Talking Points About Irrigation in Hot Weather (usually late July - mid-September)

FOR ALL IRRIGATORS

Irrigation during hot weather is much less efficient (more is lost to evaporation and seepage before it reaches the plant). In the extreme, it can be 0% Efficient when hot winds evaporate all the applied water from sprinklers or the ditch soaks up all the water that was supposed to make it to the field. You get much less bang for your buck irrigating hot August weather as cooler June weather.

The only way to be sure your irrigation is efficient is to check your soil moisture with a soil probe, shovel or soil moisture sensor. Look in the soil for the answer.

FOR FLOOD IRRIGATORS

Most folks have seen for themselves that it's just plain harder to irrigate in the hot part of the summer, especially after a break for cutting or your trip to Hawaii.

Hot Dry Ditches With Mature Vegetation Soak Up More Water

Most have ditches that are used intermittently soak up a lot more water in the hot season. In the spring ditches are moist from spring rains and snowmelt and don't soak up as much. Also, in spring the ditch-side plants are not as mature and don't dry out the ditch much. But when it's hot, and there's a break for harvest, that ditch can soak up a lot of water.

More Water Evaporates From Hot Fields

Its obvious that more water evaporates when you put it across hot fields.

More Water Evaporates From Pastures When Slowed By Mature (taller) Plants

Surface irrigation water flows pretty well across croplands in the early season when plants are smaller and there is less to push through. Later in the season (hot period), especially in pastures, there is just a lot more vegetation and surface debris to slow down water and make it more susceptible to evaporation.

Tailwater May Raise Stream Temps

Flood irrigation systems that have tailwater which returns to a stream may raise water temperatures and harm fish. Some options are to: 1-adjust irrigation timing for cooler periods, 2-divert tailwater to wetlands or other off-stream areas or 3-manage irrigation to eliminate tailwater.

FOR SPRINKLER IRRIGATORS

More Water Evaporates In Hot Weather and When The Crop Is Tall

Early in the season when temperatures are cool and crops low, most irrigation water enters the soil and is effective at growing the crop. In hot, windy weather, over ½ inch of each application may evaporate from crop and soil surfaces. This may cool plants but doesn't created yield.

It Takes A Lot Of Water To Catch Up After Haying

After haying or other mid-season interruption it can take 3-5 inches of water applied in one week to recharge the surface 1 foot of soil. You have to apply enough to account for evaporation (.5 inches), weekly crop water use (1-1.5 inches) and the moisture holding capacity of the surface foot (1.5-2.5 inches). Many sprinkler irrigation systems simply can't put on this much water to catch up so plants are continually stressed after cutting.

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SOIL MOISTURE – WHY IS IT SO HARD TO INCREASE IT NOW?

If you check your surface soil moisture after haying, you don't need to be a soil scientist to know it's dry. Even though you chopped off all those plants heads, their remaining stems and leaves still dry the soil out. The week after cutting hay, crops remove about 1/3 as much soil moisture and the second week about 2/3 as much as before cutting.

So now it's your job to boost soil moisture and it just seems a lot harder and takes a lot more water than it did back at the start of the season. And you are right! This is why we encourage aggressive irrigation during the cooler season and reduced irrigation in July and August. When its hot irrigators must fight an uphill battle to overcome higher crop water use and evaporation loss.

Sprinkler Irrigators who want to refill a dry surface soil to its moisture-holding capacity have to divert and apply enough water in a week to:

- Satisfy weekly crop water use (1½ to 2 inches per week in hot weather)
- Account for evaporation from crop and soil surfaces (½ inch)
- Only then can you increase soil moisture (remember the first foot of soil can hold 1 ½ to 2 ½ inches of water)
- So, if the surface foot of soil was dry to start you need to apply 3 to 5 inches in a week to fill up the surface foot of soil which makes catching up difficult
- In the cooler part of the season filling up a dry surface soil takes only 2-4 inches
- **SOLUTION**: Check soil moisture using a probe, shovel or sensor to make sure you are actually increasing your soil moisture.

Flood irrigators also have a bigger challenge during hot, dry weather:

- More water evaporates from the soil surface when its applied to hot fields
- Water distribution across fields is impeded by more crop debris on the ground later in the year
- Water distribution across fields is impeded by soil absorbing water more quickly when dry
- Tailwater from hot fields may raise stream temperatures and affect fish
- **SOLUTION**: Flooding with larger volumes of water for shorter periods may help push water across fields quicker. Check soil moisture using a probe, shovel or sensor to make sure you are actually increasing your soil moisture.

