2014 Canola Discovery Forum
Meeting Proceedings
TCU Place, Saskatoon
Wednesday, October 22

WELCOME AND INTRODUCTIONS

Terry Youzwa, Chairman of the Board for the Canola Council of Canada, welcomed everyone. The focus of the Canola Discovery Forum is on the production piece of the Canola Council of Canada's strategy. To provide a strong, stable supply of canola is just one of the pieces of the puzzle which includes building market demand and development and sustainability. It is a time to discuss where we are and where we need to go. The Canola Discovery Forum is an important step to the strategic plan of 26 MMT by 2025 or 52 bushels per acre by 2025. Themes include fertility management, stand establishment, integrated pest management, increased profits through incremental improvements and how to use big data. All the information will be collected and compiled and shared to turn this discovery journey into action.

2013 CANOLA DISCOVERY FORUM IN REVIEW

Jay Whetter, Communications Manager, Canola Watch Editor, Canola Digest Editor, Canola Council of Canada

It is important to go back and look at discussions and see what they have inspired. Here are the highlights of the 2013 CDF:

"Plant One to Get One" considered the ultimate goal that each canola seed planted will germinate and produce a plant which means a greater return from the seed investment. The fact is only 50% of canola seeds actually germinate. The focus is on genetics and agronomy, as well as on soil microfauna, and the effects on the development and establishment of canola seed. Active canola research includes: a Growing Forward 2 (GF2) study which looks at seed size and seed treatment effect on yields, and a grower group funded study which looks at wider row spacing in canola and the weed response to nutrients and competition. This forum will look at Jeff Coulter's work on corn establishment and identify variables which may also prove to be significant for canola.

Neil Harker discussed what is known about canola seed emergence in "Canola Seeds & Canola Weeds." Along with "Tenacious Weeds," it was noted that the impact of herbicide resistant weeds may be underestimated. Glyphosate-resistant kochia has been found in all three Prairie Provinces. Research is being done on glyphosate resistant kochia: Hugh Beckie is looking at resistant weed populations. Other studies include: Steve Shirtliffe looking at harvest weed seed management in kochia, cleavers and wild buckwheat, looking at seed destructors and Bob Blackshaw looking at the management of glyphosate resistant kochia. Of significance, is Jason Norsworthy's work on glyphosate resistant Palmer amaranth biotypes in cotton.

Nitrogen is the most common nutrient applied and is the highest cost per acre for canola. There were presentations on improving nitrogen to increase the return on investment (ROI) from fertilizer investment. This included genetics, the 4 R's of fertility and a focus on variable rate technology.

Blackleg and clubroot management could be improved by providing growers with more information about the disease resistance traits among varieties. This knowledge can be used by growers to rotate varieties with different traits in order to mitigate pathotype dominance and extend the useful life of resistance traits. There is a focus on blackleg identification and extension material for producers. A

blackleg strategic plan is in place. In this forum, Gary Peng will present on the characteristics and identification of clubroot in canola. A new pathotype in clubroot has been identified in Alberta that has no resistance in any of the varieties grown, so there is a need for new clubroot resources.

It was identified that growers need more information about the timing of fungicide application for sclerotinia. Focus continues on innovative forecasting models to accurately predict disease severity and best spray times. There is a GF2 research project by Weather INnovation Consulting.

Three important facets to insect management were identified:

- The validity of current economic thresholds. The greater number of relevant factors that can be isolated increases the accuracy of estimates.
- A quick response to a new insect threat. Growers would benefit from proven management practices and the availability of minor use registration pesticide program.
- The cyclic nature of some pests. Funding resources for quick responses to insect threats and cyclical pests is important to growers and the research community.

The response has been to look at coordinating management and surveying other management strategies. There are a number of research projects, one of which is the Western Grain Research Foundation looking at aster yellows and swede midge and its threat to canola production. It has been suggested that recommended lygus thresholds may be too low.

Canola rotation decisions need to find a balance between economics and pest management. More research is needed on canola rotations in partnership with other crops where each rotation builds on the last. There is a GF2 project to determine where canola fits into existing soybean and corn cropping systems in Western Canada. Neil Harker is looking at the reduced risk of growing different canola cultivars in back to back rotations. This includes using macro and micro nutrients, chaff removal and higher seeding rates.

More than 90% of yield losses are weather related. There is the opportunity to select canola genotypes for better heat and drought tolerance and for customized forecasting models. There is a GF2 research project that looks at selected varieties for: heat and drought stress in roots, flower stress and bud apportion, and weather-proofing canola.

Canola performance trials (CPT) provides growers with data to compare varieties based on more than just yield. This includes: emergence timing, days to maturity, lodging, height, flowering time and different herbicide treatments.

Biotechnology serves to help in many production issues and to improve economic and environmental sustainability. There has been communication tracking about what is being said about canola and GMO. There is greater consumer awareness about canola oil and health benefits. The CCC is starting sentiment tracking.

It was discovered that there was a need for a common definition of sustainability. The CCC has worked as part of a larger group, the Canadian Roundtable on Sustainable Crops, to develop a single Canadian definition of sustainability and metrics for all growers. A GF2 research study by Scott Jeffrey explores economic sustainability and profitability of canola in Western Canada. The canola industry also works with and supports relationships with beekeepers.

Consumers want more information on canola. There is a focus on promoting the health aspects of canola in terms of cardiovascular disease and diabetes. CanolaInfo has a new campaign on canola oil and health. Research is continuing on the health effects of canola.

"Big Data" is an opportunity to cut costs and increase productivity. Smart machinery is coming: combines will be able to calculate things such as seed loss and fix it automatically. Variable rate technology (VRT) will increase nitrogen efficiency. Precise seeding equipment will increase emergence.

There needs to be more discoveries through research. Other funding sources may need to be considered.

