

## Crambe

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Crambe is also referred to as Abyssinian mustard, Abyssinian kale, colewart, or datran. It is a member of the mustard family, which includes crops such as rapeseed (canola and industrial oilseed rape) and tame mustard. Crambe, native to the Mediterranean region, was first introduced into the United States during the 1940s and has been grown at North Dakota research centers intermittently since 1958.

Crambe seed yields an industrial oil that contains a high level of erucic acid. Renewed interest in specialty crops has stimulated research and limited production of crambe in North Dakota. Commercial production of crambe for oil crush was contracted on 4,500 acres in 1991 and 20,000 acres in 1992. Small experimental plots of crambe exist in other states. For 1992 crambe for seed production was contracted on 1,000 acres in North Dakota and 200 acres in Nebraska and Kansas. Inputs and management practices similar to small grains and its unique use as a non-food crop may make crambe a profitable new enterprise for North Dakota farmers.

### Description

Crambe is an erect annual herb with large pinnately lobed leaves similar to mustard leaves. Plant heights typically vary between 24 and 36 inches, depending on the season and plant density. The crop exhibits an indeterminate flowering habit and may continue to set seed in late season. The flowers are white, numerous and small. The round seeds are borne singly and are about 1/8 inch in diameter. Each seed is enclosed in a hull or pod which usually remains on the seed after harvest.

### Adaptation

Crambe is a cool-season crop that is well adapted to environmental conditions in North Dakota. Crambe requires an average of 52 days between planting and flowering. The flowering period usually ends about 12 to 15 days before physiological maturity. Present cultivars of crambe require between 83 and 95 days from date of planting to reach physiological maturity. Crambe is well adapted to fertile, well-drained soils with a pH of 6.0 to 7.5. When crambe is grown on soil with poor internal drainage, good surface drainage is essential. Tolerance of crambe to saline soils is less than barley but greater than wheat. Crambe is best suited to silt-loam soils that do not crust.

Crambe's tolerance to drought conditions is equal to or slightly less than that of cereal grain. It is more drought-tolerant than corn, canola, or soybeans at all stages of growth. While crambe requires adequate soil moisture for flowering, pod set, and filling, a dry period is beneficial as the plant approaches maturity.

## Rotations

Rotation of crambe with other crops is recommended to avoid a buildup of insects, diseases and weeds. In crop rotation, crambe should not succeed itself or closely related crops such as canola or mustard. Crambe should follow small grains, corn, grain legumes or fallow. Crops that produce volunteer plants the subsequent year should be avoided if possible. These options provide a break in pest cycles and provide soil conditions that can be managed easily to prepare for crambe production. Small grains should perform well following crambe. Crambe stubble provides an excellent cover for trapping snow, controlling erosion and establishing winter wheat in a no-till production system. When planting winter wheat, care must be taken to minimize stubble disturbance as crambe residue is brittle and easily destroyed.

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## Varieties

Seed supplies of the Meyer, Belann and Belenzian varieties are available on a limited basis.

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## Seedbed Preparation

A critical phase of successful crambe production is stand establishment. A vigorous stand that emerges early will take advantage of cooler temperatures and available soil moisture, and will be more competitive with weeds. The seedbed for crambe should be firm enough to place seed at a uniform and shallow depth. Drifting soil easily damages seedlings. If possible, the seedbed should be prepared to avoid wind erosion. Crambe should be sown at least 3/4 inch deep and no deeper than 1 1/4 inches. Crambe should be planted in late April to early May when the greatest risk of frost has passed. The crop is susceptible to frost at emergence but can tolerate temperatures as low as 24 degrees Fahrenheit after establishment.

A significant decrease in yield and oil content can be expected if seeding is delayed until late May or June. Conventional small grain or row crop seeding equipment can be used to seed crambe. Successful yields have been obtained with row widths ranging from 6 to 36 inches. However, row widths of 6 or 7 inches generally give the highest yields. If crusting is a potential problem, planting in wide rows may be preferred to provide more uniform emergence. A seeding rate of 15 to 20 pounds per acre is recommended.

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## Fertilizer

Crambe's response to fertilizer is similar to that of small grains, mustard and canola. Fertilizer rates recommended for mustard and canola can be used. Avoid using more than 10 pounds of actual nitrogen with the seed, as germination injury can occur.\*

*\*For information about your local area, contact your county extension agent.*

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## Weed Control

Weed control is critical in crambe production. The crop is not a strong competitor with weeds during early vegetative development, and no herbicides are labeled for weed control in North Dakota. It is very important that crambe be seeded on relatively weed-free fields. A vigorous stand should be established ahead of weed development to provide optimum competition. Typically, three to four weeks is required for a crop canopy to be formed after emergence. It is during this period that the biggest challenge for weed control exists.