Ditch Users have special challenges and may be sprinkler or flood irrigators:

- If the ditch is used intermittently, it dries out between uses but not much in early season.
- At the start of the season the ditch is cool and moist from spring snowmelt and rain so less water is absorbed by the ditch and lost through leakage and evaporation.
- Later in the season much more water evaporates when water is turned into a hot ditch and runs through hot air.
- Later in the season the ditch dries out between uses and then absorbs more water before it can reach its destination.

For Challenge Irrigation Report 8-6-2021

Irrigation Efficiency – High in Spring, Low in August

Last week we talked about how much harder it is to increase soil moisture this time of year when its so much hotter. Irrigation is just much less ***efficient*** in hot weather meaning its harder to get water **from the source to the plant**. In irrigation, we talk about several kinds of efficiency:

Overall Irrigation Efficiency

Overall irrigation efficiency is ***the percentage of diverted water that actually gets used by the crop***. Under perfect conditions such as a well water source piped to a pivot in the early season when the crop is low and temperatures are cool, irrigation efficiency can be high – 80 to 90%.

A long leaky ditch serving an undulating flood irrigation system with a gravelly soil in the hot part of the season may have an irrigation efficiency less than 10%. In the extreme, it can be 0% when hot winds evaporate all the applied water from sprinklers or the ditch soaks up all the water that was supposed to make it to the field.

Conveyance Efficiency – How much of the diverted water reaches the field.

A steel pipe in good condition has a conveyance efficiency of 100% since no water is lost between the water source and the field. A leaky ditch can have an efficiency as low as 0% if the amount of diverted water doesn't reach the field due to seepage and evaporation. Most irrigation districts in western Montana lose 50% of the water they divert from streams in ditch loss. Where ditches are near streams or shallow aquifers, some of the water is returned and reused. However, many of these ditches cross high and dry landscapes where the seeped water is lost. This is the focus of ditch-lining and enormous sums have been spent on these projects in Montana.

Field Efficiency – How much of the water that gets to the field reaches the crop.

Field Efficiency or Application Efficiency is most affected by irrigation system type. Pivots are generally considered to be about 80% efficient, wheel lines about 70% and hand lines about 60%. However, these figures are for ideal conditions and can vary dramatically with crop height, weather and other factors. Flood irrigation systems are usually considered 30-50% efficient however, I have seen well-run flood systems in the Blackfoot drainage that approach wheel line efficiency. Field efficiency is reduced by evaporation, run-off and percolation below the crop root zone. Although it doesn't benefit the target crop, run-off and deep percolation can be used by others if close enough to a stream or aquifer.

Seasonal Irrigation Efficiency – Irrigation is More Efficient In Cool Weather Than Hot

If you apply ½ inch of water on a cool day in April, most of it will enter the soil and be used by the crop. If you apply the same ½ inch on a hot windy day in August, all may be lost to evaporation from crop and soil surface reducing irrigation efficiency from 90% to 0%. With wheel and hand lines you can often see the difference in daytime sets vs nighttime sets. Even during the early irrigation season you need to adjust your irrigation based on cool vs dry weeks. Generalized system efficiency figures used by the NRCS and others do not account for seasonal differences, weekly differences or even the daily differences we see out in the field due to weather.

Flood to Pivot Conversion Projects

There are lots of considerations in converting from flood irrigation to pivots and one big on is irrigation efficiency. When you compare the amount of water diverted for flood systems to the amount actually needed by the crop you usually find that 3-4 times as much water is diverted as the crop needs (15-25% efficient). Systems with very leaky ditches may be less than 3% efficient (97% of the diverted

water is not needed by the crop). Organizations like Trout Unlimited have completed numerous projects to help irrigators convert from flood to sprinkler irrigation and keep more water in streams.

However, in some cases, there are actually benefits to what seems at first like a waste of water. Flood irrigation systems sometimes recharge streamside aquifers and wetlands that slowly release the water and help maintain late season stream flows. Flood systems help keep the watershed “sponge” wetter, longer. Preserving water high in the drainage can benefit all downstream users to the ocean.