It was identified that tech transfer falls short. Key research messages and best management practices are not getting out to growers. This has been addressed by highlighting and organizing GF1 studies along the agronomic themes identified in the 2025 strategic plan and releasing a Canola Digest Science Edition and developing a research hub. There is also a risk formulation available which provides target yields based on rain and fertilizer rates by ALS labs. Canola Watch works to deliver information to agronomists, growers and retailers. CCC has developed a research hub that will be launched in the winter; canola research will be accessible in one area and it will be user friendly.

THE GOLDEN COMPASS

Dr. Curtis Rempel, Vice President, Crop Production and Innovation, Canola Council of Canada

This is a great opportunity to exchange information: to look at what research needs to be done and to look at what is needed to ensure extension material is being communicated, to create networks and to make the canola industry more successful.

The CCC has developed a strategic plan, which will turn into an innovation strategy for the canola industry to turn research into dollars: research turns into knowledge which turns to economic gain. The strategic plan is the basis for the CCC mission statement. It differs from the previous strategic plan which was tied to yield and profitability goals, goals which were met.

There has been an increase in demand for canola in markets that recognize the value of canola oil, meal and seed. By 2025, it is predicted that there will be a 60% increase in the worldwide demand for vegetable oil with a 41% increase in demand for canola seed. It is recognized that there needs to be a sustainable increase in productivity to meet this demand through yield improvements to achieve 26 MMT by 2025. Canola has 5% of the vegetable oil market, projected out to the increase in demand for vegetable oil by 2025, at 26 million MMT of canola seed equivalent, canola still stays at 5% of the market. The goal is to reach 52 bushels/acre (but/ac) by 2025. There are three priorities: differentiated value, sustainable and reliable supply, and stable and open trade. Canadian science needs to transition research into knowledge and profit.

Global food security recognizes that fats have an impact on short term and long term health. The importance of canola oil and fatty acid profile is important. Metabolic syndromes/dysfunction results in obesity, diabetes and cardiovascular disease. Canola oil, because of its fatty acid profile, can work towards mitigating these health issues. There are new opportunities for canola meal globally in the dairy industry. There are huge health implications emerging in the dairy sector for canola. Dairy whey protein is the gold standard for protein bioavailability, and yogurts are leading global food sales. Different proteins amplify different metabolism enzymes in the body: if healthy canola meal means better milk/production it means a better end product. Research has also shown canola meal diets increases milk production by 1 litre per cow per day.

Challenges and innovation are unfolding. Where is the next opportunity? How does one meet global demand? Globally, there will not be more land coming into production, so the focus has to shift to increasing yield per acre. There is a need to increase canola yield per acre by 45% by 2025. Where can yield gains come from? There are four pillars of canola production, with yield targets tied to each

category. Two main areas for increasing yields of canola production are: genetics (herbicide tolerance) and hybridization. Significant production risks such as climate change, pollinator health and biodiversity reduction are being looked at. The one size fits all approach no longer works because individual ecosystems and landscapes are so variable. This transition period depends on the model, discover, target and deliver, to make the Canadian canola producer the most profitable on the planet. Tech transfer is important in this undertaking: the goal is to be the best tech transfer specialists.

A range of canola growers' production practices came out of a GF1 research study which surveyed production practices throughout the different ecozones in the prairies. Practices that make producers the most productive were identified to help make bottom producers into top producers. Risk management needs to be taken into account: determining if you tolerate high risk with the potential of high return or low risk with low return. What makes the top 5% more successful? Better return on marketing; 5% greater yields; and 5% lower fixed costs, variable costs result in lower input cost. The ability to be an influential manager is what is needed to make this happen.

In closing, the Canola Discovery Forum is a great venue for research project ideas and for the success of 52 by 25. Two projects in particular came out of last year's forum. One study is around root microbiomes and rhizospheres: root metabolomics which focuses on biological and seed priming products. It has tremendous promise for producers in terms of value and need. Currently, there is lack of regulatory oversight on seed treatment products. It is important to find out what a normal root biome looks like, and determine what can be changed; and how to change in the microsphere/root rhizosphere. Changes might occur through the increase in N fixation in the rhizosphere. To keep N levels high through N fixation both free living and symbiotic. Which rotations are the best to do that? By putting in beneficials, things that are not beneficial can be excluded such as clubroot spores. The second study looks at the increase bioavailability of protein for food consumption: looking at protein quality in terms of what is needed, how quickly it works, and how it affects the body. Two innovative projects using Genome Canada as a platform have huge potential for canola growers, and came out of last year's forum.

SOILSCAPE

Soil Nutrition: What We Know; What We Don't Know and Effective Tech Transfer

Dr. Jeff Schoenau, Professor of Soil Science and SMA Chair, University of Saskatchewan

Canola and soil management includes: current issues; product testing and strategies for moving ahead.

The "4R" System of Nutrient Management

The 4R system of nutrient management is the right rate, right source, right time and right place. It is important to agronomic and environmental management.

Nutrient rates already have a good data base; however, it is important to consider the transition to hybrids which have a higher yield potential and a greater demand for nutrients. Hybrids have greater efficiency for the extraction and use of nutrients; they do a better job of getting nutrients out of the soil and into the plant. Hybrids also leave less N in soil for crops following in rotation. This has implications for crops in the following rotation. The rate of N applied has been going up, and was a record in 2013.

Using one fertilizer rate, where each quarter section gets the same application regardless of N supply in the soil, no longer works. Perhaps, this is where precision fertilization begins. Ask if the allocation of N for canola is the best it can be? Adjust rates according to production potential. Tailor the application of N to the field management history: soil, field history, parent material and past management. One study compared short-term no-till (5years) and long-term no-till (25 years) and the supply rate of available N

in pea and wheat stubble. The results showed higher N in pea stubble, and the long term no-till had an enhanced ability to supply available N. There was more available N in the long term no-till. These kinds of things need to be considered when developing effective soil fertility plans.

