Irrigation Management on Corn

Cooperative Extension South Dakota State University

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Proper water management is a talent that each operator must learn for himself. The capacities of soils to produce under irrigation vary greatly because of texture, structure, and organic matter. An adequate irrigation program means that the operator must properly manage his entire cropping program plus (1) apply the right amount of water, and (2) apply it at the proper time.

Irrigators make their water management decisions in different ways. One of these ways, which has proven to be fairly accurate, is irrigation scheduling from charts giving the average daily consumptive use of water for corn.

The amount of water demanded by the corn crop will vary depending upon the planting date and the area of the state in which it is grown. Early planted corn in southern South Dakota will require the most total moisture due to additional daily heat units and a longer growing season. When air temperatures rise 10 degrees, moisture demands by a corn crop may increase about 20%.

Figures for the average daily consumptive use of water by corn are given in 1/100 and 1/10 inch per day for 7-day periods in Table 1. These figures may vary somewhat due to extreme weather conditions, such as variations in temperatures from the average for any specific area. Areas are given in Figure 1.

Simply select the date on which your corn was planted, then the area of the state (from Fig. 1) in which the corn is grown. The columns of figures under your area in Table 1 will give the consumptive use of moisture by your corn crop for each day of the 7-day period.

Some soils can hold much more water than others. Water-holding capacities of soils in inches per foot of

<table>
<thead>
<tr>
<th>Week</th>
<th>Apr. 30-May 6</th>
<th>May 7-13</th>
<th>May 14-20</th>
</tr>
</thead>
<tbody>
<tr>
<td>Area</td>
<td>1  2  3</td>
<td>1  2  3</td>
<td>1  2  3</td>
</tr>
<tr>
<td>AREA 3</td>
<td>0.03 0.03 0.02</td>
<td>0.03 0.03 0.03</td>
<td>0.03 0.03 0.03</td>
</tr>
<tr>
<td>AREA 2</td>
<td>0.04 0.04 0.04</td>
<td>0.04 0.04 0.04</td>
<td>0.04 0.04 0.04</td>
</tr>
<tr>
<td>AREA 1</td>
<td>0.06 0.06 0.06</td>
<td>0.06 0.06 0.06</td>
<td>0.06 0.06 0.06</td>
</tr>
</tbody>
</table>

Fig. 1. Corn growing areas for use in figuring the amount of water your corn crop needs.
Fig. 2. Guide for judging soil moisture. Figure describes feel or appearance of soil when judging available moisture, given in inches of water per foot of soil. A ball is formed by squeezing a handful of soil very firmly. Make a ribbon by pinching between thumb and finger and attempting to move the mass forward.

<table>
<thead>
<tr>
<th>Available soil moisture</th>
<th>Coarse sandy loam (coarse texture)</th>
<th>Sandy loam (moderately coarse texture)</th>
<th>Silty loam (medium texture)</th>
<th>Silty clay (fine and very fine texture)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Field capacity)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100%</td>
<td>.8 to 1 Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.</td>
<td>1.2 to 1.5 Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.</td>
<td>1.5 to 2.0 Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.</td>
<td>1.9 to 2.5 Upon squeezing, no free water appears on soil but wet outline of ball is left on hand.</td>
</tr>
<tr>
<td>75%</td>
<td>.6 to .8 Tends to stick together slightly, sometimes forms a very weak ball under pressure.</td>
<td>.9 to 1.2 Forms weak ball, breaks easily, will not stick.</td>
<td>1.15 to 1.5 Forms a ball, is very pliable, slicks readily if relatively high in clay.</td>
<td>1.4 to 1.9 Easily ribbons out between fingers, has slick feeling.</td>
</tr>
<tr>
<td>50%</td>
<td>.4 to .5 Appears to be dry, will not form a ball with pressure.</td>
<td>.6 to .8 Tends to ball under pressure but seldom holds together.</td>
<td>.8 to 1 Forms a ball somewhat plastic, will sometimes slick slightly with pressure.</td>
<td>.9 to 1.3 Forms a ball, ribbons out between thumb and forefinger.</td>
</tr>
<tr>
<td>25%</td>
<td>.2 to .25 Appears to be dry, will not form a ball with pressure.</td>
<td>.3 to .4 Appears to be dry, will not form a ball.</td>
<td>.4 to .5 Somewhat crumbly but holds together under pressure.</td>
<td>.5 to .7 Somewhat pliable, will ball under pressure.</td>
</tr>
</tbody>
</table>


soil are given in Figure 2. Available water can vary from below one inch per foot for a sand to over 2.2 inches per foot for a silty clay loam.

