2013 Canola Discovery Forum
Meeting Summary
Fairmont Winnipeg, West Ballroom
Tuesday, October 29, 2013

The Canola Discovery Forum will be an annual meeting which will highlight research and industry opportunities for profitable and sustainable canola production. The forum's purpose is to discover ideas and to strengthen partnerships between industry and research.

Welcome and Introduction
Brian Chorney, Chairman, Manitoba Canola Growers Association (MCGA), welcomed everyone to the Canola Discovery Forum. Congratulations went out to the Canadian canola industry on producing 15 million tonnes of canola, surpassing the benchmark set for 2015.

Dr. Curtis Rempel, Vice President Crop Production and Innovation, CCC, stated that this forum will replace the previous Crop Production Issues Team meeting. The meeting was renamed the Canola Discovery Forum to better reflect the meeting's objective, which is to have a "canola production opportunities dialogue."

"PLANT ONE TO GET ONE" – STAND ESTABLISHMENT
Autumn Barnes, Agronomy Specialist, Southern Alberta, CCC

Agronomic practices should be managed to what is seen in the field. This is the best way to manage seed establishment.

- Historically, data has shown that 5 plants per square foot yield 90% of the stand. Ten plants per square foot is the best opportunity for achieving maximal yield as canola seed has an emergence rate between 50 – 75%.
- Seed moisture should be between 8 – 10%, most growers' seeds are between 4 – 6%.
- An AAFC survey of 789 growers was conducted which looked at the production practices of producers. The data will be used to determine production efficiency and will identify characteristics which are associated with higher yields.
- In regards to stand establishment, zero tillage and direct seeding are the norm.
- Seed treatment and herbicide tolerance varieties help stand establishment.
- There is some relationship between seed size, vigor and survival. Larger seed produces larger seedlings and has higher yields but the yield benefit plateaus at 4-5 grams total seed weight (TSW).

Key Messages:

- Target even emergence of 10 plants per square foot
- Slow and shallow seeding at 0.5 – 1 inch
- Seed in warm soil 8-10^{o}C
- Responsible weed management
- Check drill placement
- Stand establishment starts in the fall

Some challenges are: what happens to seeds that do not emerge, and how do we "plant one to get one?" Opportunities to achieve greater yield include: decreasing seeding rate and/or use wider row spacing; seed placement, seeding efficiency, seed safety (fertilizer with seed), and residue management; seed coatings for root health, insect control, and mechanical injury prevention.

Top three questions:

Stand Establishment

1. Current canola emergence numbers are often around 50%. What happens to seed that does not come up? What can be done to optimize seed placement within rows and in relation to fertilizer?
2. The body of research on the relationship between seed size, seed vigour and seed survival is contradictory. How do these factors work together with modern varieties?

3. Can early seeding be balanced to avoid the July heat with the current recommendations to seed into warm soils to speed emergence? Can a model be created to promote a better understanding of this?

Seeding Depth by Yield Category				
	Low (N=207)	Medium (N=364)	High (N=218)	All (N=789)
Less than .5 inch	1%	1%	3%	2%
.5 - .75 inch	41%	56%	58%	53%
.76 – 1 inch	39%	29%	25%	30%
1.01 – 1.5 inch	12%	8%	9%	9%
1.51 – 2 inch	4%	2%	2%	3%
> 2 inch	0%	0%	1%	0%
Unsure	2%	3%	3%	3%
Average seeding depth	.94	.83	.83	.86

2013 CANOLA DISCOVERY FORUM

Speed Travelled While Seeding by Yield Category				
	Low (N=207)	Medium (N=364)	High (N=218)	All (N=789)
Less than 4 mph	4%	2%	2%	3%
4 - 4.4 mph	15%	21%	24%	20%
4.5 - 4.9 mph	25%	35%	37%	33%
5 - 5.4 mph	33%	27%	22%	27%
5.5 - 5.9 mph	12%	4%	4%	6%
6 mph or more	8%	10%	7%	9%
Unsure	3%	1%	4%	2%
Average speed	4.8	4.8	4.8	4.8

2013 CANOLA DISCOVERY FORUM

"CANOLA SEEDS & CANOLA WEEDS"
Dr. Neil Harker, Research Scientist, AAFC

Summary of crop establishment research results from Growing Forward 1 include:

- Different openers had no impact on emergence, speed did
- 40% of growers could improve yield with more plants

- Short or tall wheat stubble height did not influence canola yield
- More uniformly spaced plants increased yield, yield increased up to 100 plants per metre squared, and uniformity was important in decreased stands
- Seeding shallow is more important than seeding slowly

A new Growing Forward 2 project will look at seed size and seeding rate effects on canola yield and quality. Why do so few seeds emerge?

- A 2007 study showed slow and shallow seeding produces greater yield, but the average emergence is still 50%.
- Deep seeded plants that emerge are weaker.
- High fan opener results in more injury but does not have a big impact on emergence. Normal soil versus sterilized soil: sterilized soil produced almost no emergence in lab tests.
- Precision seeding results in consistent depth and uniformity, but there are issues with equipment cost, labour, seeding time and residue clearance.
- Consider environmental conditions: one of the biggest factors in emergence is moisture.

Weed herbicide resistance is a concern:

- 2001-2003 study compared to 2007-2011 showed increased herbicide resistance. Cleavers shifted from 0 to 16-23%.
- Glyphosate resistance weeds are on the rise with Canada having four resistant weeds.
- The most popular western Canada crop rotation is canola-wheat-canola, and there are no new herbicides with new modes of action.
- There is a need for more diversity.
- Alternative weed management includes weed seed destruction equipment and burning chaff and weed seed. There needs to be better management of herbicide use.

It was concluded that weed resistance is a serious threat; equipment that destroys weed seed presents a good opportunity for weed management; and greater crop diversity is needed.

