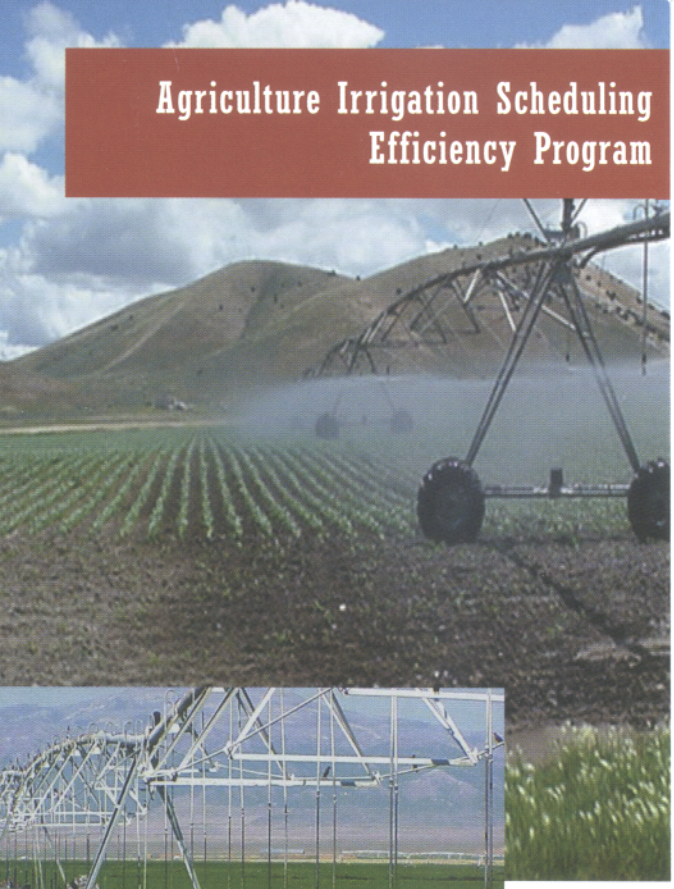
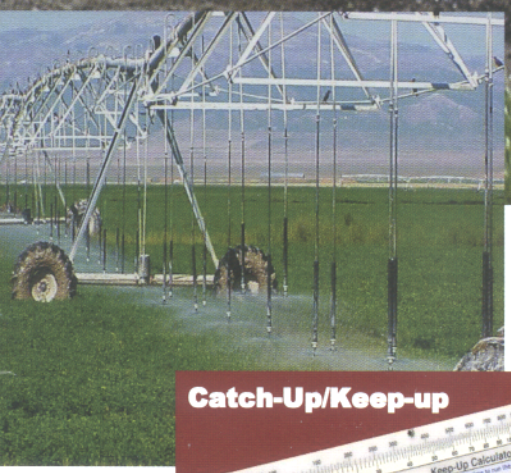
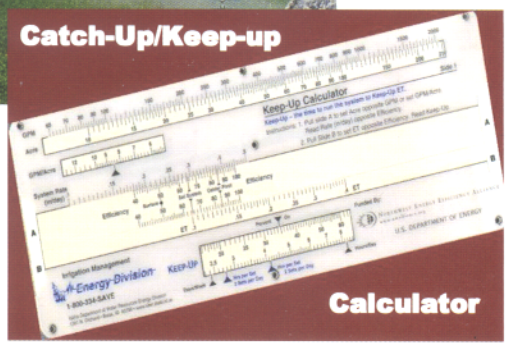
Agriculture Irrigation Scheduling Efficiency Program







Catch-Up/Keep-up

Calculator

Energy Division

Helping Idaho's Agriculture...

Evapotranspiration - ET

Evapotranspiration, or ET as it is called, is the amount of water that is transpired by a plant and evaporated from the soil.

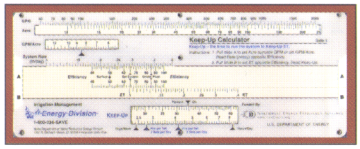
ET is influenced by crop type, weather conditions, and growth stage of the crop. When the crop reaches the stage where the canopy of the crop covers the ground, maximum ET occurs.

