

Flaxseed: recovering from the Triffid gene

The discovery of the genetically modified 'Triffid' gene in flaxseed exported from Canada to the EU could have devastated the Canadian flaxseed industry. Since 2009, farmers have struggled to regain profits and reputation as organic growers. As a result of rigorous testing and inspection, the Triffid gene has been virtually eliminated. Along with increased yields, this suggests a positive outlook for the future. Charlotte Niemiec writes

The Flax Council of Canada's spring 2012 report, titled 'Global demand for flax is growing: we'll be ready', details the challenges the flaxseed industry has faced, and focuses on the positive expectations for its future. As more evidence of the health benefits from consuming flaxseed – or linseed – oil emerges, demand for it is increasing along with its popularity.

The Flax Council of Canada is a national organisation that promotes Canadian flax and flax products for nutritional and industrial uses in domestic and international markets. One of the most important functions of the council is to disseminate credible, scientific information through publications. The council participates in national and international trade shows, and also funds nutrition and agronomic research and coordinates crop and product research and development. It analyses the industry and releases regular updates. It is currently focusing on five main areas of flaxseed use: human health; animal health and products; fibre applications; industrial uses; and breeding production.

Canada is the world's main producer of flaxseed, contributing 34% to the flaxseed industry. There are three main areas in Canada – particularly Western Canada – where flaxseed is grown: Manitoba, Saskatchewan and Alberta provinces, with Saskatchewan leading in total

flaxseed growth (see Table 1, below). Other producers include China (25.5%), India (9%), Ethiopia (3.5%), and the seed is also produced throughout Europe. Flax is a versatile plant: it can be used to make fabric, dye, paper, medicines, fishing nets, hair gels, clothes, ropes and soap. Crucially, it is the source for linseed oil, popular not only as a nutritional, edible oil but also as a wood finishing oil.

There are two basic varieties of flaxseed: the brown variety, and a golden or yellow variety. While brown flax can be eaten, it is more frequently used as an animal feed, and in the production of paints and fibres.

Health benefits

Flax contains a high amount of omega-3 fatty acids. The fatty acid composition of flax oil is 9% saturated fatty acids; 18% monounsaturated fatty acids; and 73% polyunsaturated fatty acids, of which 57% is omega-3 fatty acids and 16% omega-6 fatty acids.

Omega-3 and omega-6 fatty acids can only be found through food – chiefly oily fish and certain plants – which is why they are termed essential fatty acids. The typical Western diet contains 11-30 times more omega-6 than omega-3 fatty acids, but nutrition experts recommend roughly equal amounts.



FLAXSEED OIL IS A POPULAR NUTRITIONAL SUPPLEMENT, WITH SCIENTIFIC

Flax contains a higher proportion of omega-3 fatty acids, which are said to play a crucial role in brain development and normal growth and development.

Crippling a US\$308M industry

In 2009, the 'Triffid' event knocked the wind out of flaxseed farmers in Canada. The Triffid seed, a name taken from John Wyndham's novel on genetically engineered man-eating plants, 'The Day of the Triffids', was a genetically modified flaxseed created to be herbicide-resistant. The

TABLE 1: LARGEST FLAX GROWING AREAS IN CANADA ('000 TONNES)

Year	Manitoba	Saskatchewan	Alberta	Western Canada Total
2000/1	205.7	469.9	17.8	693.4
2001/2	199.4	495.3	20.3	715.0
2002/3	214.6	444.5	20.3	697.4
2003/4	195.6	533.4	25.4	754.4
2004/5	132.1	355.6	29.2	516.9
2005/6	147.3	881.4	53.3	1,082.0
2006/7	193.0	759.5	36.3	988.8
2007/8	105.4	511.8	16.3	633.5
2008/9	161.3	666.8	33.0	861.1
2009/10	193.0	708.7	28.4	930.1

Source: The Flax Council of Canada



PHOTO: THE FLAX COUNCIL OF CANADA

TABLE 3: FUNDING TO PROMOTE FLAX FROM THE GOVERNMENT OF CANADA

Project	Government of Canada
Natural Fibres for the Green Economy Network (NAFGEN)	US\$9.8M
Total Utilisation Flax GENomics (TUFGEN)	US\$5.7M (+US\$1M from industry)
Herbicide tolerant non-GMO flax varieties	US\$4M
Industry & producer testing for the presence of Triffid	US\$5.1M
Northern Adapted Flax Variety Development Program	US\$509,000 (+ US\$1.4M from other funders)