"TENACIOUS WEEDS"
Angela Brackenreed, Agronomy Specialist, Manitoba, CCC

Pre-herbicide tolerant canola was associated with:

- High amounts of tillage, which meant a lot of organic matter was lost in the soil
- Pre-seed granular herbicide was used: selective broadleaf and grassy herbicides
- Application of higher rates of active ingredients and a lack of cruciferous weed control
- Weeds were one of the most yield limiting factors

Herbicide tolerant canola is associated with:

- Reduced herbicide toxicity by 53%, and decreased produce exposure to chemicals by 55%
- Chemical active ingredients reduced by 1.3 million kilograms and decreased environmental impact
- Greater early season vigour
- Systems were easily adaptable to large operations which helped reach production goals
- Direct seeding with use of pre-seed burn off
- Option to grow canola on fields that are dirty (with weeds)
- Net returns and weed control is better with glyphosate HT canola systems
- A better understanding of the impact of weeds, the most common weeds, ideal timing for weed removal, etc.

Key Messages:

- A clean field will translate into greater yield potential
- Scout for the weed spectrum in individual fields, detect herbicide resistance to guide application decisions
- Rotate herbicide systems for volunteer canola control
- Fall weed control: annuals versus perennials, frost
- Look at registered herbicide options and think about weed spectrum when selecting herbicide system

Steps to mitigate selection pressure for resistant weeds include diverse rotations, higher seeding rates, varied seeding dates, shallow seeding, narrow row spacing, adequate fertility, insect and disease

protection. Reduce harvest issues and sanitation/contamination issues between fields to promote yield, profitability and sustainability.
Some of the opportunities for weed management include: alternate management solutions for herbicide tolerant weeds, the impact of wider row spacing, and the impact of decreased seeding rates. There are limitations to herbicide systems. Should herbicides be the focus of weed management? Are there more herbicide options? There needs to be continued pest monitoring and surveying, and integrated weed management measures. There are opportunities for technologies of non-chemical weed control, such as the harvest weed seed control in Australia and the Harrington seed destructor. There are also genetic opportunities.

Top three questions:

Weed Management

1. Is current weed management too herbicide dependent? Should there be a more "integrated weed management" (IWM) approach. Is a sound IWM approach going to be feasible for the majority of producers.
2. Is "harvest weed seed control" a viable option like the "Harrington Seed Destructor?" Would practices like this end up selecting for certain weed species? What are other long term implications of this type of practice?
3. What would be some implications of herbicide-tolerant trait stacking?

"THE FERTILITY CLINIC"
Dan Orchard, Agronomy Specialist, Central Alberta North, CCC

There are "4 R's" for fertilizers: the right time, rate, place, and source

- Right time – spring versus fall, pre seed versus seeding time
- Right rate – yields are often optimized by higher than normal N rates
- Right place – seedling toxicity occurs with excess rates of fertilizer
- Right source – slow release, liquid versus dry

It is recommended that fertilizer should be tailored to individual fields. Nitrogen is the most common nutrient applied, has the highest cost per acre, and can cause adverse environmental effects. Top growers pay more attention to the 4Rs of fertilizer application.

Key Messages:

- Spend money on the macronutrients first
- Increase rates of N, consider cost/finance risk to putting on high rates

Other opportunities for fertilization include breeding crops for nitrogen use efficiency, using variable rate application (VRT) and inoculating seed with nitrogen fixing bacteria.

Top three questions:

Fertility

1. How is yield affected in terms of applying nutrient to soil tests rather than maintaining soil tests at medium to high levels?
2. The current phosphate with seed recommendations was made many decades ago. Perhaps more phosphate can be put in with seed since technology has changed? More research is needed on this.
3. Management zones were based upon yield and soil test results: what about moisture availability? (Soil moisture was not included in the experimental design. It was considered as a covariate, but logistics were prohibitive to measure. There is consideration to use radar images in the spring as a measure of soil moisture and to use that as a covariate.)

3a. Is there research on using weather data and soil moisture data for modeling nitrogen use?

How Did you Determine the Rate of Fertilizer Application for Selected Field?

How Fertilizer Rate is Determined by Yield Category				
Portion who chose each reason:	Low (N=207)	Medium (N=364)	High (N=218)	All (N=789)
Estimate based on experience	66%	62%	65%	64%
Estimate based on past yields	51%	43%	54%	48%
Soil test recommendations	32%	47%	55%	46%
General fertilizer use guidelines	39%	45%	39%	42%
Advice of crop consultant, agronomist or retailer	33%	41%	40%	39%
Price / cost limitations	49%	37%	21%	36%
Other	3%	2%	2%	2%

N=789, Base: Respondents indicating a fair or better year

Nutrient Program – By Region

	MB Black/ Grey (N=129)	SK Black/ Grey (N=224)	SK Dark Brown (N=130)	SK/AB Brown (N=41)	AB Black/ Grey (N=148)	AB Dark Brown (N=63)	Peace (N=54)	All (N=789)
Exactly the same for all canola fields	58%	75%	74%	83%	63%	74%	89%	71%
Tailored for each canola field	42%	25%	26%	17%	37%	26%	11%	29%

CANOLA DISCOVERY FORUM

Portion Who Used Each Type of Fertilizer on Selected Canola Field				
	Low (N=207)	Medium (N=364)	High (N=218)	All (N=789)
Phosphate	76%	81%	83%	80%
Urea	48%	52%	55%	52%
Ammonium Sulphate	*28%*	*39%*	*48%*	*39%*
Anhydrous	29%	31%	35%	32%
Potash	26%	25%	37%	28%
Elemental sulphur	*32%*	*29%*	*19%*	*27%*
Personal blend	24%	22%	18%	22%
Sulphur and sulphate	10%	12%	14%	12%
Liquid N	12%	12%	8%	11%
ESN	3%	8%	7%	7%
Ammonium Nitrate	5%	3%	4%	4%
Liquid ammonium thiosulphate	2%	5%	2%	3%

CANOLA DISCOVERY FORUM

"IMPROVING CROP PRODUCTION WITH VARIABLE MANAGEMENT OF N FERTILIZER AT THE FIELD SCALE, CURRENT AND FUTURE SCIENCE AND TECHNOLOGY"
Dr. Alan Moulin, Research Scientist, AAFC

Field scale variability is the elephant in terms of soil fertility and management. Technology that is important in determining where in the field the inputs go, include: yield monitors, GPS, GIS computer software, variable rate fertilizer on seeders, and ground based sensors.

