

Irrigation Timing during Drought Corn, Cotton, and Sorghum Furrow Systems

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When water is limited, farmers must make several difficult decisions about how many times to irrigate, when to apply the water, and how much to apply. They also must accept that their crop may have some deficit, depending on the amount of water available. In districts where water is allocated per irrigation, farmers need to decide how many irrigations to apply and when to apply them.

The guidelines below can help you plan irrigations to minimize yield reductions in corn, cotton, and sorghum.

Reducing the number of irrigations

If the water supply is limited, first determine whether to irrigate part of the field or to practice deficit irrigation on all of it. The type of irrigation system greatly influences this decision:

- **Sprinkler systems** give irrigators better control of the amount and timing of irrigations, enabling the water to be distributed evenly over the entire field according to the irrigation plan.
- **Surface irrigation systems** require that the irrigators depend on their knowledge of and ability to manage the system.

Because surface irrigation lacks the flexibility of sprinkler systems, those irrigators must consider other strategies for managing drought, such as:

- Delaying the first irrigation of the season
- Reducing the number of irrigations
- Forgoing the last irrigation

The goal of delaying irrigation is to take a chance on rainfall during the waiting period. This strategy requires that you carefully consider weather forecasts and current soil moisture.

At times, farmers must reduce the number of irrigations but carefully control where to apply them. In some growth stages, the crop is more sensitive, and yield losses may be higher.

If the soil has moisture for the crop, the irrigator may be able to avoid the last application. After maturity, rainfall does not affect yield.

Irrigating in critical growing stages

Crops grown with limited water need deep soils that retain moisture well. These include medium to heavy soils with textures such as clay loams and silty clay loams.

If water is limited, plant more drought-tolerant crops such as dry-land sorghum, dry-land cotton, and sunflower.

Irrigation strategies differ by levels of water reduction. Following are plans for corn, cotton, and sorghum.

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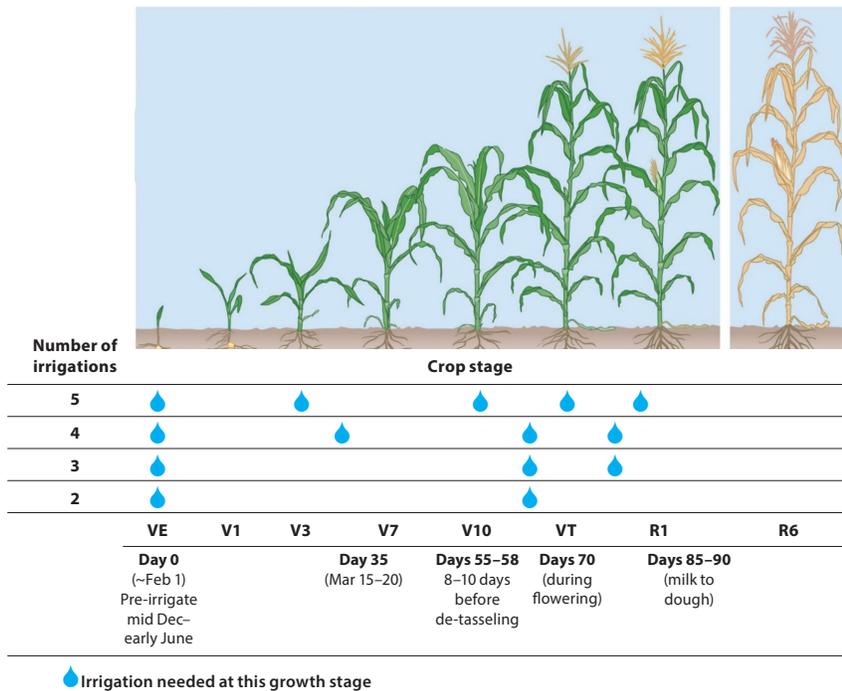


Figure 1. Timing and number of irrigations for corn in drought conditions.

Corn

Maize tolerates water deficits fairly well during its vegetative and ripening periods. Yields drop the most when the deficits occur in the flowering periods (tasseling and silking). Target your irrigation during flowering and, if water is available, during yield formation.

Five irrigations: Apply water according to the first row in Figure 1. In many situations, if soil moisture is good at planting, you may delay irrigation and end it at physiological maturity without affecting crop yields.

Four irrigations: If water is lacking, monitor the soil moisture content and consider the rainfall received during the season. With adequate rainfall, you may be able to delay and even conserve one irrigation.

Three irrigations: If you expect a wet year and decide to irrigate corn, but only three irrigations are available, try to pre-irrigate to establish good

moisture for germination. The critical stages for irrigation are before the tasseling and silking stages, when the yield potential is determined.

Two irrigations: Apply water to establish the crop, and apply the second irrigation before tasseling. You will be taking the risk of relying on rainfall to supplement that irrigation.

Cotton

Cotton must have adequate soil water during germination and establishment. An irrigation will be needed if not enough moisture is available to establish the crop and obtain good stand. If water for two additional irrigations is available, apply one irrigation before squaring and the second before peak flowering.

If only two irrigations are available, apply one before or just after planting to obtain a uniform stand. Apply the second irrigation before the first white bloom.