Source: The Flax Council of Canada Industry Update

TABLE 2: LATEST FLAXSEED UPDATE FROM THE FLAX COUNCIL OF CANADA¹

	2010-11	2011-12	2012-2013 ^f *
Area Seeded (Kha)	374	281	433
Area Harvested (Kha)	353	273	411
Yield (t/Ha)	1.20	1.35	1.28
Production (kt)	423	368	525
Imports (kt) ^a	8	7	5
Total Supply (kt)	720	569	630
Exports (kt) ^b	404	350	450
Food & Industrial Use (kt) ^d	n/a	n/a	n/a
Feed, Waste & Dockage (kt)	n/a	n/a	n/a
Total Domestic Use (kt) ^c	123	119	80
Carry-out Stocks (kt)	194	100	100
Average Price (\$/t) ^e	530 ^f	520-550	520-550

¹ August-July crop year^a Excludes imports of products^b Excludes exports of oilseed products^c Total Domestic Use = Food and Industrial Use + Feed Waste & Dockage + Seed Use^d n/a: not available due to data confidentiality^e forecast, Agriculture and Agri-Food Canada, July 16, 2012^f Crop year average prices: Flaxseed (No.1 Canada Western, ICE Futures Canada, cash, in-store Saskatoon

* Forecast for No.1 CWRS 12.5% protein and No.1 CWAD 12.5% protein 1/S St. Lawrence/Vancouver

Source: Statistics Canada

one seed was found in every 10,000 tested – it was enough to threaten the entire US\$308M Canadian flaxseed industry. An article in *The Globe and Mail* in 2009 detailed the devastation, explaining how prices for flax dropped by two or three US dollars/bushel from US\$11.2/bushel after news of the contamination spread. As 70% of Canada's flaxseed was exported to the EU, 70% of it suddenly became worthless. How the seed resurfaced remains a mystery, but the man who created the seed – Dr Alan McHughen – admitted that he had given some seeds to farmers for educational purposes, on the condition that they did not plant them. He conceded, however, that some farmers might have disregarded this condition.

Farmers who had prided themselves on producing organic flaxseed were stumped. Their crops might have been ones contaminated with the Triffid gene and they had been entirely unaware.

The Canadian authorities implemented a three-stage testing system, and it was made compulsory for all farmers to undergo extensive testing and inspection procedures to prove their crops did not contain the GM gene. Processors would not accept flax for shipment if it did not come with a pre-seeding test and two certificates. Although the test cost US\$203, various programmes covered half the cost, meaning that farmers had to find just US\$102 to verify that their flaxseed was negative for Triffid. The test took two to three days to complete, and seed had to be sent off to accredited seed labs. The tests continue to this day.

Farmers cooperated and, three years on, very

little flaxseed tests positive for the Triffid gene. The Flax Council of Canada tracks the results, and has reported that 10% of producer stocks tested positive in 2009; 7% in 2010/11 and just 3% in 2011/12 to date. The Flax Council's industry update says that: "Flax producers, [the] industry and the federal government have pulled together to address the impacts of the Triffid event and have successfully decreased the number and intensity of positive tests. The testing protocol is a short-term solution to regain access to the existing European crusher market. The long-term solution is a workable, science-based international policy regarding the low-level presence of genetically modified organisms in exported crops. Such a policy would allow trade to continue without the undue cost and risk associated with testing while at the same time ensuring food safety."

Developing non-GM flaxseed

Despite Triffid, producers of flaxseed in Canada are still keen on developing adapted varieties. In 2010, the Flax Council of Canada enlisted the help of Cibus Global to develop new, non-GM varieties that are higher-yielding and have improved weed resistance, the update says. Even though the herbicide-tolerant Triffid was banned, there is still a need for a herbicide-resistant flaxseed, which would "add immediate value to the Canadian flax crop".

According to the update, "Flax is a poor competitor for weeds and few chemical options exist for weed control. Several leading Canadian flax

STTS CLAIMING BENEFITS TO COMMON AILMENTS AND ILLNESSES

modified seed was initially approved for food, feed and the environment in Canada and the USA, but lobbyists successfully petitioned to have the seeds deregistered and destroyed for two reasons. They argued that flaxseed's chief appeal was that it was organic, and therefore there was no need for a GM variety. The EU was another setback, as the region's ban on GM products made it nonsensical to introduce a GM variety of flaxseed to a market that imported 70% of Canada's flaxseed. In theory, all the seeds were destroyed.