Soils are getting better, especially ones containing forages and lentils. Reduction of tillage, rotation, and proper fertilization results in increased availability of N, P, and K. Mineralization is a significant contributor of soil N to soils and there is better mineralization due to better management practices. Mineralization is difficult to measure/predict because it is a biological process and is dependent on weather.

It is important to not only look at N fertility but also sulfur (S) fertility. It is important to determine how to account for differences between elemental S on the farm. Field trials are showing that extractable sulfate is only part of the picture – organic sulfur may be a major contributor to available sulfur. Rates need to be adjusted accordingly.

Current fertility management includes variable rate technology. Soil management zones need to be identified. There is a lot of technology available to develop these polygon zones. The challenge is to convert random variability to systematic variability and identify what is controlling variability like salinity and water capacity. What is controlling the variables? The technology is there to do this, but predicting the response to fertilizer applications in each zone is extremely difficult as there are so many factors in play.

A recent thesis concluded there was no significant difference between treatments of variable rates versus constant rate applications on wheat and pea stubble yield. If protein is low then there is an increase in yield when N is added, but if high protein and N is reduced then it results in yield penalties. Do not reduce N in areas of high N proteins. Precision fertilization and variable rate technology can be beneficial to canola growers but it needs more research.

Nutrient source, enhanced fertilizer products, coatings and additives improve fertilizer use efficiency. Environmentally Smart Nitrogen (ESN – a polymer coated additive), urea and nitrification inhibitors are emerging in a big way. They work very well in wet conditions and fall applications. They are good in places where there is high loss potential. And can be used for larger farms that are having difficulty putting product down in the spring. All fertilizer sources of a nutrient are not the same. It is important to understand how formulations will act in the soil. Selection depends on individual need: quick/short-term or long-term nutrients. An example of sulfate effect and variable uptake was given.

In terms of micronutrients, it is known that too much boron (B) is toxic to canola. There is a need for better understanding of B chemical formulation in Western Canadian soils.

Timing and placement of fertilizer for canola is important. There is tolerance for seed-row placed fertilizer for canola up to 10-20 lbs. of ammonium sulfate. Higher than that, there are problems with germination and injury. Care is required even with applications for different soil/hybrid variability: in sandy soil with a high pH there can be damage even with applications of 10 lb/a. Polish canola and juncea are more sensitive than napus canola types. There is a need to know the risk factors in the field and to ensure that everything is working alright – depth control is important. Agronomists are important as is the machinery side.

Other soil management issues:

- Canola stubble management – canola stubble dries out faster than other stubble. Height and post-harvest herbicides may affect moisture content.

- Soil active herbicides – texture, organic matter content affects the efficacy of herbicides. The soil environment, temperature, and moisture play a role in the dissipation and carry-over of herbicides. In dry years there could be a problem of potential injury with the use of these herbicides. When they persist in the soil there is a greater risk of herbicide resistance developing.

Sorting agronomic fertility fact from fiction

- Challenges are encountered when it comes to biological products – rhizospheres are very complex and sensitive to a number of complex factors such as biological/biochemical processes and behavior. Effects are variable depending on environment. It is difficult to tell if new products will work. To determine what will work, consider these points: do they apply to the laws of nature or are they unrealistic, and what evidence is there to support these claims? Research is needed.

Research and making sure there are knowledgeable individuals in the field are the best assets for increasing canola production in an economically feasible and sustainable manner.

In summary:

- Utilize the 4 R's of fertility
- Hybrids will change fertilizer needs
- Sulfur, particularly elemental is changing throughout the years
- Variable rate can be beneficial but needs more research
- Use logic to weed out new products

SOILSCAPE - BREAKOUT SESSION SUMMARY

1. What are the challenges to canola crop nutrition (think profitability, sustainability, etc.)?

- It is a balance between what sustains the farm and how the pieces are put together
- Logistics (storage of product, how much and how fast can product be applied, and simplicity). Timing and resources
- Soil variability, climate conditions and fertilizer rates
- Lack of available information: micronutrients; genetic potential of a relatively new crop; lack of understanding of the need for nutrients
- Data collection and record keeping, even though there is year to year variability, incorporate what is learned every year to better predict what will happen. Leaving a check strip in crops.
- Variable rate technology understanding and interpretation
- Foliar applications versus fertilizing at planting
- May be difficult to get everything done due to manpower, more help is needed with collection of data with on-farm trials
- Communication of results, information sharing
- Understanding the risks: budget and ROI. How will the yield tie back into economics? Economic value of nutrient applications; return on input; resource allocation and application rates; cost versus benefits of applied nutrients
- Soil testing and variable rate. How do you do a proper soil test?
- Balance fertility versus just N and S for canola
- Understanding the history of crops in rotation with canola and their nutritional needs
- Response to residual and applied nutrients to the soils
- Blend fertilizer types used in crops and the pathways these nutrients will be used and how this can be determined so it performs optimally, meets higher yield goal.
- Commodity pricing is a challenge to crop nutrition

- Challenge of understanding new fertilizer products that come on the market
- Consider not just yield but also the quality and protein profile of canola
- Fertility and disease management
- Forage removal calculators – residue management
- Understanding and utilizing fertility maps
- Modelling for nutrient management - have universities work on this with provincial and federal organization. Collaborate and coordinate with companies who are already running trials. Retailers have set up some good studies, need an integrated approach. There is a need for long term funding and good long term data
- Fertilizer application in relation to water quality and run-off. There is an increasing interest in the public to our management systems
- Improving soil health by using cover crops, breaking compaction
- Technical support for electronics and new technology in equipment
- Variable rate versus uniform balanced fertility