Background

- The goal of variable management is to apply inputs in zones where the potential for return is greatest and environmentally sustainable.
- Fertilizer N is the most important target for variable rate management.
- Soil sampling has doubled in Manitoba to 45%.
- A 2006 study showed 57% of farms used tracking and guidance systems, 10% used equipment for yield maps.
- Consultant services are also available.

Methods for variable management

- Grid soil sampling – too expensive for N management
- Landform analysis – applicable in some areas
- Satellite imagery
- Unpiloted aerial vehicles or drones
- Soil conductivity sensors – high salinity zones
- Optical sensors (green seeker) – can be hooked up to variable rate fertilizer. Information should be collected at the right growth stage

Variable rate technology is available and producers have a keen interest in advanced methods of variable rate management. A new project with CCC and AAFC will look at advanced statistical methods for identifying management zones.

"OIL CHANGES"
Lisa Campbell, Oil Nutrition Research Manager, CCC

There are three pillars of canola research which include: oil, meal and agronomic practice. Cardiovascular disease and diabetes are major health issues affecting low- and middle income countries. Based on old research, canola oil had qualified health claims for its ability to reduce cholesterol levels. New research was needed to add to canola oil's health claims.

The Canola Oil Multi-Center Intervention Trial (COMIT), from Growing Forward 1, looked at the health benefits of multiple types of oil in the diets of individuals who were at risk of cardiovascular disease. Key findings were:

- Canola oil and high oleic canola oil are equally effective in reducing LDL-cholesterol
- DHA enriched canola oil significantly increased HDL cholesterol, decreased LDL cholesterol, and significantly reduced blood triglycerides
- DHA enriched canola oil reduced inflammation
- Canola oil and high oleic canola oils had no effect on vascular function or inflammation
- Canola oil and high oleic canola oil reduce abdominal fat in comparison with a flax/safflower blend oil

Another study looked at the effect canola oil has on glucose control and heart health in Type 2 diabetes. Key findings:

- Canola oil improved glycemic control
- Canola oil significantly reduced total and LDL-cholesterol
- Canola oil resulted in weight loss, but the difference was not significant against the control group

These studies confirmed the previous health claims of canola oil, as well as added new health benefits. Growing Forward 2 research on canola oil nutrition will have a continued focus on heart disease and

diabetes, ongoing work on canola oil and metabolic syndrome, and further investigation between canola oil and weight control/body fat reduction.

Canola meal is often not included in swine and poultry diets. GF1 research shows that weanling pigs and broiler chicks can have significantly more canola meal in their diets. This represents a market that can be expanded for canola. The dairy industry is another important market for canola meal. Research was done that found an optimum combination of canola meal and corn DDGS for increased milk production. Growing Forward 2 research on canola meal nutrition will include: maximizing use of canola meal in dairy diets with further work on understanding the mechanism by which milk production is increased, validating and expanding on previous research that high canola meal inclusion levels for poultry and swine diets can be used while maintaining high levels of performance, evaluating high energy/high protein canola meals, and evaluating new economical approaches to the processing of canola meal to increase its value to the monogastric market.

"RESISTANCE TO DISEASE MANAGEMENT"
Clinton Jurke, Agronomy Specialist, Western Saskatchewan, CCC

Diseases pose a threat to the canola industry in terms of production, market and profitability risks.

Blackleg

- Is a long-term canola disease.
- It emerged shortly after the arrival of canola-quality rapeseed and peaked in the late 80's and early 90's. It represents a trade barrier.
- The incidence of blackleg had dropped off, but in recent years there has been an upward trend which may be due to the changing pathogen and to monitoring.
- Blackleg has high levels of pathogen diversity and gene flow which makes control difficult.
- The best strategy for blackleg control is to use differing R-genes and quantitative resistance in multiple lines and/or regional deployment. This practice should be used for long-term sustainability.
- Some work has been done on what resistance genes are present in different varieties. Twenty-two of top cultivars are R, three are MR. A concern is that about half of canola varieties have a single resistant gene called Rlm3.
- Producers currently do not receive information on which resistance genes are in different varieties.
- Work has been done on quantitative resistance, half of the current varieties were found to have poor levels of adult plant resistance (APR).

It already appears that resistant varieties have become susceptible in certain fields. There is a need for more data, such as the type of rotation and the canola varieties. It would be beneficial to look at how other areas manage blackleg, such as Australia where there is stronger blackleg pressure. Australia labels resistance groups, and has found that switching resistance groups reduces infection.
A Blackleg Steering Group has been created and a blackleg strategic plan is in place. It has identified research priorities and extension messages for Western Canada. Key to blackleg management is proper identification and risk assessment. Blackleg risk assessment guidelines are available. Another key is adding diversity if there is a high risk of disease pressure, including diversity in crops, varieties, and fungicides.

Clubroot

- Canada has become the current leader in clubroot research over the past decade.
- Soil movement spreads this disease and current research is studying if eradication is possible.
- There is low pathogen diversity and high gene flow.
- There were high levels of clubroot in 2013 because of the warm and wet conditions.
- Some clubroot resistance cultivars have been developed, but there is a need to make sure this resistance lasts. This is a challenge due to the fact that the spores can last up to 20 years in the soil. For clubroot resistance erosion it is recommended to rotate between cultivars with different sources of resistance.
- There is the opportunity to work more on resistance longevity and sources of resistance.
- The best management practice in regards to clubroot is to reduce soil movement and implement sanitation practices.

Growers need to know not only what will work, but what will not work. What does not work: fungicides, seed treatments, boron, liming soil, most soil amendments, bait crops and tillage. What does work: crop

rotation (longer rotations with R cultivar reduces but does not prevent the disease), resistance cultivars, early seeding, equipment sanitation, early identification, zero tillage, quarantine, eradication, brassica weed control, clean inputs, and a management plan. It is important for producers to plan for both before and after the disease presence is confirmed.

