



# Grain Sorghum

G. Armah-Agyeman, J. Loiland, R. Karow, W.A Payne, C. Trostle, and B. Bean

## History

Sorghums (*Sorghum bicolor*) are warm-season grasses native to Africa. They were introduced into the United States in the 17th century. They are grown primarily under dryland conditions or with limited irrigation in the semi-arid southwest and the Great Plains. Grain sorghums generally are cultivated in areas that are too hot and dry for corn because of their ability to withstand drought.

Development of early maturing varieties and other genetic improvements have made it possible to grow the crop in areas where it could not be grown before.

Worldwide, sorghum mainly is food for humans; but, in the U.S., grain sorghum serves mainly as feed for livestock. The U.S. is a major sorghum producer and exporter, and the crop is second only to corn as a feed crop.



## Description

Sorghum is similar to corn in appearance. In the vegetative stage, it can be mistaken for corn. It differs from corn in that most commercial varieties can tiller in response to favorable environmental conditions.

Early sorghum varieties were tall and made combining almost impossible, but the current commercial hybrids have dwarf genes and stand only 2 to 5 feet tall. The mature stem is pithy and has leaves alternating on opposite sides. The number of leaves varies from 7 to 18 or more, depending on the variety and the amount of time required for it to reach maturity.

Its leaves and root system are what make sorghum tolerant to drought and give it superiority over corn and other cereals. The leaves and stems are covered with a wax coating that protects them from drying out. The leaves have many small stomata.

Grace Armah-Agyeman, former Extension research associate, Department of Crop and Soil Science, Oregon State University.

Jim Loiland, U.S. Department of Agriculture, Natural Resource and Conservation Service, Pendleton, Oregon.

Russell S. Karow, Extension agronomist, Oregon State University.

William A. Payne, Calvin Trostle, and Brent Bean, Texas A&M University Agricultural Research and Extension Center, Amarillo



Under moisture stress, the leaves roll along the midrib to keep the plant from losing water and wilting.

The sorghum plant has an extensive root system that can penetrate to depths of 5 feet or more. Because of this extensive and efficient root system, the plant acquires more available soil moisture than many other crops.

Unlike corn, sorghum is mostly self-pollinated, because both female and male flowers are borne on the same head. The sorghum head is a panicle that stands about 3 to 14 inches long and 2 to 5 inches wide. Pollination starts as soon as the head is out of the boot and continues for about a week.

Cross-pollination sometimes occurs and causes off-type plants in the field. Some of the serious pollen contaminants of grain sorghum are Johnsongrass, forage sorghum, and sudangrass.

The seeds come in a variety of colors: white (food grade), red, brown, yellow, creme, or bronze. Brown colored grains are high in tannins, bitter chemical substances that make them unpalatable.

## Conditions for growth

### *Climate*

Sorghum is adapted to a wide range of soil and climatic conditions. It is well able to withstand both high temperatures and moisture limitations. It always will out-yield corn in low moisture conditions. Moreover, it can yield as high as 10,000 pounds per acre with ample rainfall or irrigation.

Sorghum reaches its maximum water use during the boot and flowering stage. During this time, the crop can use over 0.3 inches per acre per day under hot, dry, windy conditions. Stress during this time has a greater effect on yield than at any other time during the growth of the plant. The need for water starts declining significantly after the soft dough stage.

Sorghum yields best when average temperatures during the growing period are in the 75 to 80°F range. The crop can withstand temperatures above 100°F, but extended



periods of drought will result in significant yield reduction. Grain heads are produced over a long period of time; thus, short periods of drought do not seriously affect yield.

### *Soil*

The crop grows successfully on all soils and over a wide range of soil pH. But, it yields best on soils with a pH of 6 to 6.5. Think of liming when soil tests show a pH of less than 5.5 to ensure improved nutrient uptake and yield increases. Check with your local Extension specialists for soil test recommendations.

**Note:** Iron (Fe) deficiency, manifested as iron chlorosis in sorghum, generally occurs at a pH higher than 7.8 to 8.0, because sorghum is a poor accumulator of iron. Such sodic soils exist in Oregon, particularly in some parts of the Umatilla area.

## Cultural practices

Good cultural practices are most important for obtaining high yields.

### *Seedbed preparation*

A well-prepared seedbed is essential for controlling weeds and achieving good stand establishment. You can use the same standard seedbed preparation methods that you use for wheat to prepare the land for sorghum.

Corn and sorghum do equally well with reduced tillage as a land preparation method. Some growers in western Kansas and a number of other sorghum-growing areas engage in conservation tillage practices.