2. ***What are the solutions to the challenges identified to canola crop nutrition (Communication, logistics, research, innovation, etc.)?***

- Communication between farm, research and retail. Communication between canola, pulses and wheat – collaborative research. Coordination of research, better collection of data and putting ideas into practice and make a profit
- Use and understand the meaning of soil testing, understand crop rotation, understand the importance of the history of the field
- Understand the 4R's
- Find a way to coordinate producers to accurately follow protocol, and then follow through on data collection; provide growers with a protocol for test strips. Need to monitor strip trials, use of aerial trials like a drone
- Develop a database so there is successive data rather than a single test strip; currently there is a lot of un-replicated data that is not being utilized or analyzed
- Economic incentives for farmers to adopt new technology; ROI's drive decision-making
- Placement and rates – better equipment to separate inputs, rates based on research and understanding of current conditions, and utilization of "safeners" to seed proximity and fertilizer placement
- Fertilizer blends – researching the performance of various blends and interactions of numerous nutrients applied together in a blend.
- Profitability – common sense approach, keep it simple, educate based on the crop history, commodity price, input cost, equipment and infrastructure available to best management
- New products – research to understand efficacy and apply to own farm
- Need a BMP document
- Time is a budget item, look at fall application as an opportunity to split workload
- Rotation – need data to prove longer term sustainability perspective. Need to understand the impact of higher yield goals on soil nutrient profiles. Need to consider disease resistance and maybe nutrition is not the driver.
- Water – drainage planning with neighbours; weather patterns affect decisions for tillage
- Acidic soils – need to raise awareness of the issue and possible solution
- Variable rate technology (VRT) – the opportunity is there, but not exploited as yet.
- Succession planning for researchers is important
- Modernize the nutrient side – risk modelling, green seeker technology
- Genetic improvements to utilize nutrients more effectively during stressful conditions
- Research on foliar application
- Better fertilizer delivery systems – openers; separation

- Imagery to determine fertility, needs lots of development, more research
- Biologics – is nitrogen-fixing canola a reality?

3. What are growers doing right to optimize canola crop nutrition?

- Using their own history as a background to make decisions.
- Utilization of information to make informed decisions
- Planning for long term success rather than optimizing profits for one year
- Investing in newer equipment and technology
- Shift into more business-like mentality by farmers
- Investing in research
- Consulting with agronomists
- Adoption of new technology
- Utilizing good management practices – seed placement and seeding speeds are being implemented
- No shortage of N applications
- Need better communication with machinery producers to produce better machinery
- Pushing the envelope to see if they can maximize yields by hybrids
- Better timing of fertilizer application, better fertility placement with new equipment
- Agronomists have a better understanding of fertilizer placement regarding recommendations
- Some growers using crop rotations to maximize fertility
- Greater understanding of stand establishment: adjusting seeding rate/spacing; TKW, germination % and seed by #/ft^2 versus lb./ac.
- Greater understanding of impact of down pressure; wind speed; type of drill; creating mechanical damage; seeding rates across the drill
- Collecting more information on soil nutrients through soil testing, yield monitor by field and by zone
- Consulting more with advisors/agronomists regarding nutrients/management
- More business-conscious in cropping and farming; make decisions to get a better return for the risk involved
- Adoption of newer technologies like varieties, soil testing, equipment and farming practices
- On-farm strip trials
- Producers have recognized the need to control disease and pests to realize potential of nutrients

BABY STEPS TO BIGGER PROFITS: THE 5% RULE

Incremental Improvements Have a Huge Influence on Profits

Kristjan Hebert, CA, Managing Partner, Hebert Grain Ventures

The Executive Program for Agricultural Producers (TEPAP) is a farm management philosophy and a great networking program. There are 7 key principles of the program:

1. True competitive advantage – Change is inevitable and if you are not ahead, you are behind
2. Strategic management – Focus on where agriculture is going in 5, 10 and 15 years and plan for the future
3. Analysis – Assess the areas of operation that are not helping you at all. Look at what not to do and the opportunities for change
4. Learning organizations – Look for the best, adapt it and apply it to your business to optimize profit
5. Continuous management improvement – Management is the number one differentiator between farms, it is the largest factor that affects everything else. Constant learning is important

6. Timing – Top growers know what to do at particular times: seeding, marketing, expansions, etc.
7. The future belongs to endless opportunities and to producers who are able to recognize and capitalize on them

The 5% rule is that the repetition of 5% increments ends up making huge long-term differences. The 5% increase is something small, but if it is done over three things it will have an additive, dramatic effect. A base case was presented and net income can increase 117% when the 5% rule is applied.

The **goal of farmers** is to increase their profitability, become more efficient, improve marketing and decrease risk. An effective strategy to achieve this goal is to use accrual financial statements, manage margins, rather than cash financials. A focus on margins as cash can have a two year delay before there is the realization something is wrong. Look at the return on equity and manage margins.

Yields

Variable rate fertilization results in a uniform crop, so you can make better decisions throughout the year. There is no need to worry about canola being at seven different growth stages and then have to try to figure out when to spray. Chemtrition, fungicides and seed treatments can be used to build a culture where there is 100% field potential, management is aimed at maintaining the 100% field potential. Tissue test 4 days before spraying to know which micronutrients are low and address them. Consider TKW, seed rates in stand establishment. Timing includes managing human resources and building a business with good team members that will allow things to happen at the right time. Risk management includes self-insure. Filling the gaps with farm programs: what are you willing to risk? Straight cutting can save time and money.

Price

Future contracting, using options can manage risk better. Consider varieties that have higher oil contents, grow varieties that will provide a better return on investment. Risk management; consider looking at not making as much return on good years to limit losses in bad years. Forward managing is an area that can be improved substantially through education.