Sclerotinia

- In 2013, the incidence of sclerotinia was up in Manitoba and down in Saskatchewan.
- There is a need for research on the use of fungicide and whether this correlates with the recorded disease pressure.
- Sclerotinia levels are known to be variable and are related to moisture.
- New research with regards to sclerotinia is qPCR based petal tests for the level of sclerotinia in the field and weather-based assessments and modelling.

Control of sclerotinia can be optimized by rotating fungicides, using tolerant varieties, and continual assessment of disease pressure.

Top three questions:

Disease Management

1. How can disease resistance become more durable?
2. How can assessment of disease risk and appropriate disease identification be improved?
3. Are there other structures, or models, of disease extension that can be developed to promote disease management in Canada?

"DON'T PLAN(T) FOR LAST YEAR"– Variety Evaluation and Selection
Shawn Senko, Agronomy Specialist, Northern Saskatchewan, CCC

New and better ways of evaluating varieties are being implemented in Canada which gives growers the opportunity to select the best variety for their growing conditions. While there is a hybrid pipeline for producing canola varieties where performance testing is not mandatory, most varieties are evaluated. The Western Canada Canola/Rapeseed Recommending Committee (WCC/RCC) compares varieties more on quality than yield performance, while the

Canola Performance Trials show (CPT) show data on field variety performance, including yield. Performance data sets are not used for registration.

The current system of CPTs allows varieties to be divided into herbicide groups to be treated with their appropriate herbicides instead of each variety being sprayed with conventional herbicides. Western Canada is broken down into season zones to create sites across the prairies for varieties to be grown under different conditions. Field scale trials are also available through industry for comparing varieties.

Key Messages:

- Look at more than just yield and consider disease resistance, oil type, and situation-based variety to optimize production and profitability
- Evaluations of varieties should be based upon multiple sites and over multiple years. Look at sites that have different growing conditions and choose those varieties that are consistent across the board.
- Ensure that CPTs, Crop Insurance, and company strip trials have consistent data and if there are discrepancies, contact representatives to see what differences may be in play

There is a need to ensure that producers receive this information. The ultimate challenge is performance trials that reflect the changing management practices of Western Canadian canola producers.

Top three questions:

Variety Testing

1. Small plots have a nice, balanced data set and the large plots do not. Is there a way to present the large plot data in a more balanced way?
2. If it is a wet year, the small plots do not get seeded, or they are planted on high ground. Is the best data on varieties that tolerate wet feet being presented?
3. What algorithms from the biological system can be used, that combine small plot data and large plot data to achieve a concrete result?

"DON'T LET THE BAD BUGS BITE"
Keith Gabert, Agronomy Specialist, Central Alberta South, CCC

Producers need to be able to identify pests and know why they are present, whether good or bad. If detrimental, they have to be aware of economic thresholds and how to get rid of the pests. There is a need for pest forecasting and mapping of insect arrival. While there are a lot of predictable elements, insects are quite variable and do not always warrant control. As such, effective plans are not always in place to deal with them.

- **Flea beetles** are a sporadic pest. In 2013 there was significant flea beetle pressure recorded in Manitoba. Scouting during seeding as well as post-seeding is important. While almost all canola seed is treated with neonicotinoid, striped flea beetles are an increasing concern as there is some evidence of tolerance. In 2014, a group 28 insecticide with a new mode of action will be introduced for added flea beetle control.
- **Cut worms** are a sporadic pest and have distinct habitat preferences depending on the species. The larvae overwinter from the previous fall, so they can be identified in the spring. There is ongoing research to determine species distribution across the prairies. A challenge is species identification, with progress recently made on DNA identification for four main species.
- **Aster Leaf Hoppers** are a significant threat to canola crops. They are the vector for aster yellow and 2012 yields were significantly lower because of aster yellow. They were not as much of a problem in 2013. They are blown in to Western Canada from Southern US and the high levels in 2012 could be attributed to the drought in the US.
- **Cabbage Seed Pod Weevil (CSPW)** is a regional pest, and the aim is to prevent the spread of this insect. In 2013, there was advancement of this pest into Northern Alberta, with the problem predominately located in Southern Alberta and Southwestern Saskatchewan. The larvae eat 4-5 canola seeds, and the time of infestation coincides with flowering which makes spraying difficult. Research indicates that the economic threshold for CSPW is 20-30/10 sweeps; this means that 25% of pods will manifest one more larvae exit holes resulting in a significant decrease in yield. CSPW is a significant threat in Western Canada.
- **Lygus Bugs** economic thresholds depend on flowering to "early pod" versus "late pod." Threshold tables are being updated.
- **Bertha Armyworm** population levels cycle every 5-7 years. In 2013 the levels were quite high especially in Alberta. Regional levels are easily tracked with pheromone traps during the flight stage. Scouting for worms is important for effective control measures during the early stages. The best time for spraying is when the worms are ½ inch or longer, this offers the maximum control for the investment in insecticides.
- **Swede Midge** is a small fly and a serious pest of cruciferous crops. Most of the canola growing area is suitable for Swede midge. It is now in its second year of infestation in Western Canada, primarily in Northeastern Saskatchewan. Symptoms of an infestation include: swollen, distorted shoots; premature bolting, swollen and closed buds; bottle-shaped flowers; multiple branching and blind head (witches' broom). More information is needed on the timing and number of generations, when canola is most susceptible, Swede midge biology, control measures and economic thresholds.

Additional pests and potential pests of Western Canada include:

- Pollen beetle which is currently found in Ontario but may make its way here
- Slugs for which there is no good control and whose damage is hard to diagnose
- Cabbage root maggots are an important pest to scout for
- Red turnip beetle which does not have a registered insecticide.

Key Messages:

- Scouting is the best defence to prevent insect damage
- Monitor for insect forecasts and media information on current pest outbreaks
- Predict potential pests and be prepared by having a plan of action in place

Future considerations for pest management include: a tracking system for new and emerging pests; biology and management; updated economic thresholds that include additional factors such as crop stand, yield potentials, etc.

