

Pollinating Hybrid Canola-the Southern Alberta Experience

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Canola is a Canadian success story. This oilseed crop has brought prosperity to many canola growers in the prairies. Over the last few years it has also contributed to an unprecedented growth in the number of honey bee colonies for pollination of hybrid seed canola. There are many challenges to supplying bees for pollination on time and on budget. Following is an overview of the canola industry and honey bee pollination.

Canola is an oilseed crop that was developed in Canada from a low acid cultivar of rapeseed. The species name is *Brassica napus* and this is the main species grown. *Brassica rapa* has a shorter growing season which is great for some areas of Canada but it does not yield as much oil as *B. napus*. The name Canola comes from the term CANadian Oil Low Acid. There is a strict definition of canola, which has been codified in Canadian law. It only applies to an oilseed that has less than 2% erucic acid (a crystalline fatty acid that is not good for your heart) and less than 30 micro moles of glucosinolate (a compound that binds some unpleasant tasting alkaloids that are released on eating).

Development

The crop was developed in the 1960's by plant researchers Dr Keith Downey, Agriculture Canada, Saskatoon and Dr. Balduf Stefansson, University of Manitoba, Winnipeg. Canola was introduced to Canadian farmers in 1968. In the race to develop the low acid varietal, technicians, Martin Mallard and Burton Craig at the University of Saskatchewan built a gas chromatograph before the equipment was commercially available. This innovation saved a month of turn around time in sending samples away for testing for erucic acid and

glucosinolate levels. Interestingly there is a beekeeper connection, Paul Pawlowsky, manager of the Honey Co-op had a brother Sid who worked for Keith Downey on the canola program, the Pawlowskys supplied the bees for the pollination trials.

Production

Canola is grown commercially mostly on the prairies in Canada. In 2008, 16.6 million acres (6.6 million ha) were planted and the acreage is expanding. There are 52,000 canola producers. Canada is the largest single producer of canola in the world.

Production was 12.6 million tonnes of canola seed in 2008 at a value of \$13 billion. Some of the crop went to the 13 crushing plants in Canada and was sold as meal for animal feed and oil for the food industry (canola seed has 42% oil and 58% meal). Some of it was shipped as seed for production of biofuel. Some of it was sold as certified hybrid seed canola. Some seed is sent to Australia or South America to grow in the opposite season to be returned as parent seed for the following year in Canada. Sixty percent of Canada's exports of canola meal are to the USA. They are a net importer of canola. Almost half of the canola oil seed crop was shipped to China in 2008/9. Japan, USA, Mexico and Saudi Arabia bought the rest. Production is expected to be down in 2009 so the record exports may not be repeated.

What is in a Name?

Over the past fifteen years some innovations were made using recombinant DNA technology for producing seed with herbicide tolerance. This has created a lot of controversy. The terms transgenic, genetically modified, genetically transformed, genetically engineered have been used in very

derogatory ways to describe the new bio engineered seed. Some EU countries have banned GM products. Some have gone so far as to call it "frankenfood". To this group of detractors, Percy Schmeizer, a canola farmer from Humboldt Saskatchewan is a hero. Monsanto claimed he was growing their product without paying the royalties. Percy claimed the wind and bees contaminated his plants with pollen from neighbouring GM crops. The judge believed Monsanto but Percy is making money as a guest speaker in countries such as UK and India and providing them with anti GM information.

On the other hand canola that has been bio engineered is also called less inflammatory names such as PNT (plants with novel traits), high yield, non conventional, herbicide tolerant, pedigreed canola and the most commonly used and politically correct term is hybrid canola. Interestingly, the religious Hutterite colonies who farm communally live a simple life and believe in low impact farming, have embraced hybrid canola because they believe it saves excessive amounts of pesticides and herbicides.

The Players

The main players in the Alberta hybrid seed industry are Monsanto with Round Up ready seed, BayerCrop Science with their Liberty Link seed, and Pioneer Hi-Bred which grows BASF brand Clearfield variety. Hi Tech Production grows seed for other companies and is a smaller company among the giants. Around 50% of the canola seed planted in Canada is Roundup Ready, 30% Liberty Link, 15% Clearfield (not GM but a mutagenic variety) and 5% are conventional. All of the seed companies have seed production units and all employ agronomists to advise the farmers and supervise crop production.