Cost

Change the things that you can: timing, schedules, equipment and technology. How many more acres can be worked: always use the most amount of land possible. How many more hours can equipment be used: running machinery reduces costs of that machinery. Purchase machinery that is suitable for the size of the farm. Consider auto steering which allows for the ability to run 24 hours: operators do not get as tired, are better able to watch what is going on, overlap less and can work longer. Forecast costs to the best of your ability and be willing to change.

Data

Will drive us into the future.

Strategic management includes looking for trends, identifying them before anyone else, being willing to change and benefit from the profit. Benchmarking is important, accrual financial statements, marketing and comparing yourself to the best. Benefit from peer groups: use like-minded groups for comparison and accountability. Standard operating procedures are important (SOP's). Keep detailed records so that anyone will know what to do in the event of a lapse in manpower. Family and succession planning, currently agriculture is weak at this, come up with a plan ahead of time. Let everyone participate and be informed.

Agriculture Research Role

- Genetics – harvest/pod shatter, disease resistance, and oil/protein content. Let the researchers handle it

- Fertility and seed quality are key areas
- Residue management
- Margins and not yields are important
- Technology has area for improvement in transitioning data into application
- Utilize data to improve farm management; not using improved methods widens the gap between the top 5% growers

In summary:

- Repetitions of 5% increases will result in significant increases in profits: increase yield by 5%; reduce input by 5% and increase efficiency by 5%
- Look at margins and plan ahead
- Benchmark, there is probably someone doing things better than you, so look at this and apply it.
- Use accrual accounting rather than cash management

THE 5% RULE - BREAKOUT SESSION SUMMARY

1. ***What are some of the small changes that will have the biggest impact on canola productivity?***

- Strategic planning (genetics, establishment, fertilizer, IPM and harvest)
- Stand establishment; use the plant one to get one ideals: use high seed quality, reduce disease potential, chose varieties suited to your area, understand total kernel weight (TKW) and seeding rate and proper calibration of seeding equipment
- Timing of seeding dates
- Soil testing and leaving a check strip is important
- Seed treatment to enhance early season vigor
- Fertility/variable rate using individualized fertility rates per crop and per field
- Predictive models and yield maps
- Residue management
- Harvesting – straight cutting – reduce pod drop, reduced wear and tear on machinery
- Standard operation procedures and managing manpower
- Benchmark and continuous learning; using technology to be more efficient; using data sets and archiving data
- Financial management – marketing, look at margins, accrual accounting versus cash management
- Timing of fungicide applications – crop stage dependent and herbicide rates and timing
- Equipment/machinery efficiency per acre and controlling traffic
- Auto steer to reduce overlap and increase efficiency in manpower
- On-farm scouting – recognition of crop problems on time
- Crop rotation
- Proper storage and controlling temperature

2. ***How can growers minimize costs with minimal effect on canola production? (Inputs with lowest return on investment)***

- Have a target plant population! Seeding rates – finding ways to stop seed mortality; sectional control on drills
- Use technology such as the green-seeker
- Buy inputs at the right time
- Strategic chemical inputs - understand soil fertility; soil testing
- Use integrated pest management
- Combine settings and minimizing harvest losses
- Increase efficiency – reduce tillage, straight cutting versus swathing

- Harvest costs – use fuel efficient combines, run equipment longer, SOP's (mean less breakdowns, less reliance on a single person)
- Preventive maintenance – equipment failure is a huge cost
- Better understanding of cost of production (COP): variable and fixed. Keep track of all costs and how it affects productivity; look at the ROI of new technology, which costs are not giving a ROI?
- Focus on canola varieties best suited to your area
- Look at cost per bushel versus cost per acre
- Increasing inputs
- Bundling
- Monitoring fields, using agronomists
- Doing on-farm testing to identify the lowest ROI
- Saving multiple applications by doing more at one time
- HR management
- Planning – have supplies priced in advance
- Risk management – the do's and don'ts
- Management role is important

3. How does canola production become more profitable?

- Price + yield – cost = profit!
- Move to cost per bushel and look at net income/returns
- Marketing – create and use strategies to regulate future calls, regulate the margins. Pre-hedging the crop at input time; know your COP (variable and fixed) so you can lock in a price. Divide marketing into components: futures and basis equals cash
- Plan and use your finances based on accrual rather than cash basis, carrying inventory
- Yield stability would reduce barriers on spending to maximize yields; understand your opportunity costs
- Benchmark – know where you should be at, look at other regions and profitability and learn from their practices
- 5% rule – marketing, lower costs, yield
- Know how much value any new practices will bring
- Understand data being collected and figure out application to optimize production
- Early adoption of new technology, be ahead of the curve
- Pick two things to improve on each year (goals)
- More profitable alternative crops to reduce tight rotations
- Improve transportation efficiencies
- Utilize business specialists; focus on long term plan
- Pool or group purchasing power
- Straight cutting
- Variety selection
- Increased efficiency – human resources; seeding; harvest management
- Having some bonification; growers should see oil profits

4. *What are some of the research opportunities with respect to the 5% rule*?

- Improvement of varieties
- Reduce seed mortality and dormancy: TKW, vigor and treatment and equipment
- Maintain or improve canola seed placement with "conventional" planting speeds
- Focused research program for new and emerging pest issues: improve preparation for new pests with regards to control methods and availability of protection products
- Better prediction method and resistance for sclerotinia
- Leave check strips; strip testing to identify ROI's

- Establish soil fertility guidelines; soil tests rates; fund fertility placement research
- Optimal disease management with tight rotation
- Optimal use of herbicides in canola
- Singulation rollers
- Cost minimizing research; provide examples/mock-ups of possible financial situations for producers
- Human resources research
- Understanding VRT
- Proper crop rotations accompanied by economics, problem identification and management
- How much more does technology allow growers to be profitable? Yield increases need an economical component.

