CONSERVING WATER
IN AGRICULTURE

Stretching Irrigation Water Supplies

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Conserving Water in Agriculture

Stretching Irrigation Water Supplies

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In a drought, every gallon of water saved means more crop production. There are many places in a typical irrigation operation where water is lost. Here are some prudent management practices that can conserve water and possibly make the difference between making a profit or taking a loss.

Note: These practices are designed for individual farms *only*. On a river basin, they'll have various effects. Often, they'll actually *reduce* the amount of water available—water that had previously run off is now kept and used in one place.

Four basic ways

The four general ways to conserve water are: (1) schedule your irrigation—apply only the water required, (2) apply the water uniformly, (3) have a tight system, and (4) change cultural practices.

Schedule irrigation. This is your first step (see PNW 288, "For further reading," other side). Irrigation scheduling determines how much water crops use and how much the soil can store. Knowing this, you can scientifically determine when to irrigate and how much to apply. If you apply too much water, it will percolate below the root zone, where it is effectively lost.

Apply only the right amount of water at the right time. Most irrigation systems have the capacity to apply too much water early in a season. Scheduling helps you get the best use out of your irrigation water.

Shift crops to save water. Cultural practices can affect the amount of water used. If possible, substitute shorter-season crops into your rotation. Alfalfa, grasses, corn, and sugar beets need water all season; but wheat, barley, rye, and some vegetables need water only early in the season.

Another alternative is to choose a crop variety with a shorter growing season. For example, shorter-season corn varieties are available. These varieties may not have as much yield potential, but they'll more likely produce a crop. A number of crops can produce a respectable yield with only one irrigation near a critical-growth stage, such as flowering.

Don't overextend your water supply. Plant only the land area that you can cover with your irrigation water supply. This is one decision where irrigation scheduling can help. Fallowing too many acres is expensive; fallowing too few may result in crop failure. Plant drought-tolerant cover crops to protect fallowed land from wind erosion.

Be ready to change. Change your fertilizing program when you expect drought. Set realistic yield goals. Use a soil test to avoid excess fertilizer. Overfertilized crops will suffer damage and reduce yields when water is short. Control water-using weeds with minimum tillage. Consider chemicals or mowing rather than tillage. Every cultivation results in moisture loss.

In general, be conservative with crop inputs. Try to keep cash costs low on cropland subject to drought. This minimizes the financial risk associated with drought.

Sprinkler systems

Use the irrigation schedule to run the irrigation system only long enough to refill the root zone. Shut the system off sooner if it's being run too long. On side-rolls, handlines, and solid systems, determine how long to run the system by probing to find the depth of water penetration.

Probe two or three times during an irrigation. Probe within a few feet of the lateral, halfway between sprinklers. Probe the soil to confirm the soil has the capacity to hold an irrigation from center pivots, drip, and solid-set systems.

Odd set times may pose problems when a system is run at night and labor is geared to a 12-hour set. Use a time clock to shut off systems automatically. Straighten side-roll systems in daylight so you can easily move them in darkness.

Apply water uniformly, as far as it's practical. No system applies water uniformly to the soil—some areas will be overirrigated while other are underirrigated. Uniform application requires correct nozzle size, sprinkler spacing, and system pressure. Have the system design evaluated and correct any distribution problems, especially if poor uniformity has shown up in previous years.

Be sure that your sprinkler lines all have the same size nozzles. Check all nozzles for wear; replace worn nozzles with new ones. If a lateral rises more than 15 vertical feet from the start, install flow-control nozzles to improve uniformity.

Use correct pressure. Be sure your system has adequate pressure. Check the pressure of the sprinkler at both the farthest and the highest points. In general, maintain pressure above 40 psi (some designs may vary).

High winds and temperature. Keep evaporation losses to a minimum by avoiding irrigation during periods of high wind and temperature. Sprinkler losses from a 5/32" nozzle will be about 9% in winds of about 5 mph and a temperature of 80°F. These losses will increase to 20% if the wind increases to 15 mph.

With 15-mph wind and temperatures of 100°F, the losses will reach 26%. (*Note:* These losses are not all evaporation.) Small sprinklers have higher losses than large sprinklers.

High winds also distort the application uniformity. Normally, high winds occur only for short periods of a day, so avoid irrigating during these periods. To do this, you need temporary storage if the water is delivered continuously.

Use a lateral offset program on side-roll or hand-move systems (figure 1). This simple practice will reduce the effective lateral spacing by half after two irrigations—enough to raise uniformity about 10% and reduce percolation loss by about the same amount (see PNW 286, "For further reading"). The only additional equipment required is a short swingline coupled with a little more management of the system.

Special soil conditions. Prevent wasted runoff water caused by excess application rates on fine-textured soil. (See PNW 287, "For further reading.") Users of center pivot and solid-set systems can apply extremely light rates at frequent intervals to limit surface water movement. This practice, however, increases evaporation from the wet crop surface.