## **Planting date**

Do not plant grain sorghum until the soil is warm. Plant when soil temperatures are between 60 to 65°F to ensure emergence. Recommended planting dates for eastern Oregon are generally between May and early June. When the soil is warm enough and soil moisture supply is adequate for germination, you can plant.

Research shows that planting too early or too late results in decreases in grain yields, but late plantings reduced yields most. Late planting usually coincides with periods of high heat stress, which may result in low moisture for germination or in soils that are too hot for seedling growth. If the planting date is delayed, consider increasing the seeding rate to make up for the fewer tillers that will develop.

Choose a variety based on the number of days to reach maturity to match the planting date. Early maturing sorghums grown in Texas flower in about 55 days and mature in 80 to 90 days. The medium-early hybrids flower in 58 to 60 days and mature in about 90 to 98 days. Medium maturity varieties flower in about 60 to 64 days and mature in 98 to 105 days. Long-maturing cultivars flower in 65 or more days, and mature in 105 or more days.

## **Method and rate of seeding**

You can use a regular grain drill for seeding grain sorghum. So, if you are a wheat grower, you do not need to buy new equipment to incorporate sorghum into the rotation.

It is best to plant at a row spacing of 20 inches or less, because narrow row spacing has achieved higher yields compared to the 40-inch spacing formerly used. A row spacing of 12 to 14 inches may be best for eastern Oregon farmers.

There are about 15,000 to 20,000 seeds in a pound. Seeding rates of 8 to 10 pounds are recommended in some parts of the U.S., but 4 to 6 pounds per acre is generally adequate under dryland conditions. You can increase rates with irrigation.

Plant seeds 1 to 2 inches deep.

One of the popular rotations for dryland areas is a grain sorghum-fallow-wheat rotation.

Growers harvest the grain sorghum in the fall and leave the residue on the field till the spring. Some rotations under irrigation grow wheat followed by sorghum, and then immediately follow with wheat.

## **Fertilizer**

Like corn, sorghum uses relatively large amounts of nitrogen and moderate amounts of potassium and phosphorous. For example, sorghum removes about 100 pounds of nitrogen and 14 pounds of both phosphorus and potassium for every 100 bushels per acre of grain produced.

A soil test is the best way to determine how much of any particular nutrient you need to use. Consult your local Extension agent for advice on the fertilizer needs of grain sorghum crops grown in eastern Oregon.

## **Weed control**

Early weed control is very important. Sorghum grows slowly in the seedling stage, so it is vulnerable to weeds. One or two shallow cultivations before planting eliminates most weeds and helps the sorghum get a head start.

After plants are established, control weeds by cultivating with rotary hoes, knives, and disks.

The following herbicides have been used historically on grain sorghum: atrazine, dicamba, bromoxynil, trifluralin, linuron, propaclar, and metolaclor. In some areas where annual grasses are a problem, growers make pre-emergence application of alaclor or metolaclor. Be sure to plant safened seeds when you apply these two chemicals. There are several options for post-emergence control of broadleaf weeds.

Check with weed control experts in the region for advice on herbicide application, especially when other crops are in the rotation. **Always read product labels for specific instructions and restrictions for each herbicide.**

## **Birds**

Birds, especially blackbirds and sparrows, are a major problem, especially at the soft

dough stage when the kernel is high in sugars. Birds are most difficult to control. There is no single effective method. To minimize damage, do not plant fields near timbered or scrub brush areas.

There are some sorghum varieties that are high in tannins, so they are less palatable to birds. The tannins are high at the soft dough stage and decline as the crop matures. This would be the ideal solution, except that high tannin varieties do not command high market prices because of their reduced feed value. The National Grain Sorghum Growers Association strongly discourages planting high tannin varieties because of potential mixture problems between high and low tannin types in feed markets.

### ***Insects and diseases***

Greenbug, chinch bug, sorghum midge, cutworm, and corn earworm are insect pests that cause significant yield losses in grain sorghum. Root rots, head smut, loose smut, and covered kernel smut are some of the serious diseases of sorghum.

Use resistant varieties and good field sanitation practices; these are the most environment-friendly practices that can control these pests. Use fungicidal seed treatment to control loose and covered kernel smut. See your Extension agent for advice on using pesticides.

### ***Harvesting and marketing***

Most growers harvest with a combine when grain moisture is about 13 to 15 percent. If drying facilities are available, you can harvest grain when moisture content is up to 25 percent. Time of harvest depends on the weather and on the availability of grain drying facilities in the area.

You must store grain sorghum at 11 to 13 percent moisture. This is important in order to minimize storage losses and maintain grain quality.