ALL ABOARD THE BIG DATA TRAIN TO 50% YIELD GAIN
Moving from an Analog to a Digital World
Kip Tom, Managing Member, Tom Farms LLC and President, CereServe In.

Building blocks to prepare for the future

- Innovation – in agriculture includes benchmarks such as machinery; hybrid plants; crop care products; biotech; data collection. The next step is the data revolution
- Social license – how to fill the demand for food sustainably and profitably
- Human talent – re-educate; update with technology

Data will be a driver in agriculture's human talent. The generational gap in technology will decrease with education. Production skills; making sure people know what they are doing is part of risk management and using the data to know if you have enough inputs. This all relates back to management and communication skills as well as social media skills. Globally, data will help people understand the role of agriculture in future food production. Data can be used to measure sustainability; big companies and technology will want to get invested. Lack of succession planning will affect the future. The size of farm business is as reliant on data compared to machinery. It gives the ability of large farms to have control over how inputs are applied on the farm. Knowledge base and the growing acceptance of new technologies drive farm business and acceptance is happening really fast, there are lots of opportunities. Data is used for risk management skill regarding future planning and the ability to predict not just in the short term but the long term. It drives critical components to planning strategy. It is important when it comes to land resources, equity firms and hedge funds; that data show the rate of return for investment purposes. Land and resources are a high demand asset and data can be used to make smart decisions on whether you should buy and at what price. It allows you to know how much the business is actually worth.

Data is the key to expansion; it accurately communicates those practices which lower the carbon footprint thereby reducing public concern.

Data will be the driver of innovation. The average farmer has 40 chances in a lifetime to "get it right." There is one chance per year that data/science will change things; it will relay what works and what does not work quickly. Outreach programs need to be developed for youth to keep them interested in farming. A radical change is needed, there needs to be an agricultural revolution.

The Convergence of Innovations
Farming is a manufacturing industry with a finite amount of resources. Everything has to be done right or it will fail. SOP's are critical. Biotechnology, information technology and mechanical implementation/process control technology are important. The tools available allow for greater change and to assess how we are doing. Mapping technologies can be used to improve productivity.

Environment and operating data, using weather data and drones can determine fertilization applications. Pressures can be varied to create ideal seeding rates. Use VR seeding, fertilizing and irrigation based on maps generated through the data collected for better management decisions.

Preserving Resources

Data can be collected to determine how much water plants are taking in and the amount of moisture in the soil. Know the soil types and topography to understand how water should be applied – variable water application. Climate Corporation Field evaluates how much N should be applied based upon seeding time, soil and helps predict yields. Data science is used to develop weather models to help tell you when to harvest and to also predict yields. Technology and data is used to measure, monitor and control factors affecting production. It is useful as a decision-making tool in determining production costs and determining how much crops should sell for. Use precision, field scripts; manage fields 10 square meters at a time. Up to 20 metrics can be used to determine field management. Use peer groups and yield benchmarking to compare what varieties produce under certain soil types and compare them against other farms in your area and other geographical locations. Collect good data: you may need it in the coming years. Compare your farm against other farms, know if you are staying ahead or falling behind. Collect data on planting speed; determine what speed is best by collecting data over time. Look at planting population and figure out what seeding number gives the highest yield. Combine data with others and aggregate it to make sense of the data.

Intellectual property needs to be considered. Data is being collected but it is not being used effectively. This needs to change. There are implications for data aggregation and sharing of data for executable decisions.

Where do we collect data today?

Planting – Soil testing, tissue sampling, GPS, sensors on tillers, seed depth and rate, fertilizer
Planes and drones
Sprayer – machines will turn sprayers on and off if insects or weeds are in an area based on mapping technology
Satellites – can collect a large volume of data
Grain plants – identify truck, driver and crops
Weather station – make sure weather data from satellites is accurate
Fertilizer/warehouse seed/chemicals – identifier chips, tracking of products of fertilizer, seed, chemicals when it goes out, where it goes and when it comes in
Commodity markets – know cost of production and estimated yields and calculate profits
Utility companies – consumption of electrical kilowatt hours, determine usage

Most important OADA (Open Ag Data Alliance) – collects data and determines who can have access to the data. This ensures that your data is protected. Bottom line is to develop an enterprise resource planning (ERP) system; collect all of the data to make informed decisions on when to do things such as apply fertilizer or irrigate.

What does the future hold?

- Sensor technology will continue to grow
- Robotics: machinery and drones
- More broadband in rural areas
- ERP systems to improve yield
- Increased food safety and laws – traceability
- More crops grown for specific end uses
- Model to authenticate production for crop insurance purposes.

In summary:

- Data collection is the key to increased efficacy, it allows you to see what has been done and how it can be improved
- Data can be used to not only improve your own business, but it can be a tool to share with others and the industry
- Be mindful of where your data is going, who can access it and be sure to protect it because it is valuable
- There is never too much data collection because you never know when you might need it
- Communication is key to increasing efficiency, and is necessary to keep the public informed
- Manage the field 10 square meters at a time; using a broad approach is not the way of the future as there is too much variation in the environment

THE BIG DATA TRAIN – BREAKOUT SESSION SUMMARY

1. ***What data sources on the farm can help Canadian canola growers optimize production?***