Canola and Bees

Commercially grown canola is predominantly a prairie crop. It is so common that 80% of Canada's honey crop is from canola. This amounts to

50 million lb per year of Grade No 1 white honey. It is almost impossible for bees to avoid encountering GM plants. However in 15 years of GM canola production there have been no verified complaints about the effect of GM crops on honey bees. Approximately 300,000 colonies harvest open pollinated canola. The expanding hybrid seed production industry, where farmers produce seed under contract to the seed companies, required 80,000 colonies in 2008 for pollination in southern Alberta.

Canola Requirements

Hybrid seed canola is grown in southern Alberta. Although other areas in Canada meet a lot of the criteria, this area meets all the requirements for heat, water, soil and isolation. The zone is centered around the 13 irrigation districts between Lethbridge in the south to Calgary in the north and east through Brooks and Medicine Hat. Here water is readily available to provide the 19 inches (480 mm) required by this crop. Days are mainly sunny, day length is 18 hours and there are sufficient degree days for rapid growth. Farms are measured in sections (640 acres) which provide good isolation for canola varieties.

Canola Planting

Seeding canola starts in late May. The parent stock consists of two genetic lines. They are planted in rows or "bays". The bays are planted in a ratio of 1:3 or 1:4 male to female plants depending on the company preference. The female flowers are male sterile so pollen must be transferred from a plant in the male bay. The crop is 90% dependent on honey bees. Honey bees are introduced at day 45 to provide this pollen transfer. Plants in the male bays will produce seed if left but they are mowed early to eliminate any potential for unwanted seed. The crop is certified by Canadian Food Inspection Agency inspectors for isolation, rogue plants and plant type.

Spraying

The agronomists advise when and where the sprays will be applied. Usually the crop is dusted with a

fungicide to prevent sclerotinia, a month before the bees are brought in. If there is a need for an insecticide during pollination period the agronomist will order Decis®, a low risk pyrethroid. Most canola seeds are now treated with systemic insecticides such as Gaucho® (imidacloprid), Poncho® (chlorothianidin) or Helix® (thiamethoxan). Although there is an expressed concern by many beekeepers around the world about the use of systemics, the experience in Canada is that we have had 10 years of large scale use on canola with no observed ill effect. This is not to let the systemics off the hook as there are some valid concerns about the application methods and residues in some other crops. In the past there were more complaints from beekeepers about Lorsban (chlorpyrifos, an organophosphate) and Sevin (carbaryl or 1-naphthyl methylcarbamate). For canola, the seed treatments, when applied according to label specifications do not appear to be an issue.

Contracts

All seed companies have contracts with growers and beekeepers. For the beekeeper it lays out the expectation for timing of arrival and departure, as well as the arrangement of payment depending on colony strength. Fees range from \$110-\$150 for 10-17 frames of bees and the quality is verified by the seed company.

Timing

Timing is very important as the crop is in bloom 45 days after seeding. Honey bee colonies are moved in to the fields over a period of 10 days starting June 20th. They are moved out again starting July 20th. While on the field the colonies are supered twice.

Challenges

There are many challenges for the beekeeper pollinating hybrid seed canola. Like any pollination venture it is a high capital investment. It requires an investment in moving equipment, forklifts, and trucks as well as a palletized system for the hives. Larger trucks bring their own issues with

need for driver training and Class 3 licences and adequate road access.

Staff is a big issue. Day length can be 18 hours and the work intense. Workers often prefer to work 12-14 hour days and have time off rather than work in shifts. Local seasonal workers are hard to recruit in rural areas and there are not enough young people interested in working in the apiculture business. Foreign workers are frequently hired to fill the gap. They come from Spanish speaking countries such as Mexico, Central and South America and the Philippines. This brings its own problems of language difficulties, housing and transportation, not to mention the hassles with government departments such as Health Canada, Human Resources and Immigration Canada.

