

Tame Mustard Production

Revised by

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Mustard is a cash crop that can be planted in rotation with small grains. Mustard is available in three types: yellow, brown and oriental.

Yellow mustard (*Sinapis alba*) is the most common type grown in North Dakota. Only small acreages of brown and oriental (*Brassica juncea*) are being grown. Yellow mustard is used for a table or "hotdog" mustard, while brown and oriental are used for oil and spices.

All mustard should be grown under contract, assuring the producer of a guaranteed market. North Dakota producers harvested 88,400 acres in 2002, which is believed to be the highest amount on record in the state. According to U.S. Department of Agriculture census data, 43,800 acres of mustard were harvested in the U.S. in 2012, and the acres harvested in North Dakota were about 16,000 (National Agricultural Statistics Service census 2012).

Adaptation

Mustard is best adapted to fertile, well-drained soils. Coarse-textured sands and sandy-loam soils should be avoided because they tend to be droughty. Mustard has some tolerance to salinity. Yellow mustard varieties mature in about 85 to 90 days, whereas the brown and oriental types require about 90 to 95 days to reach maturity. Mustard usually will yield best when sown into small grain stubble.

Small grain crops following mustard in rotations usually will yield better than if following small grains. Crops such as sunflower, canola, safflower, dry bean and soybean are not recommended in close rotation with mustard because all are susceptible to sclerotinia (white mold).

Cover photo by Duane R. Berglund.
Photos on Page 4 by Hans Kandel.

Mustard Growth Characteristics

Mustard seedlings emerge rapidly but tend to grow slowly, leaving the ground initially exposed to water and wind erosion. Under favorable moisture and temperature conditions, the ground will be covered in four or five weeks. Five weeks after emergence, the plants begin to bud. The crop will appear to be rather uneven at this stage of development. A week to 10 days later, it will develop into full yellow bloom, and the plant stand will appear more even.

Good moisture supplies and cool temperatures favor a long flowering period. The longer the blooming period, the higher the yield potential. Fully grown plants usually vary in height from 30 to 45 inches, depending on type, variety and environmental conditions.

Seedbed Preparation

A prepared seedbed for mustard should be firm and fairly level. Shallow tillage, just deep enough to kill weeds, will keep soil moisture close to the surface and leave the seedbed firm. This will permit shallow seeding and encourage rapid, uniform emergence. Producers have planted mustard successfully into standing small grain stubble and minimum-tilled stubble. The firm, moist seedbed has resulted in good stand establishment.

Varieties

Yellow mustard varieties tend to be shorter, earlier maturing and lower yielding than brown or oriental varieties. Seed for planting desired varieties usually is available from contracting firms.

See Tables 1 and 2 for variety information.

Seeding Date and Rate

Early seeding is recommended but should be late enough to avoid damage from spring frost just after emergence. Seeding should occur from April 20 to May 15, with planting later than May 15 usually resulting in lower yields.

Yellow mustard has approximately 100,000 seeds per pound and is seeded with a grain drill or air seeder at the rate of 10 to 14 pounds per acre. The higher

Table 1. Mustard variety trials at North Dakota locations from 2007-2010.

Variety	Type	Langdon	Carrington	Hettinger	Williston	Minot	All locations
		2008, 09, 10 Avg.	2008, 10 Avg.	2007, 08, 10 Avg.	2007, 08, 09 Avg.	2007, 08, 09 Avg.	2007-2010 Avg. ¹
Seed Yield Pounds Per Acre							
AC Pennant	Yellow	1,578	889	1,149	885	1,761	1,279
Ace	Yellow	2,001	1,246	1,080	916	1,989	1,460
Andante	Yellow	2,145	1,142	1,190	936	2,001	1,507
Tilney	Yellow	1,977	1,011	1,276	1,002	1,866	1,456
Forge	Oriental	2,353	981	1,512	1,008	1,508	1,507
Common	Brown	2,105	1,167	1,532	916	1,451	1,453
Duchess	Brown	2,154	1,135	1,599	988	1,832	1,570
Mean		2,045	1,082	1,334	950	1,773	1,462
CV %		5.3	12.6	11.9	11.9	15.9	15.3
LSD 0.05		194	334	283	NS	503	168

¹ Averaged across all years and locations, reported in this table.

Source: NDSU Extension publication A-1105, "North Dakota Alternative Crop Variety Performance" (2007-2010).

Table 2. Mustard agronomic traits averaged across locations in 2010.