Fields that contain perennial weeds, such as Canada thistle, sowthistle, field bindweed, and quackgrass, should be avoided. Annual weeds that typically compete with crambe include foxtail, wild oats, kochia, pigweed, ragweed, wild buckwheat and wild mustard.

The crop cannot be harrowed for weed control since this will destroy a high percentage of the crambe seedlings. Use of a rotary hoe after crambe emergence may damage the crop. If crambe is planted in wide rows, between-row cultivation may be used to control weeds. Crambe is susceptible to damage from certain soil herbicide residues and drift of broadleaf herbicides.

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## Diseases

Few disease problems associated with crambe have been observed in North Dakota. Crambe is susceptible to sclerotinia (white mold) but less so than sunflower and dry beans. Other potential diseases include alternaria, blackleg and pythium rot.

Carefully plan crop rotations to keep disease pressure to a minimum. Maintain a four-year rotation with crambe as well as other crops susceptible to sclerotinia, such as canola, mustard, dry beans, soybean and sunflower. Seed treatment is generally not required on good quality crambe seed. Use seed from disease-free fields, excluding areas where blackleg or alternaria were present.

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## Insects

Insects potentially damaging to crambe include aphids, cabbage maggots, grasshoppers, leafhoppers and lygus bugs. Of these, only grasshoppers have significantly injured crambe (typically in field margins). Crambe is most susceptible to grasshopper damage at the seedling stage. Grasshoppers tend to choose other crop foliage as crambe develops.

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## Harvesting

As crambe approaches physiological maturity, the leaves turn yellow and drop. A few days after most leaves have fallen, the seedpods and upper branches turn straw colored. When the color has progressed below the last seed-bearing branches, the seed should be ready to harvest.

Straight combining is recommended for a mature, clean and low-moisture crop. Timely harvest is important to avoid high shattering losses. Swathing may be necessary if maturity is variable, where some plants are beginning to shatter and others are still slightly green. If a sufficient number of green weeds are present, swathing may be required. When swathing, reel speed should be reduced to one-half to two-thirds of that for small grains. Seed shatter can be minimized by swathing during a time of day when humidity is high. Swathing should be done just below the lowest seed pods, leaving the stubble as high as possible. This will allow the windrow to settle into the stubble and reduce loss from wind.

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## Transportation

The vehicle in which crambe is transported must be tight with no cracks or holes. Crambe seed will flow through a rather small hole, much like sand passing through an hour-glass. As a transport vehicle moves down the road, crambe seed can be easily blown from it at low speeds. The load should be completely covered to prevent such losses.

Transportation costs are high because a small amount of seed is hauled in a given truck load. To reduce this cost, crambe production areas should be close to processing plants unless dehulling is performed.

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## Cost Comparisons

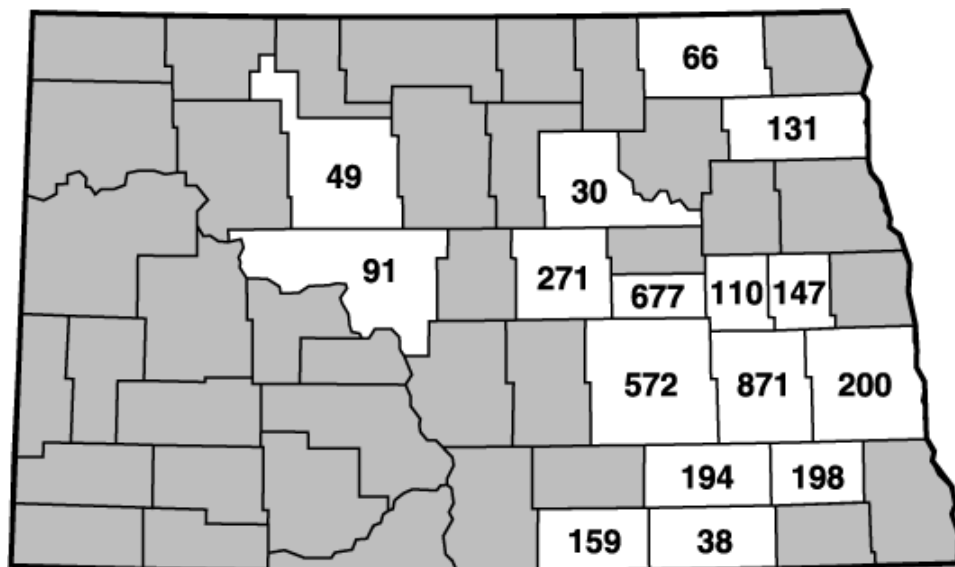
Crambe is a relatively bulky commodity, similar in per-bushel weight to sunflower. Transportation costs are greater than for wheat, barley, flax and corn, but similar to sunflower transportation costs. Crambe requires slightly less fuel per acre to

produce than does spring wheat.

