

Strategies for Reducing Irrigation Water Use

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When water is plentiful, growers usually schedule irrigation practices around other farming activities. For example, most growers change furrow irrigation sets at 12- or 24-hour intervals because this timing is convenient and uses labor efficiently. When water is in short supply, you need to rethink some practices to obtain maximum benefit from available water. After all, next to the land itself, water is a grower's second most important resource. It makes sense to exchange management and labor for water.

Not everyone faces serious water shortages now, but problems might spread if Oregon has another dry winter. Also, power crises will lead to growing pressure to save water for power generation or endangered species such as salmon and bull trout. The issues affecting the Klamath Basin or similar ones such as Total Maximum Daily Load (TMDL) might be only a few years away from affecting many parts of Oregon.

The ideas below are only suggestions. One or more of them might work on your farm. They are not prioritized, but some will save more water than others. The first group of strategies can apply to any type of irrigation. The second group applies specifically to furrow irrigation.

General strategies

- ◆ Leave some ground idle and apply the saved water to high-value crops. Because irrigation districts must keep their system charged with water, this strategy will have a greater impact if everyone in the district cuts back on irrigated acres.

Figure 1.—Using the AgriMet crop water use data.

(1) ESTIMATED CROP WATER USE - JULY 16, 2000 ONTO											
(2) CROP	(3) START	(4) DAILY CROP WATER USE-(IN) PENMAN ET - JULY				(5) Daily Forecast	(6) COVER DATE	(7) TERM DATE	(8) SUM ET	(9) 7 DAY USE	(10) 14 DAY USE
		12	13	14	15						
ONYN	401	0.32	0.3	0.29	0.31	0.32	710	820	20.6	2.16	4.3
POTS	501	0.33	0.32	0.3	0.32	0.34	610	820	19.7	2.3	4.28

- (1) = Location of weather station: ONTO = Ontario, Malheur Experiment Station
 (2) = Crop: ONYN = Onions; POTS = Shepody Potatoes
 (3) = Start Date: Crop emergence date
 (4) = Amount of water used by the crop each day for the past 4 days
 (5) = Estimated water use for the date on the chart, i.e., July 16
 (6) = Cover date: Date the crop reached full canopy
 (7) = Term date: Date irrigation stops or crop is harvested
 (8) = Sum ET: Total estimated water use from the beginning of the growing season to the current date
 (9) = 7 day use: Prediction of water needed by crop for the next 7 days
 (10) = 14 day use: Prediction of water needed by crop for the next 14 days

- ◆ Do not over-irrigate. This sounds simple, but isn't. Most growers err on the side of excess. Too much water has less visual impact than too little, but it wastes soil and fertilizer as well as water.
- ◆ Use "ET" (evapotranspiration) charts from the Bureau of Reclamation AgriMet system. The charts show fairly accurate estimates of crop water use and can help you decide when and how much to irrigate. (See Figure 1 for information about how to use these charts.)
- ◆ Use soil-moisture monitoring equipment to measure how much moisture is in the soil. There are several types of sensors available. The most commonly used in Oregon are Watermark sensors, the Diviner, and tensiometers. These instruments, when used with ET charts, provide a fairly accurate estimate of irrigation needs. For more information on measuring soil moisture, see *Instrumentation for Soil Moisture Monitoring*.
- ◆ Graph soil moisture readings. The most important aspect of soil-moisture monitoring is graphing the readings in order to improve your irrigation

accuracy. Even if you measure soil moisture with a shovel and your fingers, you can graph the readings. Figure 2 shows a portion of a graph used for Watermark sensors.

- ◆ Know each crop's tolerance of drought stress and irrigate accordingly. Some plants handle drought stress better than others. Barley uses less water than wheat. Sugar beets can extract moisture from a greater depth than most crops. Russet Burbank potatoes suffer greatly in quality when drought stressed—losing tuber grade and fry color. Shepody potatoes suffer less quality reduction than Russet Burbank, but still more than other crops. Total yield is reduced when Shepody and Umatilla Russet varieties are drought stressed. Potatoes can be stressed very early, but not after setting tubers. Water stress on onions affects yield and grade and reduces the percentage of single centers. Wheat and corn lose test weight and yield. For most crops, water



stress at the flowering stage is most damaging.

- ◆ Know the water-holding capacity of your soils. A sandy loam soil will not hold as much water as a silt loam; thus it must be irrigated more frequently, but apply less water with each irrigation. Extra water is lost to leaching.
- ◆ Know the water-use requirements of the crops you intend to grow, and make sure you have enough water to get an economic yield.

