

Tame Mustard Production

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Mustard is an economic cash crop that has a distinct place 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 most commonly 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. Mustard in North Dakota was grown on 24,439 acres in 2006. This was considerably less, compared with four to five years ago. North Dakota producers planted 65,069 acres of mustard in 2003 and 130,984 acres planted in 2002, which is believed to be the highest amount on record in the state.

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 and is similar to barley in its productivity on saline soils. 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 following small grains. Crops that can be sprayed with 2,4-D or MCPA should follow mustard so that any volunteer plants can be controlled. Crops such as sunflower, canola, safflower, crambe, dry bean and soybean are not recommended in close rotation with mustard because they all are susceptible to sclerotinia (white mold).

Mustard Growth Characteristics

Mustard seedlings emerge rapidly but tend to grow slowly after emergence. 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 blossoming 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. Seedbeds should be packed before planting with a roller packer, empty press drill or rodweeder; however, in practice, this is seldom done. Some producers seed with a press drill at one-half rate in two directions to ensure good seed placement.



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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 of desired varieties usually is available from contracting firms. See Tables 1 and 2 for variety information. For yield performance and other agronomic information, consult NDSU Extension publication A-1105, "North Dakota Alternative Crop Variety Performance" (current year).

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 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. Do not back-harrow. 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. Avoid using more than 10 pounds per acre actual N with the seed because germination injury can occur. Some growers mix low rates of phosphorus fertilizer (20 pounds P₂O₅) with mustard seed and plant them together. Consult NDSU Extension publication SF-1122 for mustard fertilization recommendations based on soil tests.

Table 1. Mustard varieties.

Yellow	Oriental	Brown
AC Base	AC Vulcan	Common Brown
AC Pennant	Forage	
Ace	Lethbridge 22A	
Andante	Cutlass	
Gisilba		
Tilney		
Viscount		

Table 2. Mustard agronomic traits (*averaged across locations) 2006.

Variety	Type	Days to Flower	Flower	Plant	Days to Mature	Oil %
			Duration	Height		
			(days)	(inches)		
AC Pennant	Yellow	39	25	35	81	24.2
Ace	Yellow	40	24	37	82	24.5
Andante	Yellow	39	25	36	81	24.3
Tilney	Yellow	40	24	37	83	24.1
Forge	Oriental		25			34.7
Common	Brown					35.8

*Locations: Carrington, Hettinger, Langdon, Minot, Prosper and Williston

Table 3. Mustard seed yields (lb/A).

Variety	Type	Location						2006 Avg.	2 yr Avg.	3 yr Avg.
		Langdon	Carrington	Williston	Prosper	Minot	Hettinger			
AC Pennant	Yellow	1952	1135	632	933	1643	570	1144	1158	1324
Ace	Yellow	1928	1014	737	854	1698	722	1159	1167	1372
Andante	Yellow	2086	1139	723	910	1576	927	1227	1228	1417
Tilney	Yellow	1851	1117	716	540	1572	625	1070	1051	1281
Forage	Oriental	—	1272	498	1200	754	404	—	—	—
Cutlass	Oriental	—	—	—	—	478	—	—	—	—
Common	Brown	—	—	643	1309	1167	—	—	—	—
Trial Mean		1954	1136	658	957	1270	650	—	—	—
LSD 5%		NS	NS	112	160	382	107	—	—	—

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

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 cannot 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 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 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.

Trifluralin at 0.5 to 0.75 pound a.i. per acre (1 to 1.5 pints E.C. per acre or 7 lbs./A 10G) is labeled for grass control and some broadleaf weed control. 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 for control of certain annual grasses and quack grass. Applications are 4 to 6 fl.oz./A of clethodim or 8.5 to 12.8 fl.oz./A of Select Max. Grass weeds should be 5 inches or less in height. Apply to grassy weeds prior to mustard in

the bolting stage and allow a 70-day postharvest interval after spraying. Both Select Max and clethodim should be applied using an oil adjuvant at 1 percent V/V.

See NDSU Extension publication W-253 (current year) for more information on control of weeds in mustard, 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 plants can be caused by early season feeding on seedlings from overwintered flea beetles. Flea beetles are shiny, black, jumping beetles about $\frac{1}{8}$ 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, and partial to complete crop loss can result.

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 quickly and evenly infested. 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 that is well-tilled 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.

Diamondback moth caterpillars attain a length of $\frac{1}{2}$ inch and are light yellowish green to green. The larvae eat leaves, flowers and green pods and are extremely active when touched. Insecticides labeled for control of insects in mustard are listed in the NDSU publication E-1143, "North Dakota Field Crop Insect Management Guide" (current year).

Diseases

Several diseases attack mustard. Among the most serious are downy mildew, white rust, sclerotinia stalk rot (white mold) and virus mosaic. Mustard should not be included in crop rotations containing crops such as sunflower, canola, dry edible bean, crambe or safflower. These crops have similar disease problems, so disease infestations can build to economic levels. Several broadleaf weeds also serve as hosts or reservoirs for these diseases. Among the more prominent are shepherd's purse, pigweed, wild mustard and field pennycress. 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

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 the reel is needed, reduce speed and remove half the bats. Many growers of yellow mustard prefer to straight combine while the crop is still tough (12 percent 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.

Pods selected from the middle of the racemes of several plants in areas representing the average maturity of the field should be examined for physiological maturity of the seeds.

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 aid in reducing shattering losses from ripe pods. The windrow is inclined to be bulky and easily scattered by the wind. 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 will provide stubble in which it can lie.

The combine should be adjusted so that the seeds are completely threshed 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. When the crop is very dry, every other cylinder bar may have to be removed. To test for cracking, run 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.

Cracked seed is considered dockage and a loss to the producer. 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. Cracked seed ends up as dockage and a loss to the producer. When drying, do not to exceed air temperatures of 150 F or seed temperatures of 120 F. 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 hog 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 low-grade 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.

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