ET is important because it is the water used by a crop for growing and cooling. The ET number is directly related to the amount of water depletion from the soil that must be replaced by either rain or irrigation to maintain a healthy crop.

The application of water must be done so that no yield reduction occurs in the crop and energy use is kept to a minimum. Applying more water than the crop can use wastes water and energy and can cause chemicals from agriculture practices to leach into ground water. Applying too little or too much water stresses the plants, making them more susceptible to insects and disease, and causes a reduction in yields.

Since ET varies with crop type and growth throughout the season, applying the proper amount of water at each irrigation is critical.

The Catch-Up/Keep-Up calculator will help to manage irrigations in response to ET.



To use the calculator, the following parameters must be known:

- Acres irrigated
- Gallons per Minute (gpm) of system
- System Application Efficiency
- Water Holding Capacity (WHC) of soil
- ET

The current ET rate can be obtained from the AgriMet web site at: www.usbr.gov/pn/agrimet

APPLICATION EFFICIENCY	
Drip	90%
Center Pivot	85%
Linear Move	85%
Set System	65%
Surface (Furrow)	50%

Crop	Root Zone depth (ft)	Maximum Depletion (sm)
Potatoes	2	70
Beans	2	65
Corn	3	60
Alfalfa	4	55
Sugar Beets	3	50
Mint	3	60
Onions	1.5	70

Soil WHC	in/ft
Sand	0.4
Loamy Sand	0.9
Sandy Loam	1.7
Sandy Clay Loam	1.7
Loam	2.1
Clay	1.9
Clay Loam	2.0
Silty Clay Loam	2.1
Silt	2.1
Silt Loam	2.4
Silty Clay	2.0

Numbers given in tables were obtained from information acquired from the University of Idaho. Your actual numbers may vary.

How to Keep-Up
Using the calculator to maintain irrigations with ET

How to calculate the number of days, hours per day, and the percentage of water the system will need to run at the given ET rate:

Look at the Keep-Up side of the calculator.

Pull Slide A so the number of Acres is opposite the gpm of the water source. This will give the gpm/Acre. If the gpm/Acre is already known, set the gpm/Acre scale on Slide A to that number.

Pull Slide B so the ET rate is opposite the System Efficiency on slide A.

Read the Percent On, Hours/Day, or the Days/Week that the system will need to operate to Keep-Up.

Example:

Known parameters:

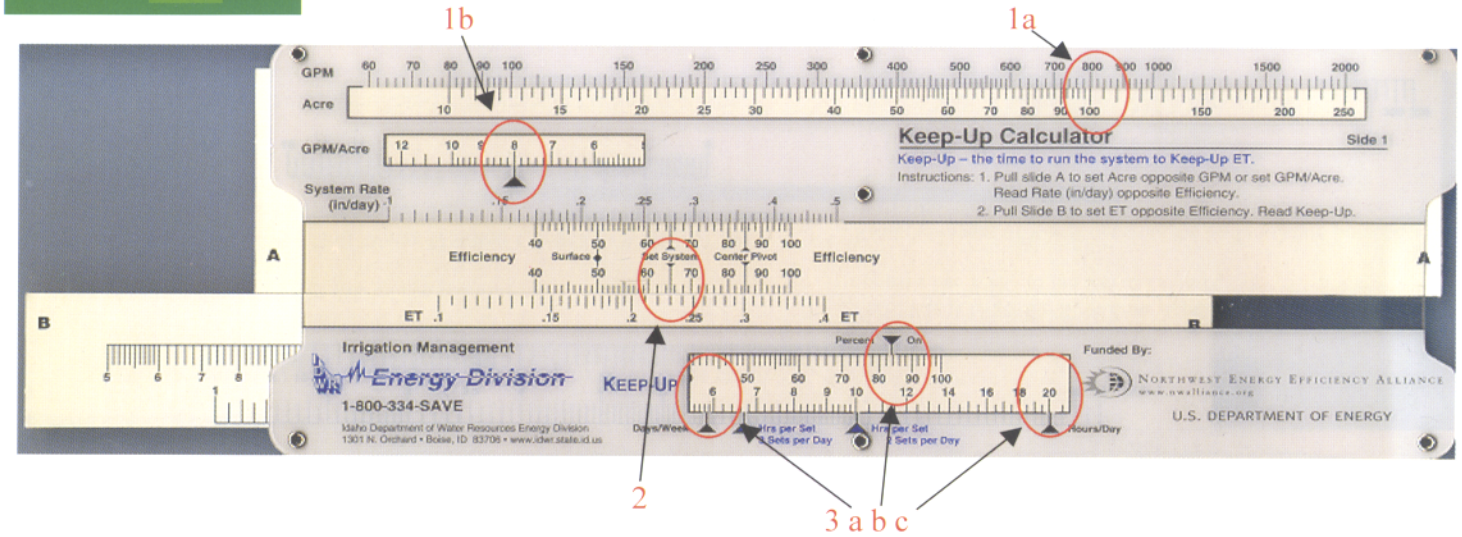
Field Size	100 Acres
System Flow Rate	800 gpm
Daily ET rate	0.23 in/day
Set system efficiency rate	65%

