

# GROWING GRAIN SORGHUM IN ARIZONA

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## Plant description:

Grain sorghum (milo) is a warm season, annual grain crop. It is more resistant to salt, drought, and heat stress than most other crops. Nevertheless, highest yields are obtained when stresses are minimized.

## Hybrids:

Grain sorghum hybrids can be classified as short, medium or full season. Medium and medium-full season hybrids are grown in Arizona as a general rule. Short season hybrids do not have the yield potential to be profitable under our growing conditions. Sorghum hybrids grown for grain are usually short in stature (not over 4 ft tall), but dual purpose hybrids utilized for both forage and grain can be much taller (5 ft or taller). Grain color can be purple, red, brown, bronze, tan, yellow, creamy or white. Bird damage to the heads may be reduced in hybrids with high tannin content in the grain.

## Planting date:

Suggested planting dates for grain sorghum are presented in Table 1. Sorghum seed will germinate when the soil temperature at seeding depth is 50°F, but germination and growth will be slow and the seedlings will be susceptible to disease. Faster germination and superior establishment is obtained when the soil temperature is 60°F at 8 am for more than 5 consecutive days. Sorghum may be planted in the summer but grain yields are usually less than a spring planting. The optimum date to plant in the summer is late enough to avoid the heat during bloom but early enough to avoid frost and poor drying conditions in the fall.

Table 1. Suggested planting dates for grain sorghum in Arizona.

Elevation (feet)	Spring planting	Summer planting
0-1000	March	July
1000-2000	March-April	June - July
2000-3000	April	June
3000-4500	May - June 15	NA

## Planting configuration:

Grain sorghum can be planted in row spacing ranging from 6 to 40 inches apart or in twin rows in a variety of configurations. Grain sorghum will generally yield more when planted in 20 or 30 inch rows compared to 40 inch rows or in twin rows spaced 12-14 inches apart on 38-40 inch beds. Grain sorghum can be planted on beds or on flat ground.

## Seeding rate:

The optimum seeding rate for grain sorghum is about 10 pounds of seed per acre assuming a seed size of 14,000 seeds per pound and 70% emergence. Seed size varies from about 13,000 to 16,000 seeds per pound depending on the hybrid, so seeding rate on a pound per acre basis should be decreased for smaller seed and increased for larger seed. The goal is to achieve a plant density of 100,000 plants per acre. Seeding rate can be increased by 20% if row spacing is 30 inches or less, with a non-tillering or short season hybrid or if planting in twin rows.

## Seeding depth:

The optimum depth of seeding is 1 to 2 inches. Seed deeper on lighter soils or if seeding into moisture rather than irrigating up.

## Fertilizer:

At the 6000 lb/acre yield level, the grain sorghum plant will take up about 150 pounds of nitrogen per acre. The actual nitrogen fertilizer requirement depends on grain yield, nitrogen contained in the soil (Table 2) irrigation water,

Table 2. Estimated seasonal nitrogen fertilizer rates for grain sorghum based on pre-plant soil nitrogen levels. These guidelines have not been verified for grain sorghum grown in Arizona.

Soil Test Nitrate ppm NO <sub>3</sub> -N	Approximate Nitrogen Fertilizer Rate lbs N/acre
0-10	150-200
10-20	100-150
20-50	30-100
Above 50	0-30

previous crop, and other factors. For example, more nitrogen fertilizer may be necessary following a small grain crop in order to break down the straw, compared to low residue crops or soil nitrogen building crops such as alfalfa. Phosphorus fertilizer is generally not required except when planting in the cooler part of the spring and the soil phosphorus level is less than 5 ppm. A need for potassium fertilizer is not expected in Arizona for most soils. Iron deficiency can occur on highly alkaline soils and zinc deficiency can occur where topsoil has been removed by land leveling.

### Irrigation:

Sorghum requires adequate soil water for maximum yields even though the crop is drought tolerant. The amount of water used by sorghum in a late June planting in the Phoenix area has been measured at 25 inches. Assuming an irrigation efficiency of 70%, the actual amount of irrigation water that would be needed to meet this water use is 36 inches. Daily water use is relatively low during establishment, peaks at about 0.4 inches per day at bloom and steadily declines thereafter. Even after the grain is mature, some soil moisture is necessary to maintain stalk integrity before harvest. Using border flood irrigation on a sandy loam soil, about six irrigations of 6 inches each will be required. The actual number of irrigations will vary, of course, depending on soil type, hybrid maturity and rainfall.

### Weeds:

Weeds in grain sorghum can reduce yield, harbor insects and diseases and create problems at harvest. Weeds can be controlled by tillage or by using herbicides available for sorghum. Even though sorghum eventually establishes a dense canopy, it is not particularly competitive with weeds early in the season because the crop develops slowly. Controlling grass weeds in sorghum can be problematic because of the limited effectiveness of herbicides available for post-emergence applications. So, pre-plant application of herbicides is recommended for grass control, or the use of seed safeners that allow the application of more effective post-emergence herbicides. Most broadleaf weeds can be readily controlled in sorghum with tillage or herbicides, or the crop can out-compete these weeds. One exception is morningglory, which can grow over the crop creating problems at harvest, so this weed should not be tolerated.