Top three questions:

Insect Management

1. When insect outbreaks or new pest threats, like Swede midge, occur in an unpredictable or cyclical manner, how can research and funding be maintained? Succession planning is important, how can entomologists be attracted and retained?
2. There is a lot of energy directed to breeding traits for disease resistance. Is there a similar genetic manipulation opportunity for insect tolerance? Is this possible and what investment would be necessary?
3. For economic thresholds, is it possible to build in additional factors like plant compensatory effects, crop stand, yield potential and impact of beneficial insects to make these more accurate while still retaining ease of use for the producer?

"MONITORING, FORECASTING AND RISK ASSESSMENT TOOLS FOR MANAGEMENT OF PRAIRIE INSECT PESTS"

Dr. Owen Olfert, Research Scientist, AAFC

Research from an AAFC project will provide effective warning to producers for management of insect pests. The key to management is to monitor for pest populations and their enemies, to forecast pest status and risk, to produce timely risk warnings for producers, and to utilize insect surveys, weather, and wind and crop data to assess crop-insect-weather interactions. This is difficult because there are many eco-regions throughout the prairies. The monitoring includes the forecasting of indigenous insect pests, invasive alien pests, and migratory pest species.

Tools available for pest monitoring include:

- Monitoring protocols have been developed by industry leaders through discussions and need to be consistent
- Technology and equipment such as GPS units, weather and wind monitors, database software, and GIS
- Surveillance tools: pheromone traps, soil sampling, sweep sampling, plant samples and insect counts per unit area
- Risk warnings are done on a weekly basis during growing season and can be easily accessed through smart phones and the internet; near real-time weather can be used for modelling and forecasting
- Modelling with respect to growth and development of insects: wind movement bringing in potentially harmful pests, and bioclimate models to predict distribution and abundance of pests and natural enemies.

Annual surveys and forecasts of pests provide a snapshot in time and depending on a number of factors will reflect the future to varying degrees. These surveys and forecasts often use qualitative terms such as "light" or "heavy" infestations.

- A case study is the Bertha Armyworm which is an indigenous insect pest. The populations are determined by counting adult moths caught in pheromone traps. These levels are known to have a 5-7 year cycle. Forecasts employ models that predict insect and crop response to environmental factors. These can be used in the spring to predict adult number and larvae development, and can also predict the emergence of adult in relation to plant phenology. Using the forecasting system, producers know if/when to implement control measures.
- There are methods for providing an early-warning system for potential infestation for migratory pests, and then for predicting the potential number of pest generations. Methods used are wind trajectory models and sentinel sites that use pheromone traps. Bioclimate models can predict the number of generations and the crop loss.
- All data is archived in a crop-insect-weather database. There is no end to the amount of raw data available from Environment Canada, sentinel sites and insect field surveys. The data base is an important tool and has future global potential because of its wide scope that can impact many other areas of study.

Challenges of this study are travel directives and funding. Funding is cyclical in nature, being easier to obtain when insect outbreaks occur. Another issue is succession planning: the age of entomology experts is high and there is a need to attract juniors.

"TO BEE OR NOT TO BEE"

Gregory Sekulic, Agronomy Specialist, Peace, CCC

There are concerns about the lack of diversity in cropping systems in Canada and globally.

The concerns encompass not only agronomic reasons, but economic and logistic reasons.

- Biodiversity is an admixture of rotations and other variables. Canola is not just a commodity; it is a habitat for many species.
- Canola production has increased over time due biotechnology and management.
- Historically, most growers practiced a 3-4 year crop rotation. Increasingly, there are canola on canola, and 2 year rotations. A one year gap has been shown to be enough to recover canola yield potential, although a 3 year rotation is optimal.

It is recommended with shortened rotations to maximize the variability of everything else. This includes herbicides, fungicides, and crop cultivars. While shortened rotations have been facilitated by biotechnology, the concerns are the impact this will have on biodiversity. *The question is whether canola is a resource to be extracted or a habitat to be managed.*

There are many beneficial insects that can be found in the canola canopy. This includes spiders, carabids, and honeybee pollinators. Honeybee pollination has been shown to increase yield of canola.

The best foliar insecticide management practices to protect beneficial insects are:

- Avoid spraying flowering canola
- Consider economic thresholds when making control decisions
- Use the least toxic option registered for pest control
- Minimize drift
- Spray during the night to avoid active insects, specifically pollinators

It is important to communicate with local beekeepers. Bees can be moved during spraying, or the hives can be covered. Beekeepers should report bee deaths. This past year, bee die-off has become a major issue and insecticide use has been targeted. In Canada, the major killer of honeybees is the cold winter temperatures. Western Canada beekeepers have a good relationship with canola producers. In summary, canola is a good crop for bees, and bees improve canola crops.

Top three questions

Sustainability

1. What are ways to maximize biodiversity in a canola cropping system without relying on chemistry?
2. Is it possible to create a habitat dominated by canola, but attractive to beneficial insects (generalists) and pollinators (managed and natural), including flowering length and nectar quality for maximum pollinator attractiveness.
3. What are effective and profitable integrated pest management (IPM) strategies for weed and disease control?

"CANOLA DISCOVERY FORUM - FUTURE OF CANOLA"

Dr. Curtis Rempel, Vice President Crop Production and Innovation, CCC

The Canola Discovery Forum will focus on the future of the canola industry.

- Additive manufacturing: making something from a small carbon source. This will have massive application on the farm, especially because the products will be biodegradable.
- Developments in insect and weed resistance: RNA interference may be a solution for managing resistant populations.
- Nitrogen fixation: bacterium has been found that fixes atmospheric nitrogen in plants. This bacteria has been used in seed coat polymers. Biological nitrogen fixation could be coming to plants at large, and not just legumes. Nitrogen management remains important, but these tools need to be optimized.
- The "omics" revolution: the need to combine the phenotypic, environmental, and genomic connections. Phenomics, or real time phenotyping in farmers' fields.
- The rhizosphere: the sequencing of genes to determine what happens metabolically. Genomic tools, such as pyrosequencing, have now been used in the rhizosphere.