- More in-depth soil analyses; soil probes – moisture and temperature. Mapping of soil tests; topography
- Weather location specific, divide farm into different plots
- Biomass indicator - easier methods to count plants; green seeker as a quantitative measurement
- Variable rate application, plant growth regulators (PGR) and corresponding normalized difference vegetation index (NDVI)
- Measuring/banding plants to determine nutrient, water uptake
- Determine real time insect and disease pressure using drones
- Crop insurance and weather data
- GPS seeding trackers
- Yield maps
- Rating grain quality
- CGC and marketing companies
- Market information
- Determine how many producers have future contracts – tells what everyone is doing, why and how this will affect the future
- Cost of production/profitability
- Storage sensors
- Satellite, remote sensing (NDVI and EVI)
- EM and Veris
- EC, OM, soil characteristics
- CVOP quality
- CCC, CPT and Canola Watch
- Environment Canada
- SK Ag – Knowledge Centre, provincial specialists, regional crops specialists
- Local agronomists
- Conferences
- Researchers
- Field days – IHARF
- Social media
- Google search
- Other producers/peer groups – benchmark – yields, production costs.
- Resource materials
- Western Producer/ Grainews / Real Agriculture/ Equipment dealers/ Chemical companies and surveys

- UCC to maximize yields
- Determining the limiting factor to optimize production and is it manageable?
- On-farm field trials
- Enterprise Resource Planning (ERP) software – individual fields as profit centres. Data tells you ROI on individual fields
- Analytics from Climate Corp – measure, monitor and control
- Earnings before interest, taxes, depreciation and amortization (EBITDA)
- Social license
- Logging use of seed, inputs to determine marginal costs to create benchmarks
- Data on seed density – use this data to enhance machinery efficiency
- Carbon footprint – data shows we are lowering carbon footprint
- Cyclical issues – using long-term data to start identifying cycles

2. ***What industry wide data sources can assist best practices and profitable canola production (crop insurance, agricultural census, Environment Canada, equipment manufacturers, life-science companies, internet providers and others)?***

- Disease survey
- Saskatchewan Ag/Manitoba Ag/Census data/John Deer programs/Crop insurance/DST
- Data from the CCC – yield, variety information, blackleg, stand establishment
- Commodity groups
- AAFC
- Weather, Environment Canada
- Retail plot system
- On-farm trials
- Equipment analytics – real time sensors
- Third party data consultant/analyst/management
- Data collection points – producers can upload data anonymously to grow a large, free data set
- Economic data – benchmarking
- Research groups
- Open Agriculture Data Alliance
- Food Safety – data to support no residual in grain
- Match supply with demand – match up supply chain optimization
- Pest forecasting maps
- Remote-sensing radar
- Seed/chemical company yield and product trial data

3. ***How would research change in light of new data collection sources, or does it need to change?***

- Better field scale trials
- Improved user/automated systems
- Spatial analysis
- Equipment diagnosis/optimization
- Repeatable data, stats, validity – large randomized, replicated trials
- Research can be more focused and more detailed. Can fit 60 years of data into one year.
- Third party collection of data for on-farm research trials
- Traceability
- Meta-analysis of big data based on research criteria
- Becomes more site specific on-farm/farmer trials
- Data can help to identify research gaps and priorities, targets, and speeds up research
- Studies globally to determine how different varieties work in various areas

4. Does big data mean bigger profit?

- No, big knowledge is needed. It depends how well it is analyzed and utilized
- It should if enough useable, accessible data is generated
- It depends on how it is used, costs for collection and analytics
- There may be opportunities to sell data
- Can help to save time and that can increase efficiency and profitability
- Can help to identify small changes with ROI i.e. 5% rule

"CANOVISION" SUMMARY PANEL –ANALYSES OF THREE KEY ADRESSES

Moderator: *Jay Whetter, Communications Manager, Canola Watch Editor, Canola Digest Editor, Canola Council of Canada*

1. **Given the data revolution, how do you see the approach of research changing from government and universities, and what roles will they play?**

- There needs to be a lot more collaboration between universities and government; we can get the trials going but need the universities to make quicker decisions to set it up and to know what to collect
- The ability and equipment is out there to get data really fast; collaboration to get lots of field years from the data quickly is needed. Collaboration will help with quality data, provides a variety of land and real time decision

2. **When does technology/data become too much and how do you find a use for it?**

- Try to collect everything you can because you may use it in the future. Focus on what can maximize your ROI
- The ability to decide quickly on whether this is something you should or should not do ultimately comes down to personal judgments and objectives and if it delivers value. What is good for one operation might not be applicable to another
- Collecting data is really important. We do not mine data enough. We may not use all the data but if the important aspects are covered it may be very effective. Data if it is somewhere can be potentially used. Collect and store everything
- One of the things to be aware of is to keep things simple, restrict 2 or three projects at a time. Get 2 or 3 years of data; if you try to get more, it gets complicated and falls apart. If things are too complicated you lose sight of the main objective

3. **What number of farmers can do what you are doing and where do you think we will be in 10 years?**

- Education component and not cost is where the hurdles are at. Value can be added to those of us who want to expand. It is going to take universities and industries to support farmers to collect data. There is a lot of work to do in industry to help growers understand how to use this technology.
- A change in management mentality is required to ensure this is implemented into daily farming practices; build a culture that data is used to move forward. We are a long ways away from this.

4. **Producers are spending a lot on technology and research. Can we get value back for providing data to the industry secto**r?

