



Edible Mustard

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History

Mustard and rapeseeds (*Brassica* sp.) are native to the temperate regions of Europe. They were among the first domesticated crops. Mustard has been cultivated for at least 4,000 years as an oil, spice, and medicinal plant. It has been cultivated not only for seed, but also as a forage, green manure, and garden crop. It was introduced into western and northern Europe in the early Middle Ages.



Mustard has been a major specialty crop in North America since the mid-1940s. Production of mustard in the Upper Midwest began in the early 1960s. Production acres in Canada peaked in the mid 1980s. Alberta, Manitoba, and Saskatchewan currently grow a large share of the world's mustard crop. In 1996, Saskatchewan harvested 470,000 acres with a yield of 425 million pounds.

Yellow, brown, and oriental mustards are grown in North America. Yellow mustard (*Brassica hirta*) comprises the majority of the acreage grown in Oregon. Brown and oriental mustards (*Brassica juncea*) are not produced currently in Oregon.

Today, people consume more than 700 million pounds of mustard worldwide each year. Yellow mustard usually is used as a condiment and as dry mustard. Brown and oriental mustards are used for oil and spices.

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Description

Yellow mustard is a spring annual broad-leaf with a well-defined taproot. Mustard emerges rapidly (5 to 10 days) and grows quickly under favorable moisture and temperature conditions. The crop canopy covers the ground completely in about 30 days after planting. At approximately 35 to 40 days after sowing, plants begin to bud. Five to 7 days later, flowering begins. Plants reach full bloom 7 to 10 days after flower initiation.

A long bloom period (longer than 15 days) is ideal. Seed yield is related directly to length of bloom.

Varieties of yellow mustard usually mature in 80 to 85 days. Brown and oriental types require 90 to 95 days. Mature plants vary in height from 30 to 45 inches, depending on genetic potential and environmental conditions.



Photo courtesy of University of Saskatchewan (<http://interactive.usask.ca/skinteractive/modules/agriculture/crops/oilseeds/mustard.html>)

Conditions for growth

Climate

Mustard is a cool season crop with a short growing season. Adequate water and cool temperatures (less than 85°F) favor a long bloom period. Seedlings are tolerant of mild frosts (26 to 33°F) after emergence, but severe frosts (below 26°F) can destroy the crop.

Mustard, especially the brown and oriental types, has a drought tolerance between that of wheat and rapeseed. Moisture stress caused by hot, dry conditions during the flowering period frequently causes lower yields.

Soil

Mustard is adapted best to fertile, well-drained, loamy soils, but it can grow in variable soil types with good drainage. Soils prone to crusting prior to seedling emergence can cause problems. Avoid dry sand and dry, sandy loam soils, also.

Seed germination

Seed will germinate at a soil temperature as low as 40°F.

Cultural practices

Small grains following mustard usually yield more than when they follow continuous small grain. Sunflower, canola, safflower, flax, dry bean, field peas, lentils, and soybean have similar diseases and insect pests to mustard. Avoid close rotation of these crops to mustard.

Seedbeds

Seedbeds for mustard are similar to those required for small grains. The soil should be firm and fairly level. Till deep enough to kill weeds, but keep soil moisture close to the



surface and leave a firm seedbed. Roll or pack the seedbed (before sowing) if the soil is loose or uneven, and also if soil moisture varies.

Sowing depth and seed placement

Seed depth depends on seedbed, soil and weather conditions, and the type of seeding equipment available. Ideally, sow mustard into firm, moist soil with a minimum of soil cover. When sowing with a disc or hoe drill, place seed 0.5 to 1 inch deep into moist soil and press over the row. Uniform placement assures even, vigorous emergence.

You can plant mustard successfully into small grain stubble provided the seed makes good contact with moist soil and is not more than 1.5 inches deep (preferably not more than 1 inch). You can use disc and hoe drills or air seeders to seed mustard, but **uniform depth control is critical** for seed placement.

Row spacing

If mustard stands are poor (less than 4 to 5 plants per square foot 10 days after planting), decide rapidly whether to replant. Uniform, competitive stands are important, as with all spring crops.

It is best to plant mustard at a 6- to 7-inch row spacing to ensure a competitive stand. You can use a row spacing up to 12 inches; however, the canopy will not close as quickly. Therefore, weed competition and evaporative water loss may be greater. Row spacing wider than 12 inches is not recommended.