The Canola Discovery Forum is all about discovery, and will be an important venue for the pooling of resources between industry, academia, and producers. A collaborative effort between the canola industry stakeholders is important to keep research and the industry growing forward.

2013 Canola Discovery Forum
Meeting Summary
Fairmont Winnipeg, West Ballroom
Wednesday, October 30, 2013

Panel Presentation "CanoVision" – Opportunities and Challenges for Sustainable Canola Production
Presentations by an industry cross-section of panelists.

CANOLA PRODUCER
Meeting Chair: Brian Chorney, Vice President, MCGA

Sustainability can be described as the ability to maintain and increase productivity of the land for future generations and to make a living along the way. It encompasses both environmental and financial viability. Five opportunities and challenges to promote sustainability were outlined: weather forecasting, rotations, fertility management, crop protection products, and farming finances.

Weather dictates farm operations and weather forecasting represents an important aspect management. Research into better forecasting will enable producers to plan for the upcoming growing season in both the short term and long term. The ability to accurately forecast the weather is vital to the sustainability and profitability of canola production.

One of the main tools to ensure sustainability is crop rotation. A basic 3-4 year rotation is important for controlling disease and insect risk. Spreading the land base into different crops spreads the risk around. Biotechnology is important in the sustainability piece. Zero tillage would not be possible without some of the genetic developments. Variety selection is dependent on what suits a rotation and there are many variables that are now part of variety selections: herbicide resistance, volunteer control, disease packages, pod-shatter, and others. These traits combine with CPT trial data can be used to select a variety with high economic benefits. Many traits can still be developed with regards to rotation; varieties that deal with stress, excess water and drought, nitrogen fixation, and fertilizer efficiency are some examples.

Fertility management includes accurate soil testing and ensuring the fertilizer research is current with the seeding tools that are out there. A technology transfer gap exists between industry and research and producers. The farm machinery companies have tools and the research shows there are opportunities with variable rate, but farmers are struggling with the methodology and implementation. Soil temperature is an important aspect for seeding, and again weather forecasting plays a role.

There have been few new crop protection products over the last years. New tools are needed for resistance issues and overall control of weed spectrum. Also, forecasting models need to be developed for disease/pest risk in order to better plan applications and rotations.

Many developments and technologies are coming forward in the industry, but the consideration is how they fit into the current financial environment. Both crop rotation and crop insurance help to manage some of the financial risk. Technology providers have used risk sharing programs in the past; this may be something that can be added again in the future.

FEDERAL GOVERNMENT SCIENTIST
Dr. George Clayton, Program Director, AAFC

Four main drivers of the agricultural industry are: population growth, climate, diminishing resources, and the competition in the production of not just food, but also feed, fiber and fuel. These circumstances provide many opportunities for the canola industry.

Biotechnology will continue to have a major impact on the industry. Things in the pipeline include nitrogen fixation and self-pollinating plants. Synthetic biology is becoming more important and more ramped up and industry responds to those agricultural drivers. This is a GMO world, but also an anti-GMO world. There are many developments in the future and it will be important to mitigate the negative perceptions.

Succession planning is about both people and organizations. We are on the cusp of large organizational changes in terms of agriculture changes and technology transfer. Partnerships have evolved over time.

In summary, there are large social and ethical issues to be dealt with and a need to have people deliver succinct messages. Collaboration is key in moving forward.

LIFE SCIENCE/SEED DEVELOPER COMPANY
Chris Anderson, North American Canola Breeding Lead, Monsanto

The challenges in the canola industry are the opportunities for developers. The demand for canola is increasing, and the supply needs to be increased in a sustainable way. There is a need to increase productivity. The challenge is to maintain this upward trajectory and to continue to develop a range of products that are wanted and needed by growers. To continue to deliver hybrids that meet and beat expectations and to integrate other aspects add quality parameters and extra value to the canola supply chain.

Weather cannot be controlled, so there needs to be the development of tools that can mitigate its adverse effects. This is the reason varieties are tested across large regions and over multiple years. The varieties that work best each year are variable. Developers try to maximize yields across a number of variables

A large challenge facing canola developers is disease management. There has been great success in using genetics to manage disease, but it is a limited tool. Variety resistance needs to be used in conjunction with other production practices such as spacing, fungicides and rotations. There needs to be a holistic approach to disease management. Whenever a disease incidence changes, it means there a shift in one element of the disease triangle: host, pathogen, and environment. The canola industry needs to monitor for potential disease risks.

Another challenge for canola developers and producers is data management. There is a need to manage a lot more data than ever before and to develop the tools that turns this data into decisions.

Access to technology and a regulatory system that accepts new technology without being a trade barrier is another opportunity. Frameworks need be developed to allow new technologies to reach global markets and be competitive with other crops. It is all about delivering value to farmers.

VARIETY DEVELOPER/FOOD COMPANY
Mr. Rick Wiebe, marketing Manager, Cargill Limited Canada

Cargill is an oil company and a seed company. It is in the unique position of meeting growers' demands and addressing the consumer and marketing side. Consumers have the ultimate control over production. They want to know the story behind their food. The canola industry needs to be involved in promoting a positive connection with consumers.

Consumers look at the farm as a starting point in sustainability. They want to decrease the environmental footprint before utilization. Doing nothing poses a significant risk for the industry. The canola industry needs to be proactive in dealing with these issues. There are opportunities to ensure future market access for canola.

EQUIPMENT MANUFACTURER
Mr. Andrew Seibert, John Deere Inc.

Canola is expensive to grow relative to other crops. There is an opportunity to reduce costs and increase productivity though efficient use of equipment.

