IRRIGATION WATER MANAGEMENT

NRCS MONTANA - IWM - SURFACE IRRIGATION

What is Irrigation Water Management? (IWM)

Irrigation Water Management (IWM) is managing the rate, amount, and timing of water application according to the seasonal crop needs giving consideration to the soil intake and water holding capabilities. The frequency and amount of water applicatioins are managed to obtain optimum yields, use the appropriate amount of water based on soil moisture and crop water usage.

Soil and Water Resources

In most cases, irrigation water management will reduce water losses due to runoff, deep percolation, evaporation, leaks or seepage. It also will take advantage of any effective rainfall.

Groundwater quality is improved by reducing nutrient and pesticide leaching. The nutrients in each inch of water that is prevented from leaching below the crop's root zone remain available for plant use. For example: An acre-inch of water leached below the root zone of an acre of corn carries about 5 lbs. of nitrate nitrogen with it.

Reduced runoff keeps sediment and attached nutrients and any soluble substances from reaching surface waters.

Drought and Limited Water Sources

IWM is particularly important during dry years, or where water is in limited supply. Knowing when the crop is in a critical growth stage when water is needed for maximized production can make for a successful crop. Flow measurement becomes a "must" under these conditions. Spreading the available water over the entire field may not provide adequate water for most plants to produce any yield. The same volume spread over a smaller area of the best part of the field may produce a good crop yield from that portion of the crop (further details - Page 2).

Requirements of Irrigation Water Management

The adage "You can't manage what you can't measure" is very true in irrigation. It is the starting place for each irrigation set. There are many flumes, weirs, and meters that can be used to determine the amount of water delivered to each field or row. The ramp (Replogle) flume is inexpensive, and can be used in a trapezoidal ditch, with minimal head loss. It can even be made as a portable flume, to be used in more than one location. Most measurement devices will have only 2-6% error when properly installed and operated.

With the knowledge of the flow rate available, the next step is to determine the soil moisture conditions. With practice, many irrigators can develop the skill to roughly determine the existing soil moisture by feel and appearance.

A photographic guide brochure on the "Feel and Appearance Method" is available from local Conservation Districts and NRCS Field Offices.

Soil Moisture Measurement Methods and Tools

One easy to use, inexpensive tool to keep track of existing soil moisture in sandier soils is the tensiometer.

Tensiometers can be "nested" together in a field at two or more depths, to check the full root zone.

Moisture lost or gained in the soil is exchanged from a tube through a ceramic tip on the end of the tube. Vacuum pressure within the tube is measured by a pressure gauge, as water fills or evacuates the tube into the soil. Gauge readings are calibrated to soil moisture levels.

Another easy to use tool is the resistance block. Electric wire contacts are imbedded in a ceramic or similar material block. These blocks are buried into the soil at two or more depths and "nested" at one or more locations in the field. The wire leads extended to the surface of the ground are connected to a hand-held resistance meter. A DC current passed through the block responds to the resistance variations of moisture in the block.

Soils Information

Table 1. Approximate available water capacity for various soil types.

SOIL TYPE	Available water in upper 3 feet of soil profile (inches)
Silty clay and clay	4.9
Silty clay loam or clay loam	6.9
Silt loam over Silty clay, or Clay	5.2
Silt loam	7.1
Loamy sand	3.8
Fine sand	2.8

For soils that do not have restrictive layers, and have an adequate supply of water throughout the root zone, 40% of the crops water extraction occurs in the upper quarter of the root zone, 70% in the upper half of the root zone (Fig. 1).

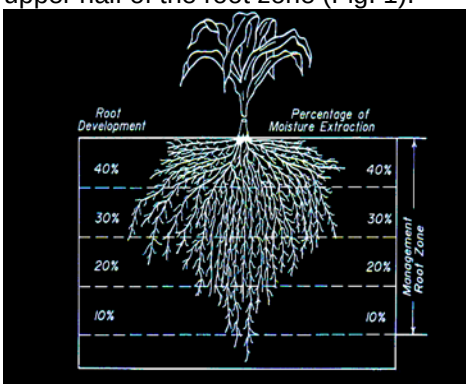


FIGURE 1

A restrictive layer could reduce the effective root zone water even further.

During years of low water availability, planning your irrigation set times and flow rates to sink in from one-half to two-thirds of the root development depth, will reduce the deep percolation losses beyond the root zone. BUT, remember you may need to irrigate more frequently during the year.

Newer Technology Aids Available for Water Management

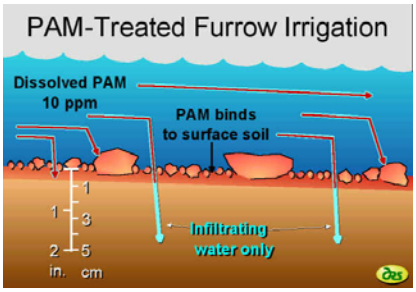
Surge Valves

A surge valve is an automation device that connects with gated pipe to deliver water to two or more sets on each side of the valve. Water enters the "T" shaped valve from a hydrant or pipe from a head gate.

An internal disc pivots to the left or right to direct the flows for pre-set time periods. The disc is controlled by a microprocessor and powered by a solar cell charged battery. By switching from side to side, a surge or flush of water will advance in segments down the furrows or borders left and right of the valve. This wetting advance and soaking cycles limits the amount of deep percolation and runoff, making for more efficient use of the water. It often allows two or more short set times to be combined and reduces labor for those set changes as well.

Irrigation Induced Erosion

Anytime water flows over the earth, it is likely to move soil particles with it. An increase in slope or water velocity generally increases erosion.



PAM or polyacrylamide is an additive to irrigation water that gathers and chemically binds lose soil particles that are dislodged in the advance flow down a field. The PAM, with collected soil particles settles to the soil surface. These larger lumps of soil are more resistant to dislodging and water movement. Nutrients that are attached to these soil particles remain in the field where the crop can use them. These nutrients normally attached to runoff sediments can pollute wetlands or streams that collect the sediments.

At the ground surface, there are larger pores formed between these soil lumps. This creates an additional benefit of increased water infiltration.

For further information contact your local NRCS field office

The table below lists some information that is specific to the site and irrigation system for which you recently requested assistance from NRCS. There may be more information as well, so don't be afraid to ask at the local office.

CROP ROOTING DEPTHS

GRAIN_____ ALFALFA _____ _____

CORN _____ BEETS _____ _____

SOIL WATER HOLDING CAPACITY (BY FOOT) 1_____, 2_____, 3_____, 4_____, 5_____

GROSS WATER APPLICATION / SET TIMES _____

SUGGESTED FLOWRATE INTO EACH BORDER / FURROW CFS GPM