### Insects:

Some of the insects that may infest sorghum are the Southwestern corn borer, Lesser stalk borer, corn leaf aphid, greenbug, sorghum midge, corn earworm, fall armyworm, stink bugs, cutworms, flea beetles and spider mites. Chemical treatment may not be warranted for most of these insects unless the damage is severe. Severe insect damage is most common when sorghum is planted late or following a corn or sorghum crop. Leaf feeders such as the corn earworm and fall armyworm generally do not cause economic damage. The Southwestern corn borer, by contrast, can cause economic damage and the crop should be monitored carefully for this insect. This pest feeds in the leaf whorls and causes a shot-hole appearance to the leaves when they unfold. After feeding on the leaves, the larvae move down the plant and bore into the stalk where the real damage occurs. Tunneling in the stalk by this pest, especially by the second and succeeding generations, weakens the stalk and may cause lodging. Southwestern corn borer should be chemically controlled when 25% of the whorls are infested. Cultural practices that may be helpful for control of this pest include avoid planting after corn or sorghum, planting early-maturing hybrids, sowing the crop early, planting over a short period of time over an area-wide basis to avoid population build-up, maintaining strong stalks through proper plant population and irrigation and fertilizer practices, and surface tillage at harvest to break the stalks and expose the larvae to cool winter temperatures and desiccation. The lesser stalk borer may be a problem when planting in June or July after wheat or barley. Application of an insecticide or flooding of young plants may control this insect. Greenbug can be damaging since it injects toxins into the plant. Nutrient or water stress can lead to buildup of greenbugs. Chemical treatment after heading is not recommended. Sorghum midge is a gnat-like insect whose larvae feed on the developing seed. Early planting helps avoid high populations of this insect. Cutworms are most likely to be a problem if sorghum follows small grain, corn, sorghum, or spring vegetable crops. The larvae of this insect feed at night just above the soil surface by cutting off young plants or chewing holes in the stems of older plants, then seek cover during the day in the soil or debris. Spider mites feed mostly on the lower surface of leaves, and, as populations increase, individual mites are barely visible

without magnification although their fine webbing will be evident. The infestation is usually observed on the edges of the field.

### Diseases:

Grain sorghum grown in Arizona usually is not significantly damaged by diseases. Generally, fungicide applications are not economical for grain sorghum diseases. The most effective control measures are hybrid resistance and allowing at least 3 years between sorghum crops. Weed control can further limit disease introduction. Of the few diseases that have been described in Arizona, most have not been problematic in recent years. These include:

- (1) Head smut, a fungal disease that infects the inflorescence and sometimes the foliage resulting in sooty vascular strands. In areas where disease occurs, only sorghum varieties with known tolerance should be planted.
- (2) Maize dwarf mosaic virus (MDMV), an aphid transmitted virus that infects grain sorghum and Johnson grass. Johnsongrass is a common alternate host for the virus in Arizona.
- (3) Fusarium root rot, also called Yuma root rot in Arizona, was reported in southwestern Arizona in 1972 in late planted sorghum. Several species of *Fusarium* cause root and stalk rots of sorghum and also are implicated in seedling and storage diseases, including mycotoxin production, but none has been a problem in Arizona to date. Tolerant varieties, earlier planting and good cultural practices have probably eliminated much of this problem.
- (4) Root-knot nematode is probably the most common and easily missed pathogen on sorghum. Damage to sorghum is not always evident, but sorghum is an excellent host and causes problems when rotated with other susceptible crops such as corn, cotton, peppers and melons.

### Harvest Aid Chemicals:

Various chemicals have been used on grain sorghum near harvest with the hope of stopping crop growth, desiccating foliage, or drying the grain. Examples of chemicals used for this purpose are salts such as sodium chlorate or herbicides such as paraquat or glyphosate. These chemicals work best when the temperature is warm and the air dry. Harvest aid chemicals have not been tested in Arizona, but experience from other regions suggest that, while crop growth may be

stopped and foliage desiccated, rarely do these chemicals speed the grain drying process. Terminating irrigation about 2-3 weeks after bloom and avoiding excessive nitrogen rates may enhance the grain drying process.

### Harvesting:

When to harvest sorghum can be a difficult decision, due to uneven maturity. Also, depending on the hybrid, the stalks and leaves may still be green when the grain is ready for harvest. Sorghum can be harvested when grain moisture content is 18-23%, and harvest losses increase outside of this moisture range. However, the grain can not be stored safely over a long period of time above a moisture content of 12-14%, so artificial drying is necessary if harvesting high moisture grain. Unfortunately, artificial drying facilities are not available in Arizona, so grain should be harvested when its moisture content is below 14%. Sorghum grain readily absorbs moisture from the atmosphere, and grain moisture content can change a few percentage points during the day. Thus, check grain moisture before harvesting and stop harvest before evening if moisture content increases above suggested storage levels. Sorghum grain is brittle and more easily cracked than the grain of wheat or barley, so care must be taken in adjusting the combine.



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