When the total water holding capacity of a soil is figured, the operator should consider a 3-foot soil depth since this is the normal corn root zone. This will mean that if the soil is a silty loam (2 inches of water per foot) the total holding capacity of that particular type of soil will be 6 inches.

Soil moisture depletion, or the amount of water removed, should not exceed 50% during the growing season. Where this 50% point is becomes a judgment figure for most operators, determined by “feel” and practice (see Fig. 2).

**Gravity Irrigation**

In the case of gravity irrigation, an operator can usually figure field capacity has been reached 24 hours after each irrigation, or when moisture has reached the 3-foot level at the lower end of the field. Waiting 24 hours allows the excess moisture (or free water) to drain out of the soil. You can check by collecting soil samples from different depths with a soil probe (Fig. 3) and trying to make a ball or a ribbon.

The time before the next irrigation is necessary can be worked out from the moisture consumption figures given in Table 1. Checks should be made periodically with the probe so that the moisture depletion figure never becomes lower than 50%.

The water management skills of the operator determine the efficiency of gravity irrigation systems. Efficiency usually ranges between 40% and 80%. Temperature and wind, important factors in efficiency ratings for sprinkler systems, have little effect on gravity watering.

Water losses under gravity systems occur because of deep percolation at the head of the field or surplus runoff at the lower end. These are factors the operator controls.

**Sprinkler Irrigation**

Center pivot machines should operate as slowly as possible. A system applying 1½ inches per acre per circle (one application) is operating more efficiently than one applying ½ inch of water.

An operator should know how many gallons per minute his machine is pumping. This output should be checked periodically with a flow meter. The efficiency of a pivot system may vary greatly depending upon wind, temperature, and humidity.

Generally an operator can figure his machine is 70% efficient. This means that for every inch of water pumped, .7 of this water will be available to the plant. This efficiency figure may vary from 50% to above 80%, depending on weather conditions.

If an operator is pumping .9 inch per acre every 3 days, his corn will be receiving (.3 in 1 day x 70%) = .23 inch of moisture per day. Table 1 shows this is equal to the amount of water used between July 2 and July 8 by a corn crop in central South Dakota. The water demand in the same field from July 9 to July 30 is 0.25 inch per day, and the operator will run behind .02 inch per day. If he uses the
consumptive use charts and knows how much water is in the soil he can project when he must start watering if he is to maintain the 50% of capacity level in his soil.

**Guidelines**

1. **Apply ½ to ¾ inch water after planting.** This irrigation will activate herbicide and assure you of uniform emergence.
2. **Do not irrigate corn again until the crop is 6 weeks old.** This is especially true in the case of fine and medium textured soils. Too early irrigation will retard growth and reduce root penetration. The operator has no choice in the matter of starting time if soils are coarse and shallow. In these situations he must irrigate whenever soil moisture drops to 50%.
3. **A corn crop will require between 2.25 and 2.50 inches of water after it has become completely dentend, if it is to mature properly.** In most cases corn in South Dakota becomes dentend about September 1. Irrigators should have at least 4 inches of water stored in their soil at this date or they will need to continue applying water after September 1.
4. **After the soil moisture for the field has been established, a soil moisture balance sheet should be started and kept up to date.** Column headings for this balance sheet are (left to right) date, precipitation amount, net irrigation amount, established crop use (from Table 1), and soil moisture deficit/credit.

**Glossary**

**GPM:** Gallons per minute.

**One acre inch:** Water required to cover an acre with one inch of

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water, 27,154 gallons.

**CFS (cubic feet per second):** 448.8 GPM.

**Efficiency:** For center pivots, efficiency may vary from 50 to above 80%, depending upon weather. Seventy percent is considered to be average for midsummer weather conditions. For gravity irrigation, efficiency depends primarily on water management, and may vary between 40% and 80%.

**Available soil moisture:** The amount of moisture in the soil that can be utilized by the crop. Available water is the difference between field capacity and wilting point.

**Field capacity:** The total water holding capacity of a soil.

**Consumptive use:** Combined total of moisture withdrawn from the soil by the plant, plus that evaporated from the soil, plus the amount of water intercepted by the plant foliage. This is why light showers or light or fast applications from center pivots are inefficient.
IRRIGATION MANAGEMENT ON CORN