's AgLine service (call 559-237-4800) is helpful in this regard, as it is programmed to determine water usage on a seven-day basis for a number of crops.

An irrigator can effectively match the applied water to the crop water use and leaching demand, and on paper be very efficient. If, however, areas of the field suffer decreased yields due to over- or under-irrigation, then the lack of uniformity has become a major factor. Effective irrigation strategies must incorporate both concepts to achieve maximum efficiency.

The uniformity of an irrigation system is dependant upon several factors. First, the irrigation method must be appropriate for the soil type and topography. Obviously, surface irrigations should not be done on rolling hills and should not be considered in extremely sandy conditions. But in fields that have gentle slopes, a surface system can be efficient even if the soil textures are less than ideal.

The crop grown is also a factor. Raisin growers have traditionally planted east-west to maximize raisin drying but wine grapes, like many other row crops, are best grown north-south to maximize light interception. Crops that are sensitive to standing water are cultivated so as to maximize drainage, or in the case of rice, borders are made to maximize the efficient holding of water at uniform depths.

Pressurized irrigation systems generally work well on any topography, but these systems must be designed to handle the site-specific conditions. "Cookie-cutter" systems should be avoided at all costs. As a general rule, pressurized systems are capable of high uniformity applications but doing so requires diligent maintenance. In areas where topography is not an issue, lower cost products (non pressure-compensating) are recommended. Where topography is an issue, emitters designed with internal pressure regulation are used to achieve uniform applications.

In areas where flood/furrow irrigation is the preferred method, a couple of practices can be used to improve irrigation performance. During fallow periods or prior to the planting of a permanent crop, laser leveling has been proven to improve irrigation performance. It is typically not cost effective to bring an entire field to a completely uniform grade; rather the reduction of high and low spots within the field is sought. Some growers look to increase the slope slightly at the tail ends of the field to encourage movement of irrigation water during the last stages of irrigation. Once an open field has been leveled, running a landplane across the ground every few years is sufficient to maintain the desired grades. Such equipment should only be used when the soil is dry in order to reduce compaction problems.

Furrow irrigated fields benefit from the use of "torpedoes" during the cultivation process. A torpedo is essentially a steel pipe, typically filled with concrete, dragged behind the implement within each furrow. The torpedo both breaks up any clods within the furrow as well as lightly compacts the bottoms, thus allowing the water to flow slightly faster down the row. This has the effect of evening out the opportunity time (the amount of time the water is present at any given point of a field) and thus improving uniformity.

Shorter row lengths have also been shown to improve irrigation performance. Shorter rows allow the grower to "micromanage" his problem areas, thus correcting any over- or under-irrigated areas.

Chemical amendments to the irrigation water also have benefits to improving irrigation uniformity. Many soils suffer from mid- to late-season crusting problems, especially where surface waters are used. This is caused by the dispersal effect of the water on clay particles at the surface, which eventually clogs the soil pores. Typically, cultivation breaks this crust during the early season but this is not available later on.

Gypsum is added to the soil to combat this condition, but if it were applied in the fall or winter, it would be gone by summer. A recent article in *Western Fruit Grower* magazine (March 2005) by University of California Farm Advisor (Kern County) Blake Sanden described a system where piles of gypsum were placed near the irrigation valves and the flowing water carried the dissolved gypsum down the field (flood irrigated almonds). Since mid season cultivation is not an option here, the use of 75 percent gypsum in this way helped improve the irrigation efficiency for this grower.

The correction of uniformity issues is a complex issue, since the solution must consider the unique conditions present in each field.

If you are having any problems or have any other irrigation related questions, please contact Eric Athorp at KRCD, (559) 237-5567 ext 117.

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