However, in 2009, the Triffid seed appeared in 34 countries. Although the amount was tiny – just

► researchers have estimated that herbicide tolerance would provide an option for much-needed weed control, add convenience to the cropping system and could potentially increase yields by 15% to 20%.”

One successful programme – the Northern Adapted Flax Variety Development Programme – is being conducted by the Saskatchewan Flax Development Commission (SaskFlax), in partnership with Agriculture and Agri-Food Canada, the BC Grain Producers Association and Manitoba Agriculture, Food and Rural Initiatives. The Northern adapted flax varieties have so far proved successful.

SaskFlax says its project objectives were to: “determine best agronomic practices for varieties better adapted to the northern portion of the Canadian prairies and thus offer a new crop

option to producers.”

The Flax Council adds that the project hopes to “include development of enhanced traits, tolerance to seeding in cold soils and chill tolerance; determine maturity; and the ability for straw to dry down rapidly.” So far, there is evidence that it is working, with flowering occurring as much as a week early.

“Early observations also show that Northern varieties exhibit some resilience to drought and to variable weather conditions,” says SaskFlax.

Other observations include: there is no yield benefit to higher seeding rates; there is a significant yield impact from the application of Headline EC (an emulsifiable concentrate, broad-spectrum fungicide), despite a lack of pasmo disease; Buctril M and FlaxMax are safe for use in flax, even at higher application rates.

Gene repair technology

With the successful implementation of Cibus Global's Rapid Trait Development System (RTDS) in Canola, it is hoped that the technology can also be used for flax. The RTDS is a new gene repair technology being deployed to develop new and useful traits in crops. It is based on altering a targeted gene by utilising the cell's own gene repair system to specifically modify the gene sequence in situ and not insert foreign DNA and gene expression control sequence. This procedure effects a precise change in the genetic sequencing while the rest of the genome is left unaltered. Since affected genes remain in their native location, no random, uncontrolled or adverse pattern of expression occurs.

The Flax Council hopes that “the development of this initial trait in flax will enable the more rapid development of additional innovative traits and enhanced germplasm, leading to increased competitiveness and new markets, such as: life-science-based products and processes; improved quality for human health, animal health and productivity; and new industrial and fibre products.”

The future of Canada's flax

The Canadian Government has so far invested a total of US\$24.6M in the flax industry (see Table 3, previous page). A ‘re-constituted’ seed is expected to hit the market in 2014, developed by the Flax Council, the University of Saskatchewan's Crop Development Centre (CDC) and SeCan – the largest supplier of certified seed to Canadian farmers. The new seed will be re-constituted from the two most popular varieties of flax: CDC Bethune and CDC Sorrel, as well as two new varieties: CDC Sanctuary and CDC Glas. This will help ensure western Canadian farmers have access to a Trifid-free seed source, contributing to the eradication of the gene. Farmers can use their stocks of existing flaxseed until the spring of 2014, when they will be provided with the new seeds. Old seeds must then be destroyed, in order to prevent the availability of two sources of the same seed on the market simultaneously. The new seed is likely to be called ‘CDC Sorrel 14’ and ‘CDC Bethune 14’, to mark the year of distribution.

According to the Flax Council's latest report (see Table 2, previous page), for 2012 to 2013: “The seed area [for flax] increased by over 50%, most of which was in Saskatchewan where seeded area increased by 58% to 0.34M ha. Seeded area also rose in Manitoba and Alberta. Total production is forecast to rise by 43%. Total supply is forecast to rise by only 11% due to the sharp drop in carry in stocks. Exports are forecast to rise due to steady US and Chinese demand, which is supported by high world vegetable oil prices. Total domestic use is forecast to fall by one third due to reduced domestic capacity. Carry-out stocks are forecast to be unchanged. Prices are also forecast to be steady on support from high world vegetable oil, protein meal and oilseed prices.”

This report, coupled with the promise of a new seed in two years' time, suggests the future of the flaxseed industry is bright.

Charlotte Niemiec is OFI's editorial assistant. OFI would like to thank the Flax Council of Canada for supplying information on which this article is based

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