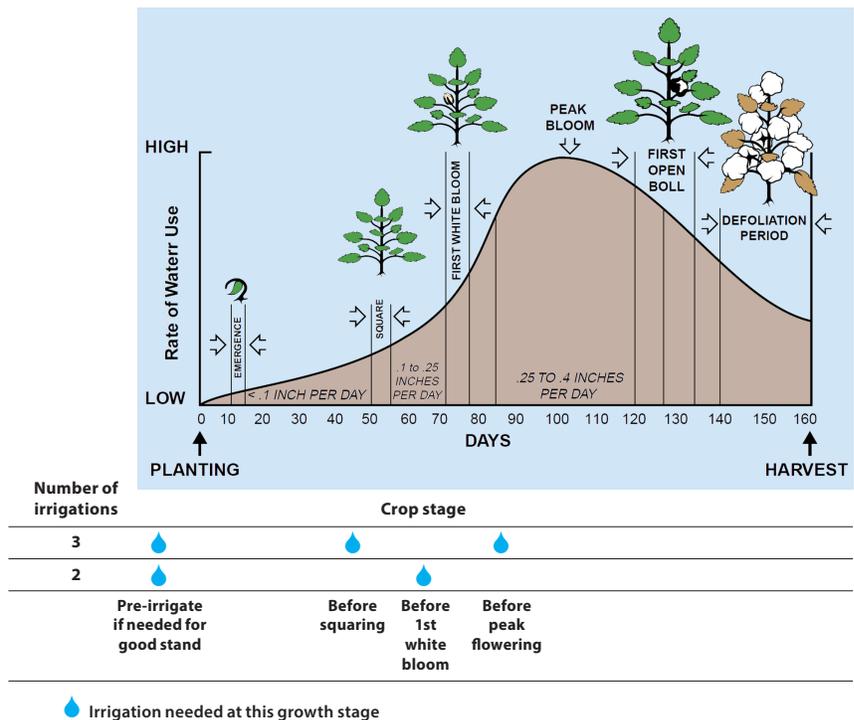


Figure 2. Timing and number of irrigations for cotton in drought conditions

Sorghum

Sorghum requires about 17 to 19 inches of water. Rainfall supplements part of these needs. The growth periods of sorghum are:

1. **Establishment**, from planting to fifth leaf visible (15 to 20 days)
2. **Vegetative**, from fifth leaf visible to head emergence or boot (20 to 30 days); in the boot stage, the head has developed nearly to full size and is enclosed in the flag-leaf sheath
3. **Flowering**, from emergence to seed set (15 to 20 days)
4. **Yield formation**, from seed set to physiological maturity (35 to 40 days)
5. **Ripening**, from physiological maturity to harvest (10 to 15 days) for a total of 92 to 120 days during the season

Sorghum is more drought resistant than are other crops such as corn. Sorghum has an extensive root system that helps the plant recover quickly after periods of water stress.

Sorghum requires from one to four irrigations, depending on climatic conditions, soil type, and tillage operations such as residue management. For optimum production when water is limited, irrigation must be timed appropriately.

If only one irrigation is available and the soil lacks enough moisture to germinate the seed, the best strategy is to apply water at pre-plant or just after planting to germinate the seed.

If only two irrigations are available, it is usually best to apply one at pre-plant and a second during the boot stage. The plant will achieve bigger gains in productivity per unit of water with these two irrigations. After the third irrigation, the productivity per unit of water will start to drop.

If a third irrigation is available, apply it during the filling heading stage. This stage is when the peduncle grows rapidly, extending the head through the flag leaf sheath. About half of the plants in a field are in some stage of bloom and two-thirds of the time from planting to physiological maturity. The plant has produced about half the total dry weight, and grain formation begins. If moisture is limited and the plant is stressed, the heads will fill poorly.

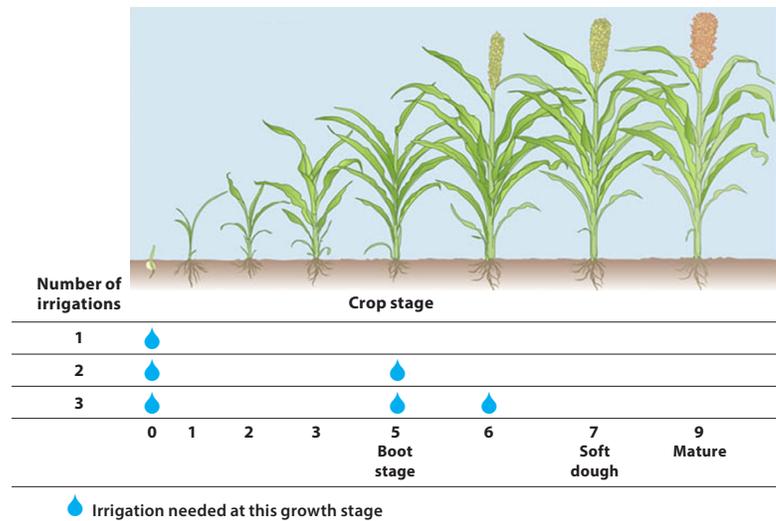


Figure 3. Timing and number of irrigations for sorghum in drought conditions

If four irrigations are available, the best strategy is to apply the last one during the soft dough stage, when the grain fills rapidly. About half of the dry weight accumulates in this period.

Other irrigation strategies

Some of the strategies to irrigate furrow irrigation systems are:

- Take advantage of this drought period to level your land if it is not leveled.
- To improve efficiencies, retouch the land already leveled.
- Avoid runoff:
 - Block the furrows at the lower end.
 - Supervise irrigations to avoid spills and runoff.
 - Use pump-back systems to help save runoff water.
- Irrigate using gated and flexible plastic pipes.
- To increase uniformity and reduce deep percolation losses:
 - Irrigate alternate rows.
 - Irrigate the tractor wheel rows.
 - Use surge irrigation.
 - Use packers and smothers on the rows to advance the water faster to the end of the row.
- Have a good flow rate per furrow to advance water as fast as possible in the row without eroding the soil. A low flow rate

will increase percolation at the upstream end, and will lixiviate (separate soluble and insoluble components) the fertilizer.

- To reduce runoff:
 - Shorten the wetting length of the rows.
 - Block the rows at the lower end.
 - Supervise irrigation closely to avoid runoff.

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