Stand establishment is an area where input costs can be reduced. Canola is commonly "over seeded" because of the low germination rate. Finding optimal seed placement to improve germination would

reduce input costs. Air seeders are commonly used in seeding, while planters are another method. The advantage of air seeders is the placement of fertilizer to the proximity of the seed, but they are poor at metering and placing canola seed. Planters are much better at seed placement and depth consistency, but are poor at applying large amounts of fertilizer. A machine that offers both of these advantages would be ideal. Another aspect of stand establishment is row spacing. Research shows that row spacing can increase yield. Innovation can result in reducing seed rates and input costs.

Equipment can be improved during harvest. Equipment can prevent canola loss during combining. Lower fuel costs, machinery repair and maintenance, and labour costs could all increase the profit per acre.
Improved management and technology transfer can reduce many operating costs including pesticides, fuel, machinery repair, total fixed and labour.

FORECASTING/MODELING
Mr. Andrew Nadler, Agriculture Meteorologist, Weather Innovation

There is a challenge to increase production in agriculture. Costs have been increasing which puts pressure on the need to maximize yield and profits. Precision agriculture is an important part of increasing production and profits; this includes yield monitoring, NAVSTAR GPS, and other programs. These programs address the where and what aspects, but there are challenges with the when in regards to season variability and weather. When to seed, fertilize, irrigate, scout, spray and harvest are all related to the weather. Greater than 90% of seeding losses are still weather related. These relationships are complex and not fully understood.

The first step in improving the forecasting/modelling is more information. Data science has a huge potential to boost productivity. There is an opportunity to create hyper-local and short-term forecasting resulting in customized monitoring and modelling. Long-range forecasting needs to be improved. There needs to be an integration of environment-plant interactions and decision support.

EXTENSION SPECIALIST
Dr. Murray Hartman, Provincial Oilseed Specialist, Alberta Agriculture & Rural Development

In regards to canola, nitrogen is the most common nutrient applied. It is the highest cost per acre, and can cause adverse environmental effects. Improved nitrogen efficiency in canola is being looked at. This includes synergism with other practices and products, bringing back the idea of integrated crop management. Hybrids have better nitrogen scavenging ability. Screening crops for nutrient use efficiency is a breeding opportunity. Another approach is a method where canola can fix atmospheric nitrogen, where seeds are inoculated with nitrogen fixing bacteria. More funding is needed in this research area.

Opportunities exist with a mega-nutrient: CO2. There is a correlation between canola yield and CO2 increase in the atmosphere. Research to reduce water loss through stomatas and to modify enzymes is being done. Weeds also take advantage of increased CO2, and can become an issue.

Shorter crop rotations will increase in the future and this will have an effect on pests. Monitoring surveys should have more program funding. Pest research should be proactive including: a list of pests and their risk of becoming established in Western Canada, an emergency use pesticide registration pipeline, and an action plan for potential threats. There is also a need for accessibility to funds sooner rather than later for an immediate response to problem pests.

An area of opportunity for the canola industry is a reduction of green seed, which is used as a grading factor in canola. Chlorophyll tendencies are predictable in varieties; it appears that it can be affected by breeding. This allows farmers to choose varieties with lower green seed to optimize profits.

Canola sustainability includes using biotechnology that already have proof of concept but have yet to be implemented. Use of antisense RNA and transcription factors are other areas that need to be investigated in canola.

Panel Questions, Comments and Ideas

- **Q**: Has there been an increase in weather forecasting accuracy?

- **A**: Forecasts have improved, but they are not where they should be. In many cases, it is better to plan for the average.
- **Q**: Are there opportunities for increased partnerships between public and private sectors?
- **A**: Opportunities exist, but partnership and funding models need policies or guidelines and they need to be strategic. At the moment there is some good dialogue between AAFC and the producer groups on how to work with their smaller centres.
- **Q**: How is irrational thought and anti-corporate sentiment to be dealt with?
- **A**: There has not been a concerted effort to tell our story, and to drive positive opinions. Consumers want more information, there is a void out there and the industry is not filling it. Targeting of some really simple, key points is required.
- **Q**: There has been a transformation on the farm. How do you ensure that all the technology in the equipment is used to its maximum benefit by producers?
- **A**: Equipment manufacturers strive to keep the interfaces simple. It will take a while to make that transformation but with current software and technology, there is a path to get there. Eventually, it is likely that growers will not need the skills they used to need to set the combines.
- **Q**: How can information from completed research projects be prevented from going into limbo and not being utilized.
- **A**: The key is having partnerships right from the start so it is more likely to succeed. It is also important to understand that proof of concept does not make a commercial product. Field environment, regulatory processes, production and the need for the product to be predictable and reliable are all needed for a commercial product. It is also important to not only fund "safe research". There is a need for program funding instead of just project funding. There is a need for basic research in order to come out ahead in the long-term.

Comment: The main message seems to be integrated management. Everything needs to work together. The better a grower farms, the better yields are attained. A major challenge to precision farming is handling the information as it relates to information privacy. All industry levels from producer, industry, seed, and equipment manufacturers have privacy blocks, so it will be challenging to implement this as an industry.

CLOSING REMARKS

Dr. Curtis Rempel, Vice President Crop Production & Innovation, CCC

This forum is an excellent platform to discuss challenges and opportunities and to develop ideas. Everyone was thanked for their attendance and an invitation was extended to next year's Canola Discovery Forum.