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## Yields

Average yields on crambe varieties at the Carrington Experiment Station have been 1,300 pounds per acre. However, yield expectations for the first year of commercial production could be 75 percent of Experiment Station yields. In 1991, Crambe was harvested in 16 North Dakota counties (see map). Stutsman, Foster and Barnes counties harvested 572, 677 and 871 acres, respectively, comprising 56 percent of the total harvested crambe acres in North Dakota.



*Crambe Production in Acres by County, 1991*

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## Storage

Crambe seed is small, round and very light weight (25 pounds per bushel). Equipment for transportation and facilities for storage must be tight to avoid loss of the seed. Before drying and storage, the seed can be passed through a roller screen or scalper to remove excess foreign material. Crambe seed should be stored at a moisture content of 10 percent or less. If seed is harvested at high moisture, natural air or artificial drying can be used. To maintain seed quality, a maximum drying temperature of 110 F is recommended.

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## Uses

Primary products from crambe seed produced in North Dakota include oil (28 to 33 percent), meal (64 to 69 percent), and hulls (3 percent).

The oil is a variable raw material that can be used for numerous industrial products. Oil from crambe seed ranges from 50 to 60 percent erucic acid by weight. Erucic acid is used for slip agents, plasticizers, surfactants, antistats, flotation agents and corrosion inhibitors. Other derivatives from crambe oil can be used for lubricants, rubber additives, new types of nylon, base for paints and coatings, high temperature hydraulic fluids, dielectric fluid, pharmaceutical products, cosmetics, waxes, and other products.

Crambe meal is used primarily as livestock protein but also can be used for protein isolates and fertilizer. The protein content of defatted, dehulled crambe meal may be as high as 45 percent, but if crambe is processed with the hull the protein content drops to about 30 to 32 percent. Seed is normally dehulled (by crushing plants) to produce a higher-protein, lower-fiber meal. Crambe meal contains glucosinolates, which are sulfur-containing substances. Single-stomached animals, such as swine and poultry, can develop toxicity problems from ingesting glucosinolates, while ruminant animals,

such as cattle and sheep, exhibit greater tolerance. The Food and Drug Administration has approved use of defatted crambe meal as a beef cattle protein supplement at levels up to 4.2 percent of the total weight of rations.

## Marketing

Commercial production and crushing of crambe began in North Dakota in 1990. National Sun Industries in Enderlin, North Dakota, has commercially crushed crambe since 1990. Tiptonville, Tennessee, and Kennett, Missouri are two additional locations that have experimented with crushing crambe. However, nearly any oilseed crushing plant could crush crambe. Expansion of crambe production and processing will lower U.S. dependence on imported petroleum oil and European and Canadian sources. North Dakota markets are limited because of the crop's recent commercialization, so crambe should only be grown under contract. Contracts provide a guaranteed price and are recommended for growers. Crambe prices are established through world futures markets for high erucic acid crops.

### Estimated 1993 Economic and Cash Flow Budgets for North Dakota

	Economic Cost/Acre	Cash Cost/Acre
	(1250 lb x \$.096)	
MARKET INCOME	120.00	120.00
DIRECT (VARIABLE) COSTS		
Seed	4.50	4.50
Herbicides	6.24	6.24
Fertilizer	8.43	8.43
Fuel & Lubrication	5.72	5.72
Repairs	7.94	7.94
Miscellaneous	1.05	1.05
Operating Interest	1.61	1.61
SUM OF LISTED DIRECT COSTS	35.47	35.47
INDIRECT (FIXED) COSTS		
Misc. Overhead	3.85	2.08
Machinery Depreciation	14.74	xxxx
Machinery Investment	7.49	15.33
Land Taxes	3.29	3.29
Land Investment	25.08	9.70
SUM OF LISTED INDIRECT COSTS	54.44	30.39
SUM OF ALL LISTED COSTS	89.92	65.87
RETURN TO LABOR & MGMT	30.08	xxxx
NET CASH FLOWS	xxxx	54.13
LISTED COSTS PER UNIT (lb):		
Direct Costs	0.03	0.03
Indirect Costs	0.04	0.02
Total Costs	0.07	0.05

*The economic budget is generated by charging market rates for all resources needed for production. It helps answer the question "Is this enterprise profitable?" The bottom line represents a return to labor and management.*

*The cash flow budget is an estimate of the out-of-pocket cash needed to run the enterprise, including not only direct costs but indirect cash costs such as principle and interest payments, insurance and taxes. It helps answer the question "Can I make meet my cash obligations if I go into this enterprise?" Total cash expenses are subtracted from total cash receipts to calculate the net cash which is available for family living and other needs.*

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