		Days to Flower	Flower Duration	Days to Mature	Plant Height	Oil ¹	Test Weight	Lodging
		(DAP) ²	(days)	(DAP)	(inches)	(%)	(lb/bu)	(0-9)
AC Pennant	Yellow	34	25	84	40	24.2	54.3	1.2
Ace	Yellow	35	24	88	42	24.5	54.1	0.7
Andante	Yellow	34	24	87	42	24.3	54.7	1.2
Tilney	Yellow	35	25	87	39	24.1	54.2	0.8
Forge	Oriental	38	23	89	46	34.7	52.9	2.2
Common	Brown	38	23	90	45	35.8	52.7	2.6
Duchess	Brown	38	23	90	43	—	52.2	2.9
Mean		36	24	88	43	—	53.6	1.7
CV %		6.6	2.7	1.1	9.0	—	0.7	60
LSD 0.05		NS	2	2	NS	—	0.9	1.8

¹ Oil averaged across data from Langdon, Carrington, Hettinger, Williston and Minot in 2006.

² DAP is Days after Planting.

rate should be used on heavy, fertile soils or soils where emergence could be a problem. Oriental and brown mustards, which have a smaller seed – about 200,000 seeds per pound – should be solid-seeded at a rate of 6 pounds per acre.

A double disk-opener press drill or air seeder can be used to seed mustard, but depth control is critical for seed placement. Mustard seeds are small and must be planted shallowly (½ to 1½ inches deep) in moist soil and a firm seedbed to ensure rapid germination and emergence. Soil crusting prior to seedling emergence can cause problems. If mustard stands are poor, decisions to replant should not be delayed.

Fertilizer

Mustard responds to nitrogen (N) and phosphate fertilizer in a manner similar to small grains. Consult "Fertilizing Canola and Mustard," an NDSU Extension publication at www.ag.ndsu.edu/pubs/plantsci/soilfert/sf1122.pdf, for mustard fertilization recommendations based on soil tests.

Weed Control

Weed control must be based on clean field selection and shallow seeding for quick and uniform emergence to obtain a good, uniform stand. The mustard crop should not be harrowed, rotary hoed or tilled after emergence.

Weeds are a serious problem in mustard production. They not only reduce yields, but weed seeds such as wild mustard, wild buckwheat and foxtail, as well as canola, are difficult to remove and can cause severe cleaning losses and market grade reductions. Such losses reduce profits to the grower.

Mustard plants are sensitive to herbicides such as 2,4-D, Banvel, MCPA, glyphosate, and most ALS herbicides, including imidazolinone and sulfonylurea-type herbicides. Spray drift and sprayer tank contamination must be avoided.

All mustards, but especially the oriental and brown types, should be sown on fields known to be relatively free of wild mustard infestation. Wild mustard can

be separated mechanically from yellow mustard with large seed, but separation is not possible with the brown and oriental mustards. Wild mustard contamination will reduce grades of mustard, resulting in severe market discounts.

Treflan, or generic trifluralin, is labeled for grass control and some broadleaf weed control in mustard. Trifluralin will not control wild mustard. Trifluralin must be applied prior to seeding and incorporated thoroughly in the soil for maximum effectiveness. Spring or fall application and incorporation are labeled. Rates should be adjusted according to soil type.

Clethodim or Select Max can be post-applied prior to bolting for control of certain annual grasses and quackgrass. Applications are 9 to 16 fluid ounces (fl. oz.) per acre of Select Max 1EC, 4 to 8 fl. oz. per acre of Select 2EC, 2.66 to 5.33 fl. oz. per acre of Shadow 3EC or 1 to 2 fl. oz. per acre of clethodim.

Grass weeds should be 5 inches or less in height. Allow a 70-day post-interval after spraying before harvesting the crop. Select Max 1EC, Select 2EC, Shadow 3EC or clethodim should be applied using an oil adjuvant at 1 percent on a volume for volume basis, but not less than 1.25 pints per acre.

For more details, see the current year of the NDSU Extension publication "North Dakota Weed Control Guide" (W253), and always follow the directions on the label.

Insects

Insects can cause serious yield losses, and growers should monitor fields closely for potential problems. Flea beetles and diamondback moth caterpillars have been the most troublesome insects.

Damage to mustard seedlings can be caused by early season feeding by overwintered flea beetles. Flea beetles are shiny, black, jumping beetles about 1/8 inch long. The adult beetles feed on the cotyledons and first true leaves, causing the typical shot-holed 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. Hot and dry weather may cause damaged seedlings to wilt and die, causing partial to complete crop loss.

In some instances, the infestation of a field can occur as a creeping movement from plant to plant across a field; in other instances, the entire field may become infested quickly and evenly. Once the crop advances beyond the seedling stage, economic damage usually does not occur because vigorously growing mustard can outgrow the beetle defoliation.