1. Find the gpm/acre.
   a. Pull slide A to set 100 acres opposite 800 gpm. Read the system rate of 0.275 in/day opposite the known set system efficiency rate of 65%.
   b. If the gpm/acre is already known, it can be set directly on the gpm/Acre scale.

2. Pull Slide B until the daily ET rate of 0.23 is opposite the system efficiency rate of 65%

3. Read the bottom scale to find the irrigation management Keep-Up with ET. The readings should be as follows:
   a. 5.8 Days/Week
   b. 83% On
   c. 20 Hours/Day

Keep-Up


1b
1a
GPM
Acre
GPM/Acre
System Rate (in/day)
Keep-Up Calculator
Side 1
Keep-Up – the time to run the system to Keep-Up ET.
Instructions: 1. Pull slide A to set Acre opposite GPM or set GPM/Acre. Read Rate (in/day) opposite Efficiency.
2. Pull Slide B to set ET opposite Efficiency. Read Keep-Up.
A
Efficiency
Surface
Set System
Center Pivot
Efficiency
A
B
ET
ET
B
Irrigation Management
Energy Division
1-800-334-SAVE
Idaho Department of Water Resources Energy Division
1301 N. Orchard • Boise, ID 83706 • www.idwr.state.id.us
KEEP-UP
Percent
On
Days/Week
Hrs per Set
Sets per Day
Hrs per Set
Sets per Day
Hours/Day
Funded By:
Northwest Energy Efficiency Alliance
www.nwalliance.org
U.S. DEPARTMENT OF ENERGY
2
3 a b c

How to Catch-Up
Using the calculator to estimate the time needed to Catch-Up with ET

How to calculate the number of hours required to meet the ET requirement:

Look at the Catch-Up side of the calculator.

Pull Slide A so the Soil Water Holding Capacity (WHC) of the soil is opposite the Root Zone depth. Read the Water opposite the Soil moisture percent on slide A. This is the amount needed to apply.

Pull Slide B so the System/Rate-ET is opposite the Soil moisture percentage reading on Slide A.

Read the Catch-Up Hours or Days for the length of time to operate the system to catch up with ET rate.