Sowing rate and date

Yellow mustard has approximately 100,000 seeds per pound. Sow seed at a rate of 18 to 27 seeds per square foot. This rate is equivalent to 8 to 12 pounds per acre, depending on seed size. Research trials in Umatilla County, Oregon consistently have achieved adequate stands with 7 pounds per acre. Use higher rates where seedbed conditions are poor or emergence may be a problem.

Sow mustard when the soil temperature in the seedbed consistently exceeds 40°F. Gener-

ally, at Pendleton, Oregon, soil temperature reaches this condition about mid-March.

Delayed planting can impact yield, because the flowering period is later in the season, which increases chances of late-season heat stress. Timely planting is important.

Variety selections

The contracting company has supplied the mustard seed, so growers generally have not had the option to select or purchase other varieties. Commercial varieties of yellow mustard available currently include 'Gisiba,' 'Ochre,' 'Tilney,' and 'AC Pennant.'

Fertilizer

Mustard responds to nitrogen and phosphate fertilizer in a manner similar to small grains or spring canola. As with small grains, nitrogen is used in the greatest quantities.

Yellow mustard is a new crop to eastern Oregon, and there is limited information on nitrogen fertility rates specific to the area. A North Dakota fertilizer guide (SF 718, *Fertilizing Mustard, Canola, and Crambe*) recommends 6.5 pounds N per 100 pounds of expected seed yield. Table 1 is based on the North Dakota recommendation and amended with information from fertility trials in Oregon. Oregon experience shows best response at about 8 pounds N per 100 pounds seed production expected.

A series of fertility trials conducted in northern Idaho in 1994-97 showed that a total N supply of 125 pounds per acre (both residual

Table 1. Nitrogen need based on expected mustard yield.

Expected yield lb/a	Soil N-NO ₃ + Fertilizer N lb/a
1,000	80
1,500	120
2,000	150
2,500	180

soil N and applied) was adequate for yields up to 1,500 pounds per acre. Nitrogen beyond this level delayed flowering and increased lodging in some instances (both undesirable effects).

Add phosphorus and sulfur according to the recommendations for spring wheat. Spring crops respond to these nutrients, particularly in an annual crop rotation. An application of 20 pounds P_2O_5 and 10 pounds S per acre is typically adequate. Work in Idaho showed that mustard was not responsive to higher rates of sulfur, as is canola.

Mixing low rates of dry phosphorus fertilizer (less than 100 pounds per acre 16-20-0-14) with mustard seed and planting them together has been effective. However, the combination must be mixed thoroughly and must stay well-mixed to assure uniform seeding.

Weed control

Weed control starts with clean field selection combined with shallow seeding for quick and uniform emergence to achieve a competitive stand.

Weeds have not been a serious problem in mustard production in eastern Oregon. However, cow cockle seeds are a potential contaminant in mustard. Cow cockle has a black seed approximately the same size and weight as a mustard seed. These seeds can cause cleaning losses and market grade reductions. Such losses reduce profits to the grower.

Weeds growing as an understory in a mustard crop do not reduce yield. However, they may contribute seed to perpetuate weed problems in future crops.

Mustard plants are sensitive to herbicides such as 2,4-D, Banvel, and MCPA. You must avoid spray drift. Sulfonylurea herbicides used on previous grain crops can cause emergence problems in mustard.

Insects

Insects have not caused serious problems on yellow mustard in eastern Oregon. But, as mustard acreage increases, growers should

monitor fields for potential problems. Flea beetles and diamondback moth caterpillars are the most likely insects to cause damage.

Adult flea beetles feed on cotyledons and first true leaves, causing a shotholed appearance. Severely damaged seedlings may die, while less seriously damaged plants often suffer a reduction in vigor and stamina. Hot, sunny weather is conducive to feeding activity, while cool, damp weather slows feeding and favors crop growth. Once the crop advances beyond the seedling stage, serious damage is rare, because mustard can outgrow beetle defoliation.

Diamondback moth caterpillars attain a length of 0.5 inch and are light yellow-green to green. Larvae eat leaves, flowers, and green pods and are extremely active when touched.

Aphids have been observed in some eastern Oregon fields. They have not been a problem to date.

Diseases

Sclerotinia stalk rot (white mold) is the only disease that has been observed on mustard in eastern Oregon. It has been observed only at low levels. However, canola, dry edible bean, crambe, and safflower have a similar problem with white mold. Do not grow mustard in short rotation with these crops, or the problem could build to economic levels.

Mustard grown in rotation with small grains is relatively free of disease. The rotation prevents serious disease problems and provides an excellent biologic break for cereal root diseases.

