# Prepare for the 2007 Potato-Irrigation Season
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Recent April showers may have delayed potato planting in some areas, but when you live in a dry climate like Idaho, most any precipitation is welcomed. Yet, just as surely as producers will plant another potato crop, they will need to irrigate it during the summer. Potatoes are particularly sensitive to water management, and yield and quality can be significantly reduced by both applying too little or too much water.

Applying too little water can reduce the number of tubers, produce undesirable tuber shapes, and increase potential for tuber problems such as translucent ends. Over-irrigating can leach water-soluble plant nutrients below the potato root zone and increase disease potential. Therefore, to minimize potential problems and achieve maximum yield and quality, irrigation equipment must be designed, maintained, and operated to uniformly apply the correct amount of water.

The amount of moisture that can be stored in the soil in combination with irrigation system capacity must be able to provide sufficient water during the highest water use parts of the season. There are advantages and disadvantages to both continually-moving and set-and-move systems. While most hand-line, wheel-line and solid-set systems are designed to meet peak water demand, uniformity of application can be challenging. On the other hand, while pivots can uniformly apply water, many systems in Idaho only meet 80 to 90 percent of peak demand.

If very little stored soil moisture is available at the beginning of the peak water-use period and the system is unable to meet daily water use, the crop will become progressively more water-stressed until the system can again meet daily water demands. Similarly, if the crop root zone is nearly filled to field capacity at the start of the peak water-use period but system capacity is grossly inadequate, the crop will become water stressed. To avoid either situation, the system should have sufficient capacity and the 1.5- to 2-foot deep root zone should be filled to field capacity before the peak water-use period. Evaluate the adequacy of a center-pivot system by determining application efficiency, long-term average crop water use or evapotranspiration (ET), and seasonal ET for higher than normal ET years.

Let's first look at application efficiency (AE). Only a portion of the sprinkler applied water reaches the potato crop root zone. The rest is lost to evaporation, wind drift, system leaks, and non-uniformity of application. AE for a well-maintained center-pivot is about 85 percent but can drop to 70 percent for a poorly-maintained system. AE for solid-set or set-and-move systems under low to moderate wind conditions is about 70 percent, and drops to 65 percent with higher wind speeds. Another way of looking at AE is that to place one inch of water in the crop root zone, the gross amount of water needing to be applied would be 1.25 inches for 80% AE (1.0 ÷ 0.8), 1.4 inches for 70% AE, and 1.5 inches for 65% AE.

Most center pivot systems are designed to deliver a gross irrigation amount of 6.5 gpm/ac in eastern Idaho, 6.5 to 7 gpm/ac in central Idaho, and 7 to 7.5 gpm/ac in western Idaho. With an application efficiency of 80%, in 24 hours these systems could apply a net amount of water to the crop of 0.28, 0.30, and 0.32 inches/day (in/d) in eastern, central, and western Idaho, for rates of 6.5, 7, and 7.5 gpm/ac, respectively. What this means is that if the crop water-use exceeds these amounts (0.28, 0.30, and 0.32 in/d), then the difference must be supplied by soil moisture storage.

A 30-year average and the 2004 average ET for Russet Burbank at Kimberly, Idaho are shown in Figure 1. Note that a 7.0 gpm/ac center pivot operating continuously in mid-season could meet the long-term average peak ET. However, long-term averages tend to under-state the peak needs in any one year. Therefore, individual year ET data such as shown in Figure 1 for 2004 are more useful in determining the capability of an irrigation system to deliver adequate water throughout the growing season. Producers could likely expect variability, such as that shown for 2004, to occur any year.

Water use can be quite variable, which makes predicting the irrigation amount difficult regardless of the type of irrigation system being used. Producers should use more than one method to predict how much water needs to be applied. One good tool that will give a producer a glimpse into the near future is to use the water use (ET) charts found at http://www.usbr.gov/pn/agrimet/id_charts.html. These charts tell you what has been used the past 7 and 14 days as well as forecast what is likely needed. There will likely not be an Agrimet location next to your potato fields, but these charts can still be used as a tool for managing irrigation scheduling along with other methods, such as tensiometers, other moisture-sensing devices, and the "feel method."

For systems not capable of meeting peak demands on low water- holding soils, consider renozzling to a higher application rate (if surface runoff is not a problem) with additional water supplied from another source. If additional water is not available, consider one of two options: 1) reduce potato acreage and re-nozzle to meet peak ET by using water from corners or the end-gun area, or 2) plant half the pivot to grain and half to potatoes. Although this is less convenient, grain irrigation can usually be curtailed by the time potatoes need extra water. This second option can also be less than convenient for pivots without programmable panels, but it can help alleviate water stress.

Replacing nozzles may not only help in being able to apply the needed water, it may also help with irrigation uniformity—how evenly the water is spread over the irrigated area. Poor uniformity causes the same problems as over- and under-irrigating. Poor system uniformity in pivots and linear-move systems can also be caused by plugged or sticking pressure regulators or by nozzles placed in the wrong location.

In general, pressure regulators on low-pressure systems have a useful life of 10,000 to 14,000 hours (about 5 to 7 years), depending on the quality of the irrigation water. As regulators age, the moving parts within them tend to stick in one position, particularly in water with high levels of dissolved minerals. As a result, the output of a 15 psi regulator may range from 5 to 25 psi, creating bands of over- or under-watering.

Adding to poor uniformity, a surprisingly number of pivots have had nozzles installed in the wrong location producing bands of over- or under-watering. Therefore, taking time to double-check nozzle location on a new or re-nozzled system is certainly worthwhile.