Most of the losses from early grain harvest come from the cylinder. Pay attention to cylinder speeds. Adjust them to 750 to

1,300 rpm for optimum results. In general, the cylinder speeds for sorghum should be half as fast as for wheat. Use a pick-up attachment on the combine if most of the plants are lodged severely.

It is normal to sell the grain to local elevators at the time of harvest. However, there is an emerging trend for farmers to hold the grain on their farms in order to take advantage of seasonal price increases.

## **Yield potential**

Yields of up to 4,000 pounds per acre under dryland conditions are possible using newer hybrids. Yields of 8,000 pounds and more are normal under irrigation. Table 1 gives the yield data of some trials done in Pendleton, Oregon.

**Table 1.** Yields of recommended grain sorghum varieties under the dryland conditions of Pendleton, Oregon.

Variety	Yield (lb/a)	Ranking
Dekalb 18 Ec	3,300	1
Dekalb 28 Ec	3,000	2
Dekalb 18 C	3,000	2
Pioneer 8925	2,500	4
Pioneer 8950	2,300	5

Planted 4/27/00

Harvested 10/6/00

Seeding rate: 87,000 seeds/a

Source: Chengci Chen et al., 2000 (unpublished data).

## **For more information**

### ***OSU Extension publications***

*Pacific Northwest Weed Management Handbook* (revised 2002). \$35

To order copies of this publication, send the complete title and series number, along



with a check or money order for the amount listed (payable to Oregon State University), to:

Publication Orders  
Extension & Station Communications  
Oregon State University  
422 Kerr Administration  
Corvallis, OR 97331-2119  
Fax: 541-737-0817

We offer discounts on orders of 100 or more copies of a single title. Please call 541-737-2513 for price quotes.

Other publications in the Dryland Cropping Systems set:  
*Garbanzo Beans (Chickpea)*, EM 8791 (2002).  
*Safflower*, EM 8792 (2002).  
*Sudangrass*, EM 8793 (2002).  
*Dryland Alfalfa*, EM 8795 (2002).  
*Edible Mustard*, EM 8796 (2002).

These are available online at [eesc.oregonstate.edu](http://eesc.oregonstate.edu), or contact one of the following county offices:

Baker, Clackamas, Crook, Gilliam, Jefferson, Josephine, Klamath, Linn, Malheur, Marion, Morrow, Sherman, Umatilla, Union, Wallowa, Wasco, Yamhill

## World Wide Web

You can access our Publications and Videos catalog and many of our publications on the Web at [eesc.oregonstate.edu](http://eesc.oregonstate.edu)

## Bibliography

- Alternative Field Crops Manual*. 1992. Grain Sorghum (milo). University of Wisconsin-Extension, Cooperative Extension, University of Minnesota: Center for Alternative Plant and Animal Products and the Minnesota Extension Service.
- Amonson, S. et al. 2001. Texas A&M University Sorghum PROFIT. <http://sorghum.tamu.edu>
- Bennett, W.F., B.B. Tucker, and A.B. Maunder (ed.). 1990. *Modern Grain Sorghum Production*. Iowa State University Press, Ames.
- Clark, L.E. and T.O. Knight. 1996. Grain production and economic returns from dryland sorghum in response to tillage systems and planting patterns in the semi-arid southwestern USA. *J. Prod. Agric.* 9:249-256.
- Fribourg, H. 2000. *Summer Annual Grasses*. [http://www.forages.css.orst.edu/Topics/Species/Grasses/Summer\\_annual/Publicati...intro.htm](http://www.forages.css.orst.edu/Topics/Species/Grasses/Summer_annual/Publicati...intro.htm)
- Martin, V.L. and R.L. Vanderlip. 1997. Sorghum hybrid selection and planting management under moisture limiting conditions. *J. Prod. Agric.* 10:157-163.
- Matowo, P.R., G.M. Pierzynski, D.A. Whitney, and R.E. Lamond. 1997. Long term effects of tillage and nitrogen source, rate, and placement on grain sorghum production. *J. Prod. Agric.* 10:141-146.
- Norwood, C.A. 1995. Comparison of limited irrigated vs. dryland cropping systems in the U.S. Great Plains. *Agron. J.* 87:737-743.

© 2002 Oregon State University

---

This publication was produced and distributed in furtherance of the Acts of Congress of May 8 and June 30, 1914. Extension work is a cooperative program of Oregon State University, the U.S. Department of Agriculture, and Oregon counties.

Oregon State University Extension Service offers educational programs, activities, and materials—*without discrimination based on race, color, religion, sex, sexual orientation, national origin, age, marital status, disability, or disabled veteran or Vietnam-era veteran status*. Oregon State University Extension Service is an Equal Opportunity Employer.

---

Published July 2002