Harvesting

Wind, rain, and normal drying generally do not cause mustard to shatter before cutting.

Yellow mustard can be direct-combined if the field is not weedy and the crop is uniformly ripe. The harvest operation can cause some shatter if the crop is overripe or extremely dry. When direct-combining, wait until the crop is mature and dry. You can remove the reel or lift it above the crop if the stand is good. If the reel is needed, operate it at a reduced speed.



Adjust the combine so that the seeds are completely threshed while using the lowest possible cylinder speed. Set cylinder speed at approximately 600 rpm. Careful adjustment of the cylinder speed and cylinder opening is important to avoid cracking.

To test for cracking, run your hand into the threshed seed. If there is cracked mustard, pieces of the seed coat will adhere to the hair on the back of your hand. If this occurs, adjust the combine further. **Cracked seed is considered dockage and is a loss to the producer.**

You may need to vary the cylinder speed during the day as crop moisture content varies. Reduce fan speed to limit seed loss, but maintain sufficient air to ensure clean seed.

Drying and storage

Mustard harvested in eastern Oregon typically does not need drying. You may need to make some arrangements for short-term storage, on or off the farm, to coordinate delivery.

Yield potential

Mustard yields in eastern Oregon have been variable due to differences among varieties, cultural practices, and environmental conditions. Table 2 lists yields from research trials in Pendleton and Moro. Data is from the 1995-1996 growing seasons.

Economics

Production

Cash production costs for mustard are similar to growing a spring grain crop. There are no herbicides currently registered for mustards in the United States, so that is not a part of production costs. Insects have not developed as a problem to date, so insecticides also are not a production cost.

Table 2. Yield of mustard at Pendleton and Moro under fallow and recrop conditions.

	Pendleton recrop		Pendleton fallow		Moro recrop		Moro fallow		Overall avg.	
	Rank*	Yield	Rank	Yield	Rank	Yield	Rank	Yield	Rank	Yield
	/27	lb/a	/27	lb/a	/27	lb/a	/27	lb/a	/27	lb/a
1995										
Gisiba	8	1,565	4	1,465	9	1,264	20	1,129	6	1,356
Kirby	1	1,789	1	1,712	5	1,308	1	1,480	1	1,572
Ochre	7	1,579	6	1,387	1	1,471	15	1,180	3	1,404
Tilney	27	1,347	20	1,098	27	1,077	2	1,365	21	1,222
Trial avg.		1,507		1,162		1,222		1,256		1,371
1996										
	/12	lb/a	/12	lb/a	/12	lb/a	/12	lb/a	/12	lb/a
Gisiba	2	859	3	1,148	6	579	8	1,110	4	924
Kirby	7	730	1	1,218	2	621	2	1,220	1	947
Ochre	8	684	4	1,119	7	577	9	1,047	9	857
Tilney	3	815	7	1,083	5	584	3	1,155	5	909
Trial avg.		717		1,058		563		1,075		853

* /XX indicates number of entries in trial. Entries not listed were experimental lines.

Markets

Mustard is produced as a specialty grain. Grow mustard under contract to guarantee a selling price and market. Prices have ranged from \$0.08 to \$0.18 per pound. Contract prices usually are not set until January for the following season.

Mustard grown in eastern Oregon has an early-to-market advantage, often as much as 4 weeks ahead of Canadian production areas. Eastern Oregon mustard also is noted for its excellent milling qualities.

Consumption of mustard has been steady. Growth of the mustard market is related directly to population growth.

There are a limited number of alternative markets when a surplus is produced.

For more information

OSU Extension publications

Other publications in the Dryland Cropping Systems set:
Garbanzo Beans (Chickpea), EM 8791 (2002).
Safflower, EM 8792 (2002).
Sudangrass, EM 8793 (2002).
Grain Sorghum, EM 8794 (2002).
Dryland Alfalfa, EM 8795 (2002).

These are available online at 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

Bibliography

Alternative Field Crops Manual, Mustard. 1991. E.S. Oplinger, University of Minnesota, St. Paul, MN. Extension Publication A3532.
Fertilizing Mustard, Canola, and Crambe. North Dakota State University, Fargo, ND. Extension Publication SF 718.

Seed sources

Montana Specialty Mills, P.O. Box 2208, Great Falls, MT 59403. (406) 761-2338
McKay Seeds, P.O. Box 1407, Pendleton, OR 97801. (541) 966-9977