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### G93-1126 Crambe Production

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## Crambe Production

**This is a complete guide to the specifics of crambe production, from seedbed preparation to harvesting, storage and marketing.**

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Crambe (*Crambe abyssinica*) is an oil crop from the mustard family. The seed contains 30 to 35 percent oil with 40 to 60 percent erucic acid in the oil. The erucic acid oil content of crambe is 8-9 percent more than that of rapeseed.

Crambe and rapeseed are high erucic acid (HEA) oils. These HEA oils have long hydrocarbon chains (22-carbons) and an isolated double bond. These structures give HEA oils their characteristic trait of having high fire and smoke points (520°F). HEA oil's abilities to withstand high temperatures and remain liquid at low temperatures make HEA oil a good lubricating and transfer oil.

HEA oil has several uses and is widely used by U.S. industries. When converted to erucamide it is a slip agent in plastics manufacturing. Erucamide keeps individual plastic sheets from sticking together. The plastics industry uses more than 20 million pounds of HEA oil as slip agents. The mining industry is researching HEA oil as a potential flotation agent in separating mined aggregate. Steel casting industries use a few ounces of crambe oil per ton of steel as a high temperature (2,500°F) lubricant. Crambe oil is useful in the textile and steel industries for spinning lubricants and sheet steel fabrication. The Agricultural Research Service (ARS) at Peoria, Illinois used crambe oil to develop Nylon 1313 in the 1970s. Uses of this nylon include temperature and moisture resistant products, such as brake lines,

tubing and gears.

The Mediterranean region is crambe's center of origin. Crambe is also prevalent across Asia and Western Europe. The former Soviet Union started agronomic testing of crambe in 1932. Canada, Germany, Poland and Sweden have also run crambe performance trials. In 1950, the USDA introduced crambe into the U.S. The first performance trials conducted in Nebraska were in 1953 and 1954. Performance trials in the late 1950s and 1960s identified crambe as a promising new alternate crop for the United States. In 1992, North Dakota produced 20,000 acres of crambe under contract.

There is no local market for crambe in Nebraska. In 1986, the USDA began the HEA Development Consortium. The consortium consists of the Cooperative State Research Service, the ARS, and the Universities of Idaho, Illinois, Iowa, Kansas, Missouri, Nebraska, New Mexico and North Dakota. The project's goal is to develop and promote domestic sources of crambe and rapeseed. The major impediments to the widespread introduction of crambe are low crude oil prices and economic conditions within a growing area. Processing plants must be close to their production sources due to the cost of transporting lightweight seed. If the crude oil price increases and supplies diminish, the importance of the renewable HEA oils will increase. Farmers, National Sun Industries (NSI) and the HEA Development Consortium have made North Dakota an important area for crambe production in the United States.

Crambe production uses small grain equipment, thus limiting the need for large investments in additional machinery. Another financial benefit of crambe is the lack of insecticide and seed drying costs. Production costs of crambe are similar to those of canola and rapeseed. Crambe is a more viable crop in western Nebraska with the opening of the NSI crushing plant in Goodland, Kansas.

### General Agronomics

Crambe is a cool-season crop adapted to the Great Plains. It takes 90 to 100 days to reach maturity from the date of planting.

Plant height ranges from 28 to 53 inches, but can vary depending on planting time, the season and plant density. Crambe is an indeterminate flowering plant. The crambe flowering period lasts two to three weeks. Its small white four-petaled flowers are on a paniced raceme. The seed pods are a buff to dirty white color. The first pods will usually remain on the plant until the last pods mature. Delayed harvest, and hard rains or hail near maturation can increase shattering. Crambe has small seed (27,000 seeds/lb), and its bushel weight is between 22 and 25 lbs/bushel. Crambe yields as high as 2,800 lbs/a have been reported in North Dakota. In 1992 yields in Cuming County, Nebraska were as high as 1,700 lbs/a. *Table I* illustrates the one-through five-year averages of the cultivar, *Meyer*, in Nebraska.

<b>Table I. Average yields of the cultivar, <i>Meyer</i>, combined over years in Nebraska from 1988 through 1992.</b>				
<b>Combined Yearly Averages</b>				
1-year	2-year	3-year	4-year	5-year
4 locs	7 locs	11 locs	12 locs	13 locs
<b>lbs/a</b>				
1130	1400	1080	1070	1090

Selected fields should be free of weed problems, due to the lack of registered crambe herbicides (the exception is Treflan). Crambe should not be grown in fields recently planted to crambe, canola, rapeseed or other cole crops (cabbage, broccoli and turnips). Fields infested with weedy mustards should be avoided due to the potential for disease or insect buildups. Crambe fits well into a small grain rotation, where it can help break up some weed and disease cycles.

### **Seedbed Preparation**

A firm, well-packed seedbed is essential for the successful establishment of crambe. Proper seeding requires a depth of less than 1 inch and good seed-soil contact. Crambe needs a seedbed that is free of debris and weeds, firm, and well-packed. After disking, a final harrowing or rolling with a culti-packer should create a smooth and firm planting surface. The final tillage operation should be done less than a week before planting to kill weed seedlings. Conventional tillage practices are effective in creating a proper seedbed.

### **Planting Methods and Rates**

Crambe, like oats, is very cold tolerant. Planting can occur in the spring after temperatures below 22°F have passed. North Dakota studies have shown that low temperatures did not appear to damage the seedlings or decrease yield. However, Nebraska studies have shown damage to seedlings at temperatures below 20°F following several warm days. Early planting dates vary from late March in eastern Nebraska to the first week of April in western Nebraska. Early-planted fields usually have the highest yields. Early plantings also result in decreased days to first flower and physiological maturity. May and June plantings have lower yields, decreased seed oil content and more weed infestations.

Planting depth is critical for good stands. Seeding depths should not exceed 1 inch. Preferred planting depths are from 1/2 to 3/4 inch deep in a well prepared seedbed. Small grain drills will do an excellent job in placing the seed at the proper depth. When using a grain drill with disk openers, the disks should be set to run at the soil surface. Hoe drills can place seed in moist soil when there is a dry surface layer. In hoe drilled fields, heavy rains can bury the slow growing seedlings.

Seeding rates vary with row spacing. Twenty lbs/a is the recommended seeding rate for rows 6 to 7 inches apart. In 12 to 14 inch rows, 8 to 15 lbs/a are adequate for good stands. Adjust seeding rates when germination rates are 80 to 90 percent. Do not use seed with germination rates lower than 80 percent.

### **Fertilization and Soil Fertility**

Crambe will benefit from a proper fertilization program. Soil testing is the most effective way to monitor a fertility program. Suitable levels of nitrogen (N) and phosphorus (P) are essential for rapid stand establishment and high yields. North Dakota studies show that a soil test P level of 12 ppm in the surface 6 inches is usually adequate for good crambe production. There is no research on crambe's K and micronutrient fertilization levels in Nebraska. Potassium and micronutrient responses would not be expected in most Nebraska soils due to the high native K and micronutrient levels. Yields in Nebraska and North Dakota crambe trials have benefitted from N rates as high as 120 lbs/a. High N rates may cause a slight delay in maturity. We recommend a soil test which would reduce the amount applied by the residual in the soil.

### **Weed Management**

Trifluralin (Treflan) is the only herbicide registered for use on crambe. Weeds can be a major problem in

production fields. Early-planted narrow row stands of crambe are an effective way of defeating many weed problems. Late plantings into warmer soils often have problems competing with the faster growing weeds. Do not plant crambe in fields with a history of weed problems.

Common ragweed (*Ambrosia artemisiifolia*), redroot pigweed (*Amaranthus retroflexus*), common lamb's quarters (*Chenopodium album*) and foxtail (*Setaria* spp.) are common weeds in crambe fields in Nebraska. Common ragweed and redroot pigweed can cause problems during combining. Kochia (*Kochia scoparia*) and wild mustard (*Brassica kaber*) are problem weeds in North Dakota and could be future problem weeds in Nebraska crambe fields.

## **Disease Management**

Few crambe disease problems are present in Nebraska, due primarily to a lack of commercial acreage. A lack of disease reports does not indicate that disease problems will remain small. As acreage expands, opportunities for diseases will increase greatly.

*Sclerotinia sclerotiorum* (white mold or stem rot) is present in North Dakota crambe fields, and it is also present in Nebraska. White mold survives in the soil in its dormant stage, called sclerotia. Infections can start in the branches, leaves, pods and stems. High plant populations, high humidity, high inoculum levels and excessive nitrogen levels create conditions suitable for white mold. Effective control measures include rotating to nonhost crops, deep plowing and use of certified seed free of sclerotia. Avoid rotations with sunflower and drybean, due to their white mold susceptibility.