- It is important to make sure that farmers are rewarded. Farmers have the right to sell and the right to own data
- Data control is necessary. It is the farmers' call and it should be at the discretion of the producer
- Data used as a benchmark and to help other farms, but the right agreement needs to be put into place

- From a research viewpoint; validating the data by seeing if what researchers are accurately predicting is what is happening on the farm.
- There is a long way to go to help producers understand the true value of their data

5. **Are there control measures in place to make sure that the sensors/calibrations are accurate?**
- Data is very specific. The combines should be calibrated daily and is specific for each machine. There are a small number that calibrate accurately. We are fine tuning all the time. There are flaws but through the years it is becoming more accurate

6. **For producers on smaller farms, the data may not be as relevant as it is for larger farms. Is there a network where you can combine and mine data as a group?**
- FBN, "Farmers' Business Network," is funded by venture capitalists. There is a signed agreement to collect data and go in and see what other producers are doing. There is also a Monsanto program, IFS, which analyzes data to create plans based on hundreds of field strip trials. With combined growers' data, you can see the benefit of fungicide applications, what varieties are good on soil types, etc.
- These programs lead to a lot of efficiencies and can cover a lot of soil types in different climatic areas. It becomes difficult to manage if it becomes too big. There is the benefit of working with people with the same interests but in different areas

7. **How secure is the data? Do you use weather forecasts and how do you use them?**
- There was a data breach last spring with one of the seed companies. Security measures change all the time, it is a risk that we live with today. OADA is good, it is a safe platform, but things change all the time
- The last thing a company wants is to have it out in the media that they lost some farmers' data, they have an interest in keeping it safe
- There are benefits to data aggregation but have fire walls to protect yourself
- Weather sciences are getting more accurate, short term weather forecasting will continue to improve. Weather stations on-farm are more accurate

8. **To increase efficacy, how do you choose different hybrids and herbicides?**
- Dual hybrids choose something with similar flowering time but from different parent lines; this will result in similar timing for fungicide applications. When it comes to herbicides, there is not a lot of difference. Track and rotate herbicides, fungicides and insecticides as well as genetics to mitigate resistance issues

9. **What traits should be considered when selecting hybrids?**
- It is less about traits and more about looking for different hybrids that react better in different environments found in the field
- Use a variety to determine insect tolerance

10. **What efforts do you use to maintain biodiversity?**
- Looking for a balance between money and biodiversity. As acres become more valuable, the goal is to farm as much as possible. Any land not suited to crop production can be put into cattle farming.
- Work hard to preserve the resources, and protect biodiversity
- It is nice that society recognizes the value of wetlands which help to protect the quality of the soil and water
- Environment protection and our carbon footprint is a concern
- Government institutions and interactions are needed to help maintain diversity

11. **How concerned are you about the collapse of bees?**

- It is important to understand how our cropping systems affect bees. There is a lot of learning to be done to understand bee culture and colony collapse.
- Bees are worked hard and are moved around a lot
- Industry want to find the reason for colony collapse as much as farmers, whether it is mites or neonicitinoids
- There is great concern and many people are looking into how we can protect pollinators

12. **What is the first step for producers to move into the "big data"/research interest?**

- There is a need to change the mindset to follow the data in the culture of the farm; it needs to be a universal agreement in your family/business
- It is about creating a culture in your farming operation. Imbed data in your culture and let it be a driver
- Make a decision that is informed; be ready to accept change and do it because it fits you

13. **How do you make your employees care?**

- This is a problem for everyone in points in time. Most people prefer job descriptions
- Fit the job to your employees, listen to them and have flexibility
- Allow them to change and to have opportunities to move up. All people want to see growth and opportunity. Invest in their growth: education and communication
- Differentiate yourself from other companies to keep them engaged and excited. Explain your mission, explain why you are using certain technologies
- Allow ownership in the decision making processes
- Make sure everyone is cognizant that they are part of the team

14. **Producers want actionable data**

- The burden is on researchers to try to break information down for producers and the burden is on the producer to understand these technologies.
- Access to more information is going to increase; data mining is faster and cheaper. It is all about what is the pathway to make a better decision to improve productivity
- Technology for some people will not matter; some people do not even use simple data that would save a lot of money. The grower has to value data and build the team in order to capture value
- Demonstration farms are important to show producers applied data

15. **When adopting new technologies, is variable rate more about the timing or product?**

- Found that fertilizer was used more efficiently, but did not use less fertilizer
- The uniform crop was worth VR; application of herbicide and harvesting are more consistent and time-saving

CLOSING REMARKS WERE MADE

2014 Canola Discovery Forum
Meeting Summary
TCU Place, Saskatoon
Thursday, October 23

2014 YEAR IN REVIEW
Dan Orchard, Agronomy Specialist, Central Alberta North, Canola Council of Canada

The growing season started off with really cold and wet soils. There was poor emergence across the prairies. It started to warm up in mid-June. There was extreme heat in mid-July in Alberta during flowering. There were drought conditions up in the Peace Country. This turned around in late July and early August and saved the crops. In the Peace, late seeded crops were better than the early seeded crops. This usually does not happen. It only occurs once every 7 years or so in the Peace. The late seeded crops got some of the rains in early August. Lygus bugs were an issue in central Alberta. It varied from finding 300 lygus bugs in ten sweeps to not finding them in the sweep nets. It brought about a realization that there is a lot we do not know about lygus bugs. It snowed in early September from north of Red Deer to Calgary: crops were flattened. Crops were quite green in the area when this occurred resulting in green seed issues: plants had to be scraped off the ground. There was pod abortion in Southern Alberta. There were no weevils which is usually a problem in the south. There was a lot of root rot and blackleg towards the end of the season.

Around Lloydminster there was very little fertility left as crops were so good last year resulting in lots of nutrient issues. Very little spraying was done for sclerotinia which was unusual, it is usually sprayed for a lot in that area. There was yield loss of 20-30% from sclerotinia. Yields were actually pretty good considering everything. South Saskatchewan had very little spraying. The yields were good where there was crop. Swathing took place very early in the Regina area. Cutting was done on the green side. There is a need for three good drying days before freezing to cut and we did not get it resulting in green seed.

Manitoba was late. Conditions at harvest were questionable. Root rot was noticed a lot across Manitoba. There was not a lot of sclerotinia reported.

Overall, crops and yield were better than expected across the prairies.

WORKSHOP #1: STAND ESTABLISHMENT

INTRODUCTION: KEY FACTORS IN STAND ESTABLISHMENT
Warren Ward, Agronomy Specialist, