

Fenugreek in Saskatchewan

February 2017

Introduction

Fenugreek (*Trigonella foenum-graecum* L.) is a self-pollinated, small-seeded annual legume (family Leguminosae) that is grown as a spice and a forage crop. Another name for fenugreek is Greek Hay.

Fenugreek has two areas of origin: the Indian sub-continent and the Eastern Mediterranean Region. Fenugreek originating in the Mediterranean is best adapted to Western Canada due to the similarity in day length.

It is widely cultivated in warm temperate and tropical regions in the Mediterranean, Europe, and Asia. The major seed producing countries are India, Ethiopia, Egypt and Turkey. In India, the seeds are used in curries, dyes, and medicines, and young seedlings are often eaten as a vegetable. In Europe and North America, the seed is used for its pharmaceutical qualities, as a spice, as an imitation maple, vanilla, rum or butterscotch flavouring, and in health food.



Figure 1. Foliage and pods of fenugreek (Source: SA)

Fenugreek was first grown commercially in Western Canada just prior to the registration of the first cultivar, AC Amber, in 1992 by Agriculture and Agri-Food Canada (AAFC) Research Station at Morden, Manitoba. The Crop Development Centre (CDC), University of Saskatchewan, Saskatoon, registered the second cultivar CDC Quatro soon after.

The market for fenugreek seed is currently very small and the crop should not be grown on speculation. Growers should contact a marketing company in order to understand their possible market before they produce the crop.

In 2016, about 1740 ha (4300 ac) of fenugreek are planted for production in Saskatchewan. Interest is growing in fenugreek as a forage crop in southern Alberta because of its unique ability to maintain a high protein level throughout the growing season.



Figure 2. Fenugreek seed (Source: A. E. Slinkard)

The Plant

Fenugreek is an erect, hardy annual plant, typically growing to a height of 0.3-0.6 m (1-2½ ft). The plant has a sharp, spicy aroma. It has a smooth hollow stem (Figure 3. C) with alternate, single trifoliolate leaves borne on a short petiole with two small stipules at the base. Leaflets are oval, and slightly toothed. Flowers (Figure 3. C1) are yellow-white (white-flowered types) or sometimes purple-tinged (normal types) and develop in the leaf axils either singly or in pairs. Pods (Figure 3. C2) are brown, slender, and sickle-shaped with a sharp beak at the end. They are approximately 7-15 cm long, each containing about 10-20 seeds.

The irregular rectangular-shaped seeds are 4 to 6 mm long and 2 to 3 mm wide and weigh 18-22g/1000 seeds. A deep furrow divides the seed into two parts: the larger cotyledons and the smaller radicle (root tip). Seed coat colour ranges from

translucent in White-flowered types, with their colour-less endosperm and yellow cotyledons showing through, to greenish brown in normal cultivars. The bushel weight for fenugreek is 55-60 pounds.

Figure 3. Fenugreek plant (Source: University of Cordoba, Spain).

Fenugreek seed contains little starch or sugar, but a large proportion of dietary fibre.

Table 1 shows the chemical analysis of fenugreek seed.

Table 1. Component chemical analysis of fenugreek seed. (Source: University of Saskatchewan)

<u>Component</u>	<u>Per cent</u>
Dietary fibre	45.4
- insoluble	32.1
- soluble	13.3
Protein	36
Oil	6
Ash	3.2
Starch	1.6
Sugar	0.4



The endosperm of fenugreek seed is a gum that surrounds the cotyledons (seed leaves) and embryo. This gum consists of galactose (digestible) and mannan (non-digestible) in a 1:1 ratio. Galactose is widely used as a thickening agent in foods such as soups, gravies, ice cream and sherbets. As a result, fenugreek may find future markets in functional food and nutraceutical production. Fenugreek gum may also have potential as an emulsifier in the petroleum drilling industry or as a precipitating agent in the potash industry.

Fenugreek seeds also contain low concentrations (less than two per cent) of coumarin, diosgenin, saponins and other steroids. These compounds and other constituents give fenugreek products an undesirable taste for some uses. However, debittered fenugreek products are now available.

Adaptation

The indeterminate growth nature and long growing season requirement for fenugreek indicates the crop is best adapted to southern Saskatchewan. This area is prone to drought stress in late summer and early fall, conditions which terminate the growth of the fenugreek plants. The plant matures in 105–140 days. Under cool, moist conditions, plant development is slow and if these conditions prevail during the end of the growing season, the plant's indeterminate nature may cause it to fail to mature and immature seeds may be frozen in the fall.



Figure 4. Fenugreek nodules (Source: SA)

The plant thrives in full sun on rich, well-drained soils with a pH of 5.3-8.2 and in optimum air temperatures of 8-27°C.

Inoculation

Fenugreek is a member of the legume family, is closely related to alfalfa, and has the ability to form a symbiotic relationship with nitrogen-fixing soil bacteria called Rhizobia.

The two origin groups of fenugreek each have their own specific strain of Rhizobium. Originally, the only inoculum available was specific to the Indian group, but little nitrogen was fixed in the Mediterranean group. However, inoculum from Russia was obtained and is very effective in fixing nitrogen in the Mediterranean group. This strain (RGFU1) is produced on a small scale. This strain is in the specific group of Rhizobia called Sinorhizobium melioli. If this inoculant product is not available, an inoculant for alfalfa or sweet clover is most suitable.

Fertility

Fenugreek is a legume and if inoculated with the suitable Rhizobium, can fix a significant amount of its nitrogen requirement. Nitrogen requirements for fenugreek are similar to lentil. Application of too much additional nitrogen fertilizer can lead to excessive vegetative growth, poor seed production and delayed maturity.

Phosphorus is important for optimum nodule, flower and seed formation and advancing crop maturity. In research conducted at the University of Saskatchewan, the addition of phosphate (P_2O_5) fertilizer was found to increase yield. Application of phosphate fertilizer is recommended based on a soil test. Seed placement of phosphate in excess of 17 kg/ha (15 lb/ac) can reduce plant stands in most legume crops and, if rates higher than 17 kg/ha P_2O_5 are needed, it should be side-banded near the seed or applied with a wider-spread opener.



Figure 5. Fenugreek seedlings
(Source: SA)

Varieties

Five fenugreek cultivars have been released in Canada. Three are normal lines including AC Amber, released by AAFC Morden in 1992; CDC Quatro by CDC Saskatoon in 1995; and CDC Canagreen, released by CDC in 2002. CDC Quatro is a double-podded variety with improved seed yield, vigour and height. In replicated trials, CDC Canagreen was similar to CDC Quatro in most agronomic traits, except seed yield, where it was 28 per cent higher. The fourth cultivar is a white-flowered line called CDC Canafen released by CDC in 2002. In trials in Saskatoon, the yield of CDC Canafen was slightly higher than CDC Quatro. White-flowered cultivars are developed for their low colour, taste and odour to better enter new markets as a component in food production. CDC Amber was licensed exclusively to G.H. Schweitzer Enterprises (now Canadian Grains). CDC Quatro, CDC Canagreen and CDC Canafen are licensed exclusively to Emerald Seed Products Ltd. An application to register AC Tristar was made in 2004 by Agriculture and Agri-Food Canada and the Lethbridge Research Centre.

Seeding

Fenugreek should be seeded in early May on light, well-drained soil and on stubble to promote early maturity. In research carried out at the University of Saskatchewan, the highest yield was achieved using a 30 cm (12 in) row spacing. A density of about 18 plants per meter of row in rows 15-30 cm (6-12 in) apart resulted in reasonable yields. The optimum plant density is 135 plants/m² (12 plants/ft²). Denser stands usually result in more uniform maturity. A seeding rate of 27-33 kg/ha (25-30 lb/ac) should be used. The recommended seeding depth is 2-4 cm (1-1½ in).

Weed Control

Fenugreek seedlings emerge quickly after planting, but grow slowly in the spring compared to many other legume crops. They do not compete well with early-season weeds. Selection of a clean field is essential for successful production.

Fenugreek seed is similar in size to flax, canaryseed, or small wheat. Seeds of these crops will be difficult to separate from fenugreek and fields containing volunteers of these crops should be avoided. A research trial was completed at the University of Saskatchewan to study the use of inter-row cultivation to control weeds in fenugreek grown in 35 cm (14 inch) wide rows. The results indicated a yield increase which was not as great as with the herbicide treatments tested.

Select[®], Centurion[®] and Odyssey[®] herbicides are registered for the control of weeds in fenugreek. The SA publication, *Guide to Crop Protection* provides more information on the use of herbicides.

Insect Control

Damage to fenugreek seedlings by wireworms and cutworms has been observed. Grasshoppers can be a pest in years of heavy infestation. Aphids and blister beetles can be insect pests of fenugreek. Dipel 2X (*Bacillus thuringiensis*) is registered on fenugreek for the control of certain insects. Consult the product label or the Saskatchewan Agriculture (SA) publication *Guide to Crop Protection* for more information.

Disease Control

Fenugreek seedlings are susceptible to *Pythium* species (damping off) and may be susceptible to other root rot pathogens such as *Rhizoctonia* and *Fusarium*. Cercospora leaf spot can cause serious defoliation and can also affect stems and pods. It has not been observed on fenugreek in Saskatchewan and may not become a concern because it is favoured by warm, humid conditions.

Powdery mildew occurs on fenugreek, but is not considered a serious problem. No seed treatments or foliar fungicides are registered for use on fenugreek in Canada.

Forage Production

In research carried out by AAFC Lethbridge, fenugreek dry matter yields have equalled two cuts of alfalfa composed of 16-18 per cent protein. Yields were doubled under irrigation. Fenugreek maintains good quality after blooming, giving producers more time for harvest. The strong odour may temporarily discourage livestock from eating it.

For more information on the use of fenugreek for forage, contact the AAFC Research Centre in Lethbridge, Alberta.

Harvesting

Fenugreek grown for seed should be left in the field until fully mature, usually after a killing frost. As seed pods are resistant to shattering, direct combining is recommended. A cylinder or rotor speed of 600-880 rpm is effective in removing seeds from the pods. Initial wind speed should be set at 75 per cent of the wheat setting.

Average yields reported by growers under dryland conditions are approximately 1500 kg/ha (1300 lb/ac); however, yields have ranged from 150-2800 kg/ha (130-2500 lb/ac).

Storage and Handling

Under cool wet conditions at harvest time, the indeterminate nature of fenugreek can lead to harvest delays and the need to combine at high moisture levels. Aeration fans in storage bins should be used to cool and dry the crop. The seed should be dried to below 12 per cent moisture for safe storage. Care must be taken to avoid spoilage in the bin. Fenugreek has been observed to spoil at 15 per cent moisture.

Use the following formula to determine the moisture level of fenugreek seed.

$$\% \text{ Seed moisture content} = \frac{100 \text{ g} - \text{weight of seed after drying (g)}}{\text{weight of seed after drying (g)}} \times 100$$

An unofficial moisture conversion chart for fenugreek has been developed and can be used as a harvest guideline.

Marketing

Fenugreek should not be grown without a contract. Most marketing channels for fenugreek are vertically integrated, tightly controlled operations. Reliable data on supply and demand, imports and exports, world trade and world prices is not available. A small number of companies offer production contracts with producers. Producers are advised to investigate potential buyers before growing the crop. For a list of special crop marketing companies, refer to the SA publication, *Saskatchewan Special Crop Marketing Company Synopsis*.

Economics of Production

The SA publication, *Crop Planning Guide - Specialty Crops*, includes information on projected costs of production and expected returns of fenugreek in Saskatchewan. Farm gate prices have ranged from 40-60 cents/kg (18-30 cents/lb) in recent years.

Additional Information:

Saskatchewan Agriculture

- The Agriculture Knowledge Centre
- Web site address: www.saskatchewan.ca/agriculture
- *Saskatchewan Special Crop Marketing Company Listing, Crop Planning Guide - Specialty Crops, Inoculation of Pulse Crops, Guide to Crop Protection*

Government of Alberta Agriculture and Forestry

- Web site Address: <http://www.agric.gov.ab.ca>

Herb, Spice and Specialty Agriculture SK

- *Growers Guide to Herbs and Spices*
- Web site address: www.saskherbspice.org/

Emerald Seed Products Ltd.

- *Fenugreek Production Guide 1997*
- Web site Address: www.emeraldseedproducts.com/index.htm

Center for New Crops & Plant Products, Purdue University

- New Crops Web site: www.hort.purdue.edu/newcrop/

Written and Edited by: A.E. Slinkard, University of Saskatchewan

R. McVicar, C. Brenzil, P. Pearce, K. Panchuk, S. Hartley, Saskatchewan Agriculture

Revised by: Dale Risula, Saskatchewan Agriculture