In southern Alberta it can still be light at 11 PM in mid summer. Trucks usually move bees between 11PM and 4 AM. Since canola is rotated on a four year basis, the drop off for pollination is different for three years in a row. GPS is an important piece of equipment to help new crew find the fields. One beekeeper reported arriving to find hives already at the location. He was upset at the waste of time and walked in to see whose bees they were. It turned out they were his. He had dropped them off, via a different access road and then drove a full circle to what he thought was the next drop. Access can be a problem in the middle of the night, finding unlocked gates and setting down in the right spot. Agronomists want the best coverage for pollination. It has been known that beekeepers have been instructed to drop off in the centre of a field. The next day the hives were soaked because it was also the centre of the pivot irrigation. Of course there is the problem of mud if it has been raining and prairie soils are, to quote a local expression, "slipperier than snot".

A problem disease called clubroot is spreading. Beekeepers are now asked

to use hygienic practices by washing their trucks and equipment between yards to help prevent the spread of the disease. This adds time an effort to each trip.



Hybrid canola parent stock are planted in "bays".

Photo: Jerry Poelman

Agronomists are very knowledgeable and are hired for their expertise. Generally things go smoothly especially with experienced agronomists who know where and when to place honey bees and who appreciate the need not to spray when bees are in the field. Some of the larger beekeepers can work with 10 different agronomists each wanting a different sequence of events.

A lot of agronomists want 50% honey bees and 50% leafcutter bees for pollination. It can be disconcerting for the beekeeper to drive in and find leafcutter shelters placed where the honey bees are to be dropped.

Very little nectar is collected from hybrid canola and the fee for rental reflects this fact. The crop can vary from 10-50 pounds (2-22 kg) per colony depending on canola variety, nectar sources from plants in surrounding fields and the stocking density. Canola honey crystallizes quickly and this has to be built into any management routine. Supers must be removed and extracted in a short period.

With 1-3 colonies per acre (3-8 colonies/ha) the nectar sources are quickly harvested. Stocking density is so high that 1200 colonies can be within a square mile. Colonies sometimes go home lighter than they arrived.

Honey collected from canola is a light

white <10 mm on the Pfund scale. It is in high demand in the USA. Export markets to Europe were affected in the past by anti GM protestors but with the approval of GM crops for the EU, public perception of hybrid crops is changing.

Advantages

On the positive side canola pollination guarantees an income. Banks that loan money to beekeepers, like to see a good cash flow. The stability provided by canola pollination contracts is an important factor in providing financing for the expansion of business.

The irrigation districts in southern Alberta are generally used for growing corn, beets and potatoes, none of which provide forage for honey bees. Canola provides an income from honey production and pollination in a normally low yield area.

A well organized pollination business is hard work, almost 24-7, for six months of the year. The reward at the end of the year, if all goes well, is a good income and an opportunity to take a winter holiday.

Role For the Seed Companies

The seed companies have researchers engaged in producing newer high yield varieties with traits for a healthier human diet. We beekeepers must remind those in the lab that it is also important to maintain the physiological structure of flowers that is necessary for effective pollination. The flowers must be attractive to honey bees. This means maintaining a good pollen source in male flowers, good nectar source in female flowers, as well as petal size and attractiveness of the flowers.

This year in southern Alberta, Bayer CropScience is working co-operatively with Alberta Agriculture to collect samples from hives when they are checked for hive quality at pollination time. It is this kind of partnership that will provide a benefit to beekeepers as well as the seed industry.

There is awareness in seed companies

of the need to improve pesticides without killing honey bees. We encourage them to pursue research into species specific insect repellents and hope that this will be the way of the future

The Future

The seed companies have scientists performing ongoing research into a variety of different traits for canola.

One trait is high oleic acid, a monounsaturated fat that is good for cholesterol levels. The oil from this plant does not require hydrogenation (the process that turns oil into solid fat and produces nasty trans fats that are not good for you). Some varieties are bred for lower linoleic acid which is a less desirable acid.



Beehives in canola, southern Alberta.

Photo: Jerry Poelman

Omega 3 is a healthy choice and there are now some canola varieties that have enhanced Omega 3 oil, which will please dieticians. Some varieties have been found that have low nitrogen requirements, which is a bonus for not having to use large quantities of fertilizer. In an age of reducing our carbon footprint, this genetic trait is valuable. Work is currently underway by industry to produce a seed that has genes for herbicide tolerance, insect resistance, is oil enhanced and low in nitrogen requirement. It is estimated that in 10 years time, 50% of the hybrid canola will have these new traits.

The future is bright for canola growers and for beekeepers supplying the necessary pollination services. Despite the hard work and the challenges, the rewards are worth the effort.