*Alternaria brassicae* (black spot) is a devastating disease of rapeseed, canola and the other cole crops in the United States and Canada. Crambe is very susceptible to black spot. Black spot overwinters on plant debris and seed. All above-ground plant parts are susceptible to infection by spores produced on plant debris or infected plants. Control methods include use of disease-free certified seed, use of a long-term rotation and control of weedy mustards and volunteer crambe and canola.

Crambe is highly susceptible to Turnip Yellow Mosaic Virus (TYMV), which has been observed in Nebraska. Mosaic symptoms and yellowing of the edges of the outer leaves that later die are the two major TYMV field characteristics in crambe. Flea beetles and grasshoppers are known vectors of TYMV. Rotation with control of volunteer plants is an effective way of avoiding TYMV problems.

## **Insect Management**

There are no insecticides registered for use on crambe in Nebraska. Contact local extension agents for current information about possible insecticides when severe insect infestations occur in your area.

Flea beetles are a major pest of canola and rapeseed in the United States and Canada. While flea beetles can be present in large numbers in crambe fields, North Dakota research shows that flea beetles cannot sustain themselves on crambe. The high glucosinolate levels are a possible reason for crambe's resistance to flea beetles. In Nebraska, insects damage seedlings along field edges. Research shows that grasshoppers feed on crambe, but susceptibility of crambe to grasshopper feeding is uncertain.

## **Harvesting and Storage**

Crambe can be direct combined or swathed if weeds or shattering are problems. Crambe is ready to harvest when seed moisture is 10 percent. The plants are mature when the seed pods and small branches turn a light tan or straw color. Seed should be ready to harvest when the last seed-bearing branches reach

maturity. Crambe does shatter less than canola, but timely harvesting is essential due to potential shattering problems.

Since the seed pods are on upper plant parts, the reel cutter bar can be set at 12-18 inches above the ground. A combine cylinder speed from 400 to 500 rpm's, with a concave clearance of 3/8 inch, and a low air-flow are necessary. Extremely light bushel weights necessitate low fan speeds. If seed is being blown out the back of the combine, air intakes should be blocked off to reduce air flow. Reel speeds should be slightly faster than the combine harvest speed to decrease shattering.

Inspect combines, wagons and trucks to insure that no openings will leak seed. Cover wagons and trucks, because the lightweight seed can easily blow out.

Small stems, green leaves and weeds often accompany crambe seed. Remove green trash before storing to lessen bin heating and reduce drying costs. Some newer combines do a much better job of removing green material than older models. Bins used for the storage of wheat are satisfactory for crambe. Seed moisture should not exceed 8 percent moisture for long-term storage. Present contracts call for crambe to be processed soon after harvest so long term storage should not be necessary.

### **Crambe Meal**

Crambe meal is a viable protein supplement for growing and finishing beef cattle. The Food and Drug Administration approved the use of solvent-extracted crambe meal in beef finishing rations at levels below 4.2 percent of the total ration. Crambe meal should be mixed well with other feed to reduce ration sorting and increase feed consumption and gain. Researchers have shown that crambe could replace up to 2/3 of the soybean meal in their control rations. Crambe meal is more acceptable to younger animals, and crambe meal consumption may be greater in the early stages of the feeding period. Members of the HEA Development Consortium are continuing crambe feeding research efforts, so changes in recommendations might occur. Crambe, like rapeseed and the other mustards, contains glucosinolates. Glucosinolates are an anti-nutritional element that can induce thyroid problems in monogastric animals. Crambe meal is not approved as a food source for poultry, hogs, or dairy cattle.

### **Crambe Economics and Marketing**

- NSI will have a crushing plant at Goodland, Kansas. This should create a market in the southern Panhandle and southwestern Nebraska.
- Contracts are necessary because there is only one buyer.
- Gross returns are similar to or better than sunflower.
- Profits decrease as transportation distances increase, due to crambe's light bushel weight.

### **Potential Crambe Benefits**

Potential benefits from growing crambe include:

- The use of current small grain equipment reduces investment costs.
- Addition of another crop to a rotation will help break up pest cycles.
- The use of a minor oil seed crop allows a farmer to increase government farm program alternatives with Flex Acres.
- Crambe is an industrial crop that does not compete with existing oversupplies of feed and food crops.

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***File G1126 under: FIELD CROPS***

***F-17, Miscellaneous Crops***

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