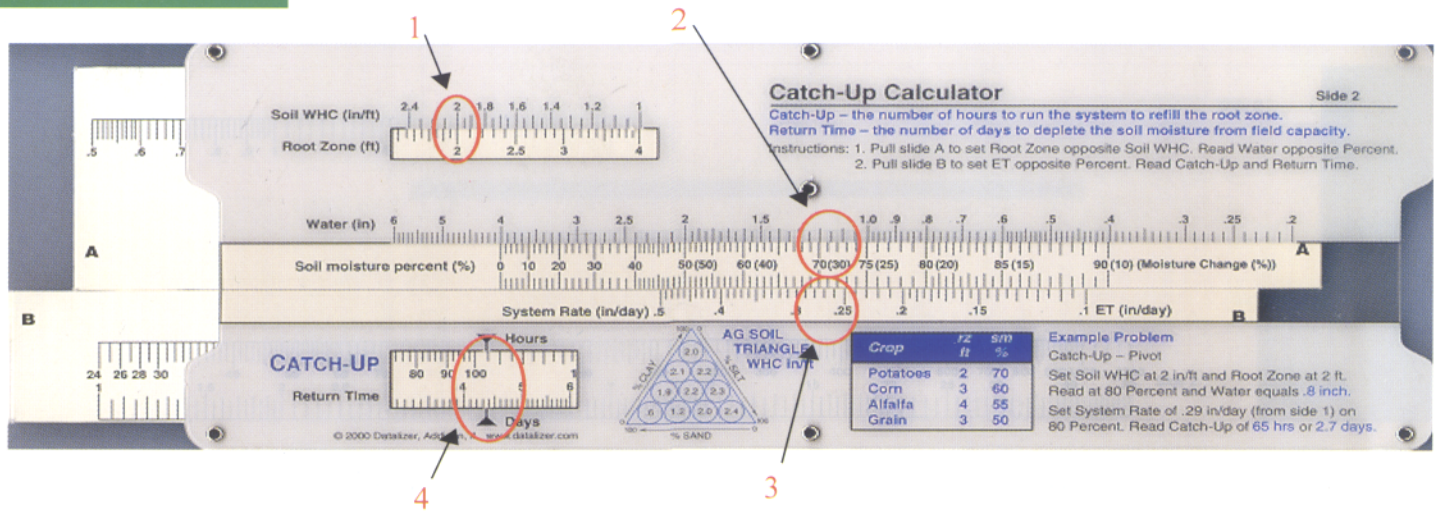
Example:

Known parameters:

Soil Type	Clay Loam
WHC	2.0 in/ft
ET	0.275 in/day
Crop	potatoes (From chart on the calculator, the Root Zone is 2 ft and the sm is 70%.)

1. Pull Slide A to set the Root Zone depth of 2 feet opposite the WHC of the soil at 2.0 in/ft.
2. Read the inches of Water opposite the Soil moisture percent. With 30% Moisture change (the number in parentheses) or 70% Soil moisture, the Water needed to apply is 1.2 in.
3. The ET rate obtained from the AgriMet system is .275 in/day. Position Slide B so the ET of .275 is opposite the Soil Moisture Percent of 70%.
4. Read the bottom scale to find the Hours or Days required to Catch-Up with ET. The Catch-Up time is 101 Hours or 4.4 Days.

Catch-Up


1
2
3
4
Catch-Up Calculator
Side 2
Catch-Up – the number of hours to run the system to refill the root zone.
Return Time – the number of days to deplete the soil moisture from field capacity.
Instructions: 1. Pull slide A to set Root Zone opposite Soil WHC. Read Water opposite Percent.
2. Pull slide B to set ET opposite Percent. Read Catch-Up and Return Time.
Soil WHC (in/ft)
Root Zone (ft)
Water (in)
Soil moisture percent (%)
System Rate (in/day)
ET (in/day)
A
B
CATCH-UP
Hours
Return Time
Days
AG SOIL TRIANGLE WHC in/ft
% CLAY
% SILT
% SAND
Crop
rz ft
s/m %
Potatoes 2 70
Corn 3 60
Alfalfa 4 55
Grain 3 50
Example Problem
Catch-Up – Pivot
Set Soil WHC at 2 in/ft and Root Zone at 2 ft.
Read at 80 Percent and Water equals .8 inch.
Set System Rate of .29 in/day (from side 1) on 80 Percent. Read Catch-Up of 65 hrs or 2.7 days.

For help in using the calculator contact the Idaho Energy Division, Agriculture, Industrial, and Municipal (AIM) group.

Check out our Loan Program and other Energy saving technologies at our web site at:

www.idwr.state.id.us/energy
or call:
The Idaho Energy Hotline

1-800-334-SAVE
(7283)

Energy Division

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