Correct system operating pressure is essential for good water application uniformity not only for center pivot systems, but also solid-set or set-and-move systems. Poor uniformity can be produced by either insufficient or excessive system pressure. Optimum pressure for brass nozzles is about 40 to 60 psi. At lower than optimum pressures, more large water droplets are formed producing uneven watering patterns. Excess pressure produces more small droplets which are prone to wind drift and evaporation.

Another factor to consider for proper irrigation is to match irrigation rate with how rapidly water will move into the soil, the infiltration rate. Water that does not move into the soil and runs off the field is truly wasted water. Runoff can be reduced or eliminated by reducing water application per irrigation to match available surface water storage, using reservoir tillage to increase surface storage, and by proper selection of water application packages to match infiltration rate.

Reservoir tillage increases surface storage by forming miniature ponds between potato rows. These "mini-ponds" can store up to 0.75 inch on 0 to 2 percent slopes, 0.5 inch on 2 to 5 slopes and about 0.25 inches on slopes greater than 5 percent.

On soils prone to surface sealing and runoff, water should be applied in droplets that produce the lowest kinetic energy per unit area—applying smaller droplets over a larger area. Some application packages (Wobblers, Iwobs, Spinners) apply water in all areas of a wetted circle at once resembling a gentle rainfall. Others, such as rotators, apply water in a few slowly-rotating high-intensity streams, which apply more kinetic energy per unit area and produce more severe crusting and runoff.

Within the "gentle rainfall" group, Spinners will produce smaller droplets. Droplet size for the Wobblers or Iwobs can be reduced by increasing pressure. Although spray nozzles are inexpensive and can produce small droplets at the correct pressure, the wetted diameter is only about 20 feet, or only 20 percent of the area covered by all the application packages listed above. As a result, the application rate is about five times higher under the spray nozzles making them more prone to surface runoff on the outer pivot spans.

In summary, proper irrigation management is essential for minimizing the potential for disease and optimizing potato yield and quality. Design and maintain your irrigation system to assure application uniformity and to be certain the irrigation system is designed to meet peak-season water requirements, considering potential root zone water storage. Early season water management should fill the crop root zone for later use during peak ET. Carefully match water application to crop ET use during the entire season.

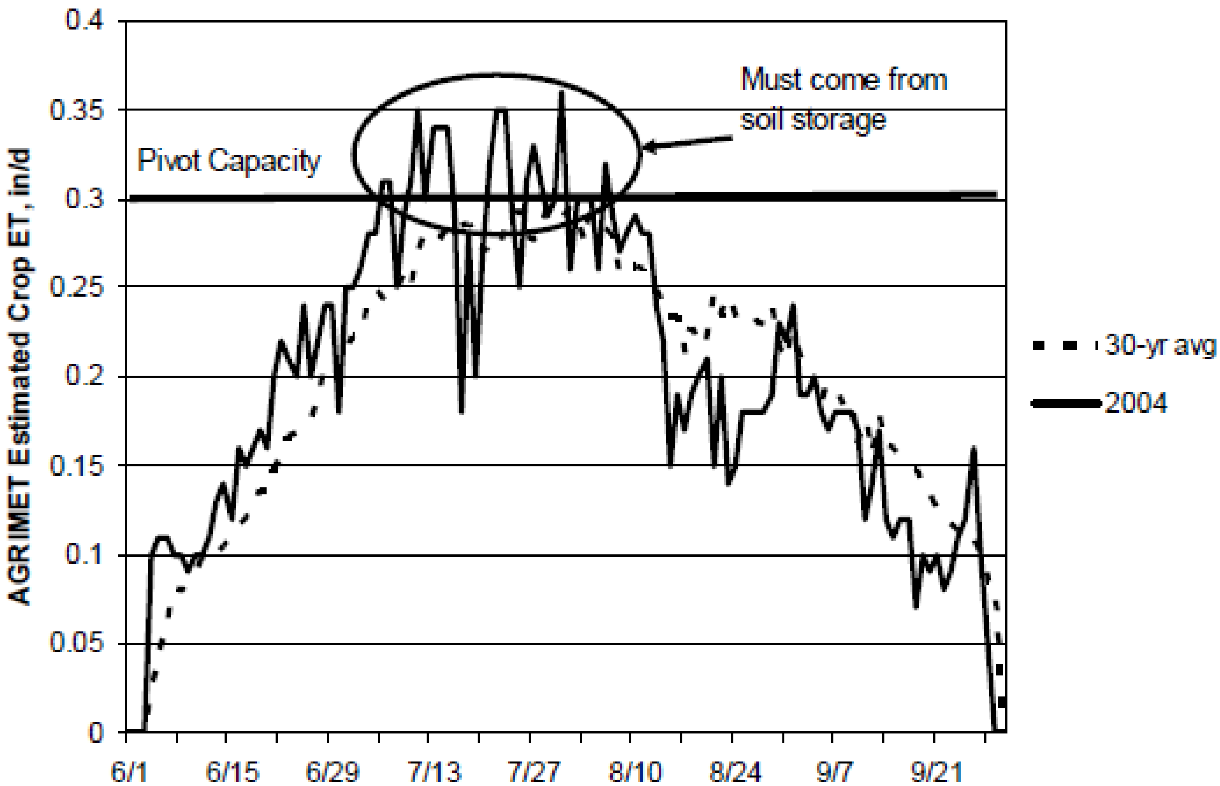


Figure 1. 30-year average and 2004 estimated ET for Russet Burbank potatoes at Kimberly, ID. Pivot capacity is 7 gpm/ac (0.3 in/d net irrigation)