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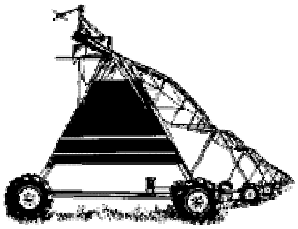

PURDUE EXTENSION

Making a Difference

Irrigation Fact Sheet #14

Irrigation Application Volumes

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Maximum economic yield with minimum amount of irrigation is a goal for most irrigators. Efficient irrigation water use means providing enough water to avoid drought stress, but not so much that water is lost out of the rooting zone or to runoff from the surface. This includes leaving enough water holding capacity to capture the next normal rainfall thus not losing the value of rainfall and also reduce the risk of leaching and run-off.

In the irrigated region of northern Indiana and Michigan evaporate losses during irrigation application are minimal due to high humidity. The humid condition cause several differences in irrigation management for efficiency compared to the arid west.

Early in the season our irrigation goals are often focused on germinating seed and incorporating fertilizers or pre-emergent herbicides. In a normal year, May and early June often receive adequate rainfall to meet the needs of the developing crops and plant roots will grow into moisture that is stored deeper in the soil profile. Chances of receiving additional rainfall in the near future are rather good, so irrigation applications are kept to a minimum with the hope that nature will be providing more water soon. Roots that are not fully established leave only a limited soil water holding capacity capable making small application ideal.

The irrigated sandy loam soils of northern Indiana and southern Michigan require about half an inch of irrigation to wet the soil profile down five to six inches. A single half inch application is often enough to germinate seed, assist in emergence (alleviate crusting) and incorporate fertilizers and pre-emergence herbicides. Heavier loam soils may need 0.7 inch to 1 inch of water to wet the top 6 inches of soil to accomplish these tasks.

By mid-June the crop is near its full rooting depth, increasing the effective water holding capacity and lowering the potential of loss below the roots. At the same time, the potential for rainfall decreases and crop water use increases, allowing producers to increase their application volume to the 0.75 inch per application range. Typical crop water use would be 0.15 inches per day, making one 0.75 inch application last about 5 days.

As July nears, irrigation goals need to switch to maximizing water to the root zone. Potential to loose water below the root zone lessens with higher crop water use and less chance of potential rain fall meeting crop needs. Transpiration is more effective use of water than evaporation from soil or leaf surface, providing an opportunity for irrigators to maximize effective water use by minimizing the time they wet the plant leaf and soil surface. Limiting the number of time the foliage is wetted also reduces the potential for many foliar crop diseases.

Coming into this period, irrigators may want to concentrate on closing in on the soil capacity by nearly filling the rooting profile to capacity, leaving just enough room for predicted rainfall. This is especially true for producers close to or short on irrigation water capacity. Short on capacity could be defined as not having the ability to meet daily water removal, 0.25 inches per day or five gallon per minute pump capacity, for every irrigated acre served by the water supply.

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In the summer of 2012, daily crop water use (E.T.) for many crops exceeded 0.30 inches per day for several days in early July. Maintaining an adequate reserve of soil moisture is a good insurance policy to help plants manage stress during periods of high temperature. To build in a reserve for extended periods of drought, downtime for repairs, or periods of extreme temperatures and wind, irrigation goals during the peak water use period should be to maintain moisture levels high with enough room to capture a one inch rainfall.

According to Michigan State University Extension, if a producer's irrigation capacity is low, this means that the grower should be starting to irrigate prior to peak use or during rainy spells to build moisture level. Many irrigators started too late and could never regain good soil moisture level during the drought of 2012. If you have the capacity to provide one inch every three days, you can afford to gamble on receiving rainfall. For most producers, starting late can lead to poor irrigated yields.

At times of peak water use, the application volume could be as large as 1.5 inches for four to five days of water use. It is all about efficiency. The plant most effectively uses water is through transpiration. Water that is lost from evaporation at the soil surface or on the leaves is less beneficial to the plant, providing only a temporarily cooler environment. Small application may help in evaporative cooling during pollination or other crucial times, but reduces the amount of water that actually gets to the roots compared to fewer large applications totaling the same amount.

Compare two irrigators using the same total amount of irrigation water in a season: One irrigator makes five one-inch applications during the peak water use period compared to another producer making 10 half-inch applications. Assuming that there is about 0.10 inches of evaporation loss from the soil surface and foliage, the irrigator making five one-inch applications will get 0.5 inches more water into the root zone.

In some situations, irrigators have equipment that applies water faster than the water can infiltrate into the soil. In these situations, smaller application volumes will reduce the potential for runoff or uneven application to the roots. Sprinklers that provide larger wetted diameters will have less runoff issues. Matching sprinkler performance to field/soil conditions and leaving more crop residue on the soil surface are two methods to reduce potential runoff without increasing evaporative loss from increased number of applications.

Late season applications are lowered as crop water use declines with increasing crop maturity. At the dent stage of development, corn water use can be as little as 0.15 inches per day on a 75 degree day. The chance of receiving rainfall increases during this portion of the growing season. Applications of 0.75 inches at the beginning of this period may quickly decline to 0.50 inch as the crop nears black layer or maturity.

Crop water use estimates can assist producers in irrigation decision making. A good source of E.T. rate charts for the most commonly irrigated crops is Irrigation Scheduling Checkbook Method from the University of Minnesota. Additional irrigation scheduling information can be found at the MSU irrigation website.

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