Strategies for furrow irrigation

- ◆ Consider surge irrigation or at least use a modified surge program on the first irrigation. The wetting-drying cycle of surge irrigation reduces water loss to deep percolation, which is particularly important on the first irrigation when the soil is friable and takes a lot of water. For a modified surge irrigation program, alternate siphon tubes between rows every couple of hours on the first irrigation. This method can save water and reduce nitrogen loss through leaching.
- ◆ Use alternate-row irrigation; irrigate one side of a bed on one irrigation, the other row or side on the next. This practice works well with crops that are less sensitive to moisture stress.
- ◆ Irrigate only the wheel row. Since its infiltration rate usually is much lower than that of the soft row, water is less likely to move below the root zone.
- ◆ Compact the soft, non-traffic rows in furrow-irrigated fields so that their infiltration rate is similar to that of the wheel-traffic rows.
- ◆ Switch to sprinkler irrigation, which allows you to manage water more efficiently and apply it to the depth needed. Remember that some crops might have more disease problems

under sprinklers because the foliage stays wet. Also, with increased power costs, this might not be a good option unless the water intake is high enough above the rest of your farm to allow you to set up a gravity flow system.

- ◆ Drip irrigation can save a lot of water, in many cases more than half of the amount used for furrow irrigation. It often increases yields as well. A drip system is costly to set up, but is practical for onions and promising for seed alfalfa. The Malheur Experiment Station is investigating ways to leave the tape in the ground through several cropping cycles. See *Drip Irrigation: An Introduction* for more information.
- ◆ Change irrigation sets when water reaches the end of the furrow rather than at a specified time of day.
- ◆ Use PAM (polyacrylamide) or straw mulch to improve water infiltration in tight soils (those with a low water infiltration rate).
- ◆ Eliminate deep watering of shallow-rooted crops such as onions and beans. Frequent, light irrigations help keep water in the root zone where plants can use it.
- ◆ Avoid over-watering the top of the field by cutting the water as soon as it reaches the end of the field. Most people over-water the top of the field, which stresses plants and causes nitrogen deficiency as nitrogen leaches below the root zone. Slightly drought stressing the bottom of the field should cause production losses similar to those caused by over-watering the top of the field. Straw the bottom of the field so that the water that gets there soaks in.
- ◆ Use catch basins to collect runoff and reuse it. Sometimes this involves pumping water to the top of the field or to the next field. Analyze the cost of pumping to see whether this strategy is cost-effective.

For more information

Web sites

- AgriMet—daily crop evapotranspiration estimates (mac1.pn.usbr.gov/agrimet/h2ouse.html)
- How to find irrigation information on the Internet (www.microirrigationforum.com/new/onthenet)
- Irrigation Scheduling (www.cropinfo.net/irrigschedule.htm)
- Instrumentation for Soil Moisture Monitoring (www.cropinfo.net/AnnualReports/1997/instrumentation.wq.html)
- NRCS Irrigation Information Links (www.wcc.nrcs.usda.gov/nrcsirrig/irrigate_bookmark.htm)
- OSU Extension Service Publications and Videos catalog (eesc.orst.edu)

OSU Extension publications

- Drip Irrigation: An Introduction*, EM 8782 (2001). No charge
 - Irrigation Management Practices Checklist for Oregon*, EM 8644 (1996). \$2.25
 - Irrigation Scheduling*, PNW 288 (Reprinted 1994). 50¢
 - Simple Irrigation Scheduling Using the "Look and Feel" Method* (includes soil appearance cards in English and Spanish), EM 8716 (1998). \$4.50
 - Soil Water Monitoring and Measurement*, PNW 475 (1995). \$1.00
 - Western Oregon Irrigation Guides*, EM 8713 (Reprinted 2000). \$5.50
- To order copies of the above publications, send the complete title and series number, along with check or money order for the amount listed (payable to Oregon State University), to Publication Orders, Extension & Station Communications, Oregon State University, 422 Kerr Administration, Corvallis, OR 97331-2119 (fax: 541-737-0817).

Figure 2.—Sample soil moisture graph.

Grower _____ Field ID _____ Soil Type _____ Year _____

Critical Levels

- Sand Soil - 30 centibars
- Silt Loam - 50 centibars
- Clays - 70 centibars

	Days															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
0																
10																
20																
30																
40																
50																
60																
70																
80																
90																
100																
110																
120																

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