Irrigating Grain Sorghum

- Grain sorghum has a fibrous root system that can extend to depths of 4 to 6 feet.
- All grain crops require adequate water to survive and grain sorghum is no exception; to help maximize sorghum yield potential under stressful conditions, water is a key component.
- Sorghum yield potential can be greatly reduced depending on the timing of drought stress relative to growth stage.
- A time period of about 1 week prior to the grain head being pushed out of the boot and continuing through 2 weeks past flowering is the most critical period for water availability.

When to Irrigate

- Assuming the soil water profile is adequate to full at planting, additional water should not be necessary until the reproductive stage begins.
- At the beginning of the reproductive stage, a 4-inch irrigation can last until the flag leaf appears.
- Two 3-inch irrigations about two weeks apart at flag leaf or boot stage should carry the plants to the soft dough stage of kernel fill.
- A 3- to 4-inch irrigation at soft dough stage allows for the completion of grain fill.¹

Sorghum Characteristics

Grain sorghum has a fibrous root system that can extend to depths of 4 to 6 feet. However, more than 75% of the water and nutrients acquired by the root system are from the top 3 feet.¹ This extensive root system allows sorghum to withstand droughty conditions better than corn and as a result, is often placed into soils and conditions that are not ideal for crop production.

All grain crops require water to survive and grain sorghum is no exception; to help maximize sorghum yield potential under stressful conditions, water is a key component. Sorghum yield potential can be greatly reduced depending on the timing of drought stress relative to growth stage (Table 1).

Row Spacing and Seeding Rate for Irrigation

Available moisture is an important factor in determining sorghum row spacing and planting population. Narrower rows have the ability to develop a soil-shading canopy quicker than wider rows. Canopy covered rows can help decrease the loss of soil water through evaporation.

According to Texas A&M AgriLife Extension Service, 70,000 to 80,000 established plants/acre should be a goal for irrigated acreage and 50,000 to 60,000 established plants/acre for dryland acreage.¹ Dryland populations are likely to approach the higher irrigated populations in regions where rainfall is more prevalent. Water use increases with higher populations as more plants are drawing upon soil water reserves and any water added through irrigation or rainfall. If stressful conditions exist, high populations can result in depleted water reserves prior to reproductive stages.

<table>
<thead>
<tr>
<th>Days after Planting</th>
<th>Inches/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 30 (early plant growth)</td>
<td>0.05 - 0.10</td>
</tr>
<tr>
<td>30 - 60 (rapid plant growth)</td>
<td>0.10 - 0.20</td>
</tr>
<tr>
<td>60 - 80 (boot and flowering)</td>
<td>0.25 - 0.30</td>
</tr>
<tr>
<td>80 - 120 (grain fill to maturity)</td>
<td>0.25 - 0.10</td>
</tr>
</tbody>
</table>

Table 2. Estimated Grain Sorghum Water Use by Growth Stage*¹

Water Use by Growth Stage

Total water usage by a sorghum plant varies by product maturity, planting date, environmental conditions, and ultimately final yield. It is estimated that a total water use (soil and plant evaporation) of 28 inches of water/acre is needed to produce a sorghum yield of 7,000 lb/acre.¹

Water use during a sorghum plant’s life varies depending on the growth stage (Table 2). During seedling development (germination to 6 mature leaves), water use is relatively low, but stress during this time can affect future growth, plant size, and yield potential. Preservation of soil moisture through conservation tillage, residue management, row spacing, weed
Irrigating Grain Sorghum

control, and planting date are important during early development as soil water evaporation can occur quickly.

After seedling establishment (about 40 days after planting), water use by the plant increases dramatically and is vitally important for maintaining genetic yield potential. While in the rapid growth phase, the seed panicle and the number of ovules that can potentially develop into seed are forming within the stalk. Any water shortage during this developmental stage can be detrimental to yield maximization and overall plant health.

The most critical period for water availability is from about one week prior to the grain head being pushed out of the boot (exsertion) through two weeks past flowering. During this time, plants suffering from severe drought may not be able to push the grain head out of the boot. Individual sorghum products vary in their ability for head exsertion under stress. Some may not be able to push the head out at all and others may have partial exsertion (Figure 1). The plant will be needing about 0.2 to 0.3 inch of water/acre/day during this phase. About 8 to 10 inches of water (if available) will have been consumed up to bloom.

The reproductive phase begins with bloom and lasts around 45 days until physiological maturity or black layer occurs. About 0.35 inch of water/day will be used by the plant from just before bloom until early grain fill. The final irrigation should carry the crop to maturity. Additional water after maturity will not add weight to the seeds. When moisture is adequate, the University of Arkansas suggests terminating furrow irrigation when > 50% of the heads are at hard dough and terminating pivot irrigation when > 75% of the heads are at hard dough. University of Nebraska Extension information suggests basing final irrigation timing on soil moisture deficits, soil type, and growth stage. If soil deficit information is not available, Table 3 provides timing recommendations based on growth stage and a fully refilled root zone, which is hard to achieve with irrigation and is not a recommended practice.

Moisture sensors can be installed at 1-, 2-, and 3-foot depths to measure moisture levels at various depths. The sensors should be located within the crop row and not placed into low areas. Information from the sensors should be read and recorded at least twice a week.

Soil probes are another means of measuring soil water and compaction. If the probe cannot penetrate the surface, there is no subsurface moisture. Prior to sorghum boot stage, the probe should be able to be pushed to a depth of 3 to 4 feet, which indicates there is about 4 to 6 inches of stored water depending on soil type. During heading, flowering, and grain fill, the probe should go to a depth of 8 to 10 inches. After black layer, a probe depth of 6 to 8 inches is sufficient to nourish the plants to harvest.

Tools and Equipment

Several tools are available to help determine the need for additional water. A standard rain gauge placed at the edge of a field can provide information on natural rainfall. Local radio, TV, and internet websites may also provide rainfall information, but will not be specific to each field. Depending on the state, web-based evapotranspiration (ET) calculators may be available to help determine water usage, needs, and availability.

<table>
<thead>
<tr>
<th>Soil Type</th>
<th>Stage of Growth for Last Irrigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silty Clay Loam</td>
<td>4 days after soft dough</td>
</tr>
<tr>
<td>Upland Silt Loam</td>
<td>1 day after soft dough</td>
</tr>
<tr>
<td>Bottomland Silt Loam</td>
<td>10 days after half dough</td>
</tr>
<tr>
<td>Very Fine Sandy Loam</td>
<td>3 days after soft dough</td>
</tr>
<tr>
<td>Sandy Loam</td>
<td>6 days after soft dough</td>
</tr>
<tr>
<td>Fine Sands</td>
<td>10 days after soft dough</td>
</tr>
</tbody>
</table>


Sources:

For additional agronomic information, please contact your local seed representative. Developed in partnership with Technology, Development, & Agronomy by Monsanto.

Individual results may vary, and performance may vary from location to location and from year to year. This result may not be an indicator of results you may obtain as local growing, soil and weather conditions may vary. Growers should evaluate data from multiple locations and years whenever possible. ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. All other trademarks are the property of their respective owners. ©2015 Monsanto Company. 150410115543  05052015L3M