Mustard generally is less susceptible to adult feeding injury than canola. No major effects on plant vigor have been noted from the feeding of the larvae on plant roots. Cultural methods can help reduce plant losses caused by flea beetles. Early planting and a firm seedbed and adequately fertilized will help plants outgrow beetle damage during the susceptible early season stages.

A few flea beetles or scattered shot-holing are not necessarily cause for alarm. However, if defoliation is greater than 25 percent of the surface area of cotyledons and first true leaves and beetles are numerous, immediate control likely will be required.

Insecticides labeled for control of insects in mustard are listed in the current year of the NDSU Extension publication "North Dakota Field Crop Insect Management Guide" (E1143).

Diseases

Several diseases attack mustard. Among the most serious is sclerotinia (white mold). Including mustard in crop rotations containing crops such as canola, dry edible bean, sunflower or safflower is risky. That's because these crops have similar disease problems, so disease infestations can build to economic levels. Mustard grown in a small grain rotation is one of the best preventatives of serious disease problems and provides an excellent biological break for cereal grain leaf diseases.

Harvesting

Shattering is a major harvesting concern. Wind, rain and normal drying generally do not cause mustard to shatter before cutting. But the actual harvesting operations can cause severe shattering losses when the crop is overripe or extremely dry.

Yellow mustard can be straight combined if the field is not weedy and the crop is uniformly ripe. When direct combining, wait until the crop is mature and dry. The reel may cause shattering when straight combining, but it can be removed or lifted above the crop if the stand is good. If you need the reel, reduce speed and remove half the bats. Many yellow mustard growers prefer to straight combine while the crop is still tough (12 to 15 percent moisture) and then artificially dry. This results in seed of uniform quality.

Brown and oriental mustard varieties generally are more susceptible to shattering than the yellow types and should be swathed. Yellow mustard should be swathed if the crop is weedy or uneven in maturity. Mustard should be swathed following general leaf drop when overall field color changes from green to yellow/brown and early enough to avoid shattering.

To determine physiological maturity, select pods from the middle of the racemes of several plants in areas representing the average maturity of the field. Most varieties are at the optimum maturity for swathing when upper pods have turned and seeds are brown or yellow. The remaining 25 percent of green seeds will mature in the swath prior to harvest.

Swathing in early morning hours will help reduce shattering losses from ripe pods. The windrow can be bulky and the wind can scatter it easily. To help prevent this, many growers pull steel drums over the top of the windrow to help push it into the stubble. Swathing at a high stubble level will reduce the size of the windrow and provide stubble in which the mustard can lie.



Cracked seed is considered dockage and a loss to the producer. Check for cracked seed several times during the day. A simple test is to push your hand into the threshed seed. If cracked mustard is present, it will adhere to the hair on the back of your hand, indicating the need for further combine adjustment.

To optimize seed quality, the combine should be adjusted so the seeds are threshed completely while using the lowest possible cylinder speed. Cylinder speed should be set at approximately 600 rpm. Careful adjustment of the cylinder speed and cylinder opening is important to avoid cracking.

If the crop is very dry, every other cylinder bar may have to be removed. Cylinder speed may need to be varied during the day as crop moisture content varies. Fan speed should be reduced to limit seed loss with the straw, yet maintain sufficient air to ensure clean mustard grain for market.

Storage

Mustard seed can be stored safely when the moisture content reaches 9 percent or less. Take care to avoid cracking the seed while moving the crop in and out of storage. When drying, do not to exceed air temperatures of 150 F or seed temperatures of 120 F. Mustard seeds are very small, so tight bins, augers and truck boxes free of cracks or holes are essential for transfer and storage of mustard.

Utilization of Mustard

Yellow mustard mainly is used in the meat packing industry as an aid to flavor, emulsification, water binding, slicing and texture in hot dogs, bologna and other processed meats. Ground yellow mustard can absorb excess fats and fluid (approximately 4.5 times its own weight) and also is used with seasoned hamburger, meatloaf, liver sausage, chili, various canned meat products and some table mustards.

Oriental mustard is used primarily in Chinese mustards. Some spice-blending houses use it as an ingredient for its hot, pungent flavor. It is an essential ingredient in mayonnaise, certain salad dressings, barbecue sauces, baked beans, steak sauces, relishes and many other flavoring sauces.

Brown mustard has limited uses in hot, spicy table mustards and other seasonings.

This publication was authored by Duane R. Berglund, Professor Emeritus and former Extension Agronomist, NDSU, 2003.

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