

PEARL MILLET

A New Grain Crop Option for Sandy Soils or Other Moisture-Limited Conditions

Overview

Pearl millet is a warm season annual grass that is best known in the U.S. as a forage crop. Estimated U.S. area planted to pearl millet for forage use is 1.5 million acres. New varieties of pearl millet, however, are being developed for use as a grain crop. These new hybrid types of pearl millet are shorter in stature for easier combining, and higher in seed yield. Use of pearl millet grain on a commercial basis only began in the U.S. in the early 1990s, but has led to production on several thousand acres in Georgia and Florida. Most of this initial pearl millet production has been for poultry feed, although the crop shows good feed potential for other types of livestock as well. Some pearl millet has been grown for birdseed.

Pearl millet was domesticated as a food crop in the tropical region of East Africa at least 4,000 years ago. Its use as a food grain has grown over the centuries, with an estimated 64 million acres of pearl millet being grown in Africa and India (this acreage is equivalent to the total U.S. corn crop). The crop is used for a variety of food products, and is even made into a type of beer.

Plant Description

Pearl millet [*Pennisetum glaucum* (L.) R.Br.] grown for grain has a growth habit similar to sorghum. Pearl millet is a warm season crop, planted in early summer when soils have warmed up. In Missouri, it reaches the stage of 50% flowering in about 60 to 70 days from planting. The flowers and seeds occur in a spike at the end of the stem or tillers, looking somewhat like a cattail or bullrush head. Including the grain head, the plant will typically be about 4 to 5 feet tall in Missouri, although height can vary from 3 to 6 feet depending on variety and growing conditions. The crop is primarily cross pollinated, and following pollination, it takes a flower about 30 more days to develop into a mature seed. Grain heads will mature a few weeks prior to leaf dry down, but



seed shatter is not usually a problem. When planted around June 1 in Missouri, it will usually be ready to harvest in late September.

Like any grain crop, pearl millet will yield best on fertile, well drained soils. However, it also performs relatively well on sandy soils under acidic soil conditions, and when available soil moisture and soil fertility are low. This adaptation reflects pearl millets origin in the Sahel region of Africa, where growing conditions are difficult. Pearl millet appears to have relatively fast root development, sending extensive roots both laterally and downward into the soil profile to take advantage of available moisture and nutrients. The crop does best when there are plenty of hot days, although it has been successfully produced in cooler areas such as North Dakota. In general, pearl millet fits in the same areas of adaptation as sorghum (milo), except that it is somewhat more drought tolerant and has a little earlier maturity. It also tolerates low soil pH better than sorghum.

(continued on page 4)

How to Grow Pearl Millet

Although pearl millet has been researched as a grain crop alternative in the U.S. for less than a decade, basic production guidelines have been developed. Several field trials with pearl millet were conducted by the author at University of Missouri research farms during 1991-1994. In general, pearl millet management is very similar to growing sorghum. Pearl millet can be considered a “low-input” crop, but does respond to fertile soil conditions and good management practices.

Variety Selection and Seed Sources

Development of grain-type pearl millet varieties is currently being done by university and USDA plant breeders, who can then release their cultivars as public varieties or under license to a private company. To date, the only available varieties are HGM 486 and HGM 686. HGM 686 has performed better in Missouri. HGM varieties are available from Crosbyton Seed (800-628-6551), a seed dealer in Texas. A new variety is expected for purchase in 2004. This variety is shorter season than HGM 686 and offers the potential as a double crop in southern Missouri. Pearl millet varieties are hybrids, so new seed must be purchased each year. Producers seeking grain-type pearl millet are cautioned to clarify that the seed they are purchasing is not a forage-type pearl millet. The forage types are much taller (7-8 feet) and have low seed yield.

Planting

Soil temperatures should be at least 65°F. or warmer before pearl millet is planted. In Missouri, optimum planting time is early June, with a range of mid-May to mid-June being appropriate. Pearl millet can potentially be planted as a double crop after winter wheat or winter canola in the southeastern part of the state, but it has too long a season for double cropping elsewhere in the state.

Seeding rate is recommended at 4 pounds per acre. An exact seeding rate is not critical, because pearl millet can partially compensate for a poor stand by increasing the number of tillers. Seeding depth should be 1/2 to 1 inch deep. No-till seeding is feasible, although the shallower seeding depth compared to corn or soybeans can make proper control of planter depth (through surface residue) more challenging.

A variety of row widths are appropriate with grain-type pearl millet. Previous work with pearl millet in Missouri has been based on 30 inch row widths. This allows row crop cultivation for weed control. At this row width, pearl millet will normally have enough leaf development to “close the row.” In other states, narrower rows have sometimes given a yield improvement over wide rows. The narrower rows prevent using a cultivator for weed control, but ground shading by millet leaves occurs earlier, helping suppress some weeds. On sandy soils, wider row spacings may be better since they will allow individual plants to develop more lateral roots, due to less row-to-row competition.

Fertility Management

Pearl millet will respond to good soil fertility, but does not have a high nutrient demand. It can be considered similar to sorghum in its fertility needs; rates recommended for sorghum by a soil test lab can be applied to pearl millet. Millet may need somewhat less nitrogen than sorghum, because current varieties yield less than sorghum.

For conventional production, about 40 to 80 pounds of nitrogen fertilizer per acre should be applied on most Missouri soils. The lower amount is appropriate if the millet follows a legume such as soybeans. Since nitrogen needs are modest, fertilizer nitrogen can be applied sidedress rather than preplant if appropriate. Nitrogen needs can certainly be met from organic sources, such as animal manure or a leguminous cover crop.

Phosphorous and potassium needs of pearl millet have not been well studied, but again the rule of thumb is to use rates recommended by a soil test lab for sorghum. Phosphorous response is likely to be improved if the P is banded near the seed. Liming is probably not necessary on most Missouri soils for pearl millet, since it has been reported to be fairly tolerant of low soil pH.

Pest Management*

Weed control

Only a few herbicides are currently labeled for pearl millet. Peak and 2,4-D are labeled for broadleaf control with pearl millet, while Banvel can be used to control some grasses, though it is still primarily a broadleaf herbicide. There is some question as to whether these labels apply only to forage millet or also cover grain-type millet. Since pearl millet is planted relatively late,

two preplant tillage operations are recommended, first to stimulate germination of weed seeds, then, several days later, to kill weed seedlings prior to planting. If planted in wide rows, row cultivation for weed control should be planned, especially if herbicide control is ineffective. Pearl millet is somewhat slow growing as a seedling, making preplant weed control important, but soon takes off and competes well with late-emerging weeds. With no-till planting, weed control by herbicides or effective use of cover crops is necessary to successfully establish pearl millet.

Insects

The only insect pest of pearl millet noted so far in Missouri is European corn borer. Chinch bugs have also been a problem on occasion in other states. Normally insecticides are not needed on pearl millet. In the event they are, there are several insecticides labeled for millets, including Malathion, Methaldehyde, Methoprene, Myphosphide, Phostoxin, Pyrellin, Seven, Success and Telone. General purpose organic materials such as certain Bt and pyrethrin products may be used on most crops, including pearl millet.

Diseases

No significant disease problems have been noted in four years of field testing pearl millet in Missouri. Rust has occasionally appeared in southeastern states, usually on later planted pearl millet. New rust resistant varieties are being developed. Seedlings trying to emerge from cold, wet soils sometimes are killed by damping off caused by soil pathogens. Fungicide applications are not recommended for pearl millet, but there are labeled products for millets: Maxim, Maxim-XL, Mefenoxam and Metalaxyl.

Birds

Birds can cause damage to pearl millet fields. The grain heads are carried on a stalk strong enough to serve as a perch for most birds that peck away at the exposed seed on the grain head. In small Missouri test plots (less than an acre), birds have occasionally eaten almost every seed. In fields of forty acres or more, damage will usually be much more limited, typically less than 5 to 10% loss, if damage occurs at all. Chance of damage can be reduced by keeping pearl millet fields away from tree lines or woods if possible.

Organic Production

Pearl millet is a crop that should need little in the way of pesticide use, and can be grown effectively with organic methods for the organic livestock feed market, which pays a premium for feed materials in many areas. Using cover crops or manure to boost fertility, employing cultural and mechanical weed control, and incorporating crop rotation can allow successful organic production of this crop.

**Pesticides mentioned as being labeled in this publication are based on reference lists published in the Thomson Publications "Quick Guide" on crop pesticides, 2002 edition. These lists are believed to be accurate, but given the changing nature of pesticide registrations, labels and relevant government pesticide regulations should be checked before applying any herbicide or other pesticide.*

Harvest and Storage

Current pearl millet varieties produce seeds that are ready for harvest before the plant is dried down. Although the seeds are not likely to shatter, it is desirable to harvest as soon after seed maturity as plant dry down allows, to avoid unnecessary grain loss to birds or storm caused stem lodging. If pearl millet is planted by early June, leaf dry down is usually complete by late September, but weather conditions can greatly affect dry down. The plants will continue to stand after a frost, so a delayed harvest is possible.

An all crop or small grain combine header is appropriate for harvesting pearl millet. Combines must be adjusted to properly thresh the small seed of pearl millet. A good starting point for the combine settings are those recommended for sorghum. Air speed may need to be reduced, and screen sizes may need to be changed on combines that use replaceable threshing screens. Efficient threshing can help improve the value of the millet for livestock use, by minimizing chaff and other materials. Since the grain heads are at least three feet off the ground, cutter bars can be run above the ground.

More research is needed on appropriate storage methods for pearl millet, but current recommendations are that the grain be stored at a maximum moisture of 12-13%. Since the seed size is smaller than sorghum and corn, it is more difficult to force air through it in a grain drier. When trucking millet long distances, it is probably best to tarp the grain to prevent seed loss.

(continued from page 1)

Utilization

Although pearl millet was developed as a food crop and is still primarily used this way in Africa and India, its grain is most likely to be used for animal feed in the U.S. Several studies have been conducted on its potential for various types of animals, including poultry, ducks, cows, hogs, and catfish. In general, it performs comparably to corn in the diet for these animals, with small advantages in certain situations.

Typically the protein content of pearl millet is 45% higher than feed corn and is also 40% higher in lysine. This higher protein and other feed characteristics have helped drive the interest in the grain by poultry producers and other livestock producers. Pearl millet is much lower in tannin than sorghum and its seed is about half the weight of a sorghum seed. Seeds are pointed at one end, rounded at the other and primarily light colored with a blue or gray tinge to them.

Markets and Economics

The main commercial market to date for grain-type pearl millet has been the broiler market. Lack of familiarity with the crop has limited its use in other livestock feed markets. However, as feed formulators and buyers become more familiar with the crop, its potential markets will expand. In the meantime, pearl millet grain can certainly be used on-farm as a feed for cows, hogs or poultry. A one-to-one substitution of pearl millet for corn in a feed formulation is usually appropriate.

Given its comparable feed value to corn, pearl millet has been priced based on corn prices, or sometimes at a slight discount relative to corn. In situations where pearl millet delivers superior feed value to corn, it should in the long run receive a premium, but it will take time for such market value to be realized. However, yields of current pearl millet are not competitive with corn or even sorghum on good, fertile soils. Pearl millet has a competitive advantage over corn and sometimes sorghum on sandier soils in moisture-limited situations.

Yields of grain-type pearl millet are expected to rapidly improve with the release of new hybrids over the next several years. At this time, 4000 to 4500 pounds per acre would be a reasonable yield on good soils, with 3000 pounds typical on more marginal soils. Thus, gross income based on these yields will be well under \$200 per acre if corn is

priced below \$2.50/bushel. Even though production costs on pearl millet are low (comparable to corn and sorghum), grain yields need to be increased by breeders to help make the crop competitive on a larger acreage.

Another potential market for pearl millet is as part of wild birdseed mixes. Although no research has been done on its use as a birdseed, it has been repeatedly noted that a number of songbirds, including gold finches and juncos, enjoy feeding on the seed. Sorghum is often used in birdseed mixes, but pearl millet may be more attractive to certain songbirds. The birdseed market could potentially absorb tens of thousands of acres of pearl millet grain production. In the mid-1990s, a few thousand acres of pearl millet were sold into the commercial birdseed market. The birdseed market could generate higher prices for pearl millet than the feed market, provided the demand is strong enough. Price initially would depend on whether the pearl millet was substituted for sorghum (low value) or proso millet (moderate value) in birdseed mixes.

Even though pearl millet is used as a food crop in other countries, it is unlikely to be used as a food in the U.S. in the near future. No research is being conducted in the U.S. on its food use potential, and little is known about its potential for use in industrial products.



Written by Robert L. Myers, Ph.D.

Published by the Jefferson Institute, Columbia, MO, a non-profit research and education center supporting crop diversification (ph: 573-449-3518). Development of this publication was funded by the USDA-CSREES Fund for Rural America program, as part of a cooperative project with the University of Missouri and other universities.

www.jeffersoninstitute.org

Revised 7/02