2013 Canola Discovery Forum
Meeting Summary/Table Notes
Fairmont Winnipeg, West Ballroom
Wednesday, October 30, 2013
Appendix

Top Challenges to Sustainable Canola Production

- Pest management and resistance issues
- Sustainability has not been officially defined – Without a baseline, how can improvements be measured and be communicated to consumers?
- Weather variability – year to year, forecasting.
- Future of canola versus other crops, especially soy and corn. The dollars spent on research for each commodity.
- Understanding and disclosure of genetics and other variety specifics for growers to make better decisions to manage risk.
- Infrastructure to handle I.P. Canola (segregate all sorts of specialty traits).
- *Funding surveys:*
    - View is "not science," but is imperative.
    - Historical data, survey data is critical.
- *Long-term research planning*:
    - Short notice funding is problematic.
    - 15 - 20 years into the future.
    - Long-term strategic research in short-term funding cycles without secession planning.
- Research capacity – critical mass. The number of researchers working on canola is too low relative to the number of issues.
- A new mode of action to bring new products to market. (At the moment it is so expensive and has a lot of delays)
- The appearance of or the presence of pest issues. (Surveillance and staying on top of issues is important.)
- Forecasting and prediction and focus on nitrogen use.
- What is the fence line on canola acres, 21 million acres? There is a need for another profitable crop for rotation inclusion.
- GMO's
    - Registration acceptance.
    - Dealing with the vocal minority.
    - Getting the story across.
- Farmers cannot expect chemical companies to bail them out with new mode of actions. There is a need to think more in terms of sustainability.
- Rotation of herbicide is just as important as crop rotation and variety rotation.
- How to strengthen/lengthen rotations beyond just canola and wheat. How will the canola industry address this?
- Communication
    - Consumer perspective of agriculture.
    - Getting data to farmers to use on farm in a manner that is practical.
    - Getting information flowing in both directions.
- Understanding the economic benefit on farm logistics and agronomic choices.
- Developing a win-win rotation in which each crop builds on the previous
    - There is a lot of agronomic information on what is a "good rotation," but it must also be a profitable rotation or producers will not implement it.
    - Profitable and sustainable crops other than canola are needed.
    - Is 20 – 21 million acres really sustainable?

    - How do we make short rotations sustainable?
- Ensuring there is both high-value and high-risk research being performed.
    - For companies, all the research needs to have a potential for payback.
    - High risk "discovery" research has value.
    - There is a need an appropriate mix of both types of research.
    - Consider other funding, the Bill and Melinda Gates Foundation was a good example.
    - The Endowment Fund could be a good source of funding for high-risk research.
- Utilizing information and resources to their full potential (i.e. Information not getting out there, messages being distorted, poor uptake, etc.) The need for better compilation and extension of data
- International discrepancies in regulatory systems.
- Consumer acceptance of modern agriculture.

.

Top Immediate Opportunities for Canola Production

- Improving stand establishment – there is a need to find out why seeds are not emerging and do something about it.
- Increase seed survivability. Partnership with seed producers and tech transfer: "**Knowledge into Practice."**
- Forecasting and monitoring for pests – proactive approach with response plan. Develop a "top five" immediate threat list (weeds, disease, insects…).
- Fertility: build new guidelines and invest in better research on new products.
- Understanding and disclosure of genetics and other variety specifics for growers to make better decisions.
- Identify risks surrounding new practices (i.e. Planters, straight-cutting, etc.)
- **Tech transfer – "Industry to growers."**
- Value chain of canola organized as canola industry
    - Envy of other commodities
    - Maintain strength of the council: producer; industry; research; innovation.
- Health story creates markets!! Push the health aspect of canola with decreased risk of heart attacks, grow more canola.
- Broader diversity
    - Insect/disease concern
    - Seed companies are interested in broader germplasm
    - Adaptation to climate change.
- Investment into biofuel plants.
    - Too valuable as a food crop currently.
- Rotate varieties to extend sustainability until something else comes on market. Look at resistance packages.
- High DHA canola, Is that really going to happen?
- Seed companies give growers information on blackleg gene for effective management.
- Need more information on blackleg identification, need to build the background information.
- Truflax – Next HT gene that will broaden application window and rates for RR canola.
- New technology that could be the opportunities in the future. Weather information innovations integrated into agriculture decision-making. Uncertainty with weather leads to less venture capital in agriculture.
- Precision placement for seeding and nutrients.
- Long-term commitment to disease, soil management, pest, and weather monitoring that will allow us to be more proactive and not reactive which causes time delays and missed windows for research.
- Systems approach to research. Looking at canola as a part of a system than on its own. Look at multi-crop, long-term rotations with multi-faceted research objectives. Partners with other commodities.
- Extension, extension, extension!
    - Use extension to make every grower a top grower, or if not a top grower, even just a bit better.
    - There are technologies available to get research information out quickly.

- Resistance.
    - We have an important opportunity to combat insect, weed and disease resistance.
- Risk vs. reward metrics and probabilities of success/failure in reaching yield potential with various practices. An example is the risk vs. reward metrics around seeding date and temperature of soil.
- More regional deployment of genetics
- Understanding the interaction of stresses (i.e. when one field has multiple stresses, what are the effects of the stresses on each other and that cumulative effect on the plant).
- Selling canola seed by the number of seeds versus by the pound, challenges to the industry but would help plant populations.
- Shattering resistant: Direct cut results in higher yields.

What is the One Thing That We are Going to Miss?

- Evolved blackleg resistance labeling – we are already missing out on this opportunity.
- Are we underestimating the impact of herbicide resistant weeds? Contingency plans for when important herbicides (e.g. Glyphosate) lose efficacy.
- Lack of dollars for canola, and lack of researchers and experts in this field (Entomologists, pathologists, etc.)
- Connecting with consumers
- European Markets: there is too much resistance and the old Soviet/Ukraine area is coming on.
- Partnerships and funding. Outside of the industry: i.e.: Gates Endowment.
- Chlorophyll is an issue; producers get less money for green seeds. There is a process to bleach out chlorophyll but it is expensive and takes out oil. There is a huge need to reduce this.
- Climate change: More concern about medium range around 10 years. Effects on other crops moving in and out of regions like Manitoba. How is that going to affect development? Disease is just one aspect.
- Canola is a Canadian made crop with a strong niche in the world market. If it is important to us, how do we maintain the competitive advantage? Will that be enough? What if soy takes over in 10 – 20 years? Keeping canola on top, whose responsibility is this?
- Impact on environment: better biotechnology to reduce pesticide rates/fertilizer rates and overall environment impact.
- Is biofuel an appropriate use of resources? With the discovery of new fossil fuel reserves, will countries still maintain biofuel inclusion rates?
- Government role in policies and decision-making in helping the industry accomplish the goals moving forward.
- GM and Consumer Awareness
- We devote a lot of resources on how to produce more and better canola, but we also need to look at the other end of the market.