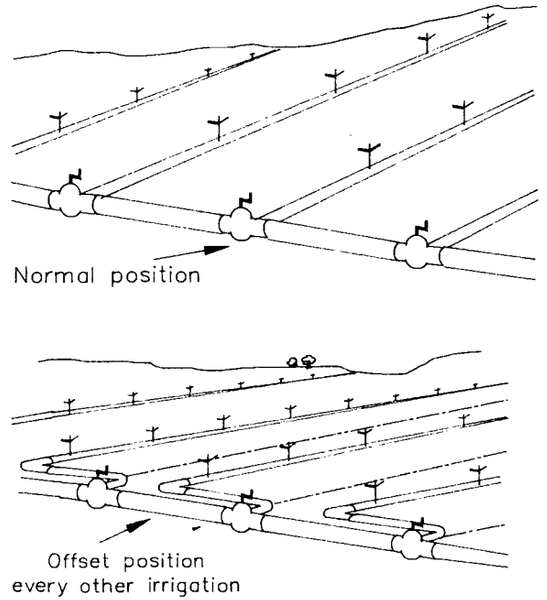

Figure 1.—An offset program alternates positioning of the lateral during every other irrigation. The total of two successive irrigations gives a more uniform distribution of water on the field.

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Check water depth. During each application, apply the greatest depth of water that's possible without runoff. Use tillage practices such as ditcher-dikers to create basins to limit runoff. Reduce nozzle size on side-roll, hand-move, and solid-set systems to meet soil intake rates. (When you do this, you may have to reduce spacing to avoid a reduction in uniformity.)

Inspect for leaks. Tests at the University of Idaho indicate that many irrigation systems leak up to 10% of their water. Inspect flexible couplers, particularly the quick couplers on aluminum pipe. Replace those gaskets that have become hard and cracked. Clean out any sand or silt behind the gasket to assure a watertight seal. Clean sand from automatic drains in center pivots and side-rolls. This sand can keep the drain from closing when you apply pressure.

Surface irrigation

Schedule irrigation. Any irrigation practice or structure that improves water control and makes irrigation scheduling easier will help stretch water supplies. Schedule irrigation to find the maximum possible time between irrigations. Stretch out irrigations to near the maximum time to minimize deep percolation.

Apply water uniformly on surface irrigation systems. This usually means moving the water quickly across the field. Larger stream sizes are the best way to accomplish this. Large stream sizes by themselves can be counterproductive to water conservation by causing large amounts of runoff.

Irrigate only every other furrow. Irrigate on the "hard" rows compacted by tractor traffic. Consider furrow packing of "soft" rows to improve water advance. Fields with low infiltration rates may have to irrigate in "soft" rows.

Use "cut-back" irrigation on furrows, corrugation, and strip-borders to limit runoff. After the water has advanced three-fourths of the distance across the field, cut back the flow rate by about half. You can do this by starting two siphons per furrow, then "cutting back" to one, or by partially closing gates or valves.

Make the output of all siphons and gates as uniform as possible. You may have to make set changes at odd hours of the day or night. Probe the soil to keep track of the "wetted front" to determine irrigation effectiveness.

Reuse water. Maybe the most important surface irrigation conservation practice is a tailwater reuse pit. You can reuse water by collecting runoff water at the end of the field and pumping it back to the top of a farm through an inexpensive pipeline.

Reused tailwater is usually less expensive, including both equipment and operating costs, than purchasing additional water from an irrigation district. This is true even when water is available. Open-impeller pumps that can pump trash are required for this purpose. The tailwater system does not disrupt regular production practices. Expect water savings between 30 and 60%..

Reduce losses in supply ditches by inspecting ditch banks for rodent damage, weeds, sediment, and other debris that cause water losses. Clean out weeds and trash—but not silt, which provides a natural seal. A clean ditch will lower water levels and reduce infiltration losses.

Use checks to control the slope of steep ditches. Farm ditch slopes should be no steeper than 1/10 foot per 100 feet. This slope limits water velocity in the ditch and prevents scouring the natural silt. Erosion of the ditch can result in excessive infiltration losses.

Summary

When water is short, the water you save by following any of these practices is important.

You'll frequently have to modify management and labor practices in a drought.

These water-conservation tips are designed for individual farms only.

These practices will have various effects on a river basin. Often, they'll actually reduce the amount of water available—water that had previously run off is now kept and used in one place.

For further reading

These publications are available from Agricultural Communications, Publications Orders, Oregon State University, Corvallis, OR 97331-2119.

Hansen, Hugh J., and Walter L. Trimmer, *Irrigation Runoff Control Strategies*, Pacific Northwest Extension publication PNW 287. No charge for single copy.

Trimmer, Walter L., and Hugh J. Hansen, *Irrigation Scheduling*, Pacific Northwest Extension publication PNW 288. No charge for single copy.

Trimmer, Walter L., and Hugh J. Hansen, *Offsets for Stationary Sprinkler Systems*, Pacific Northwest Extension publication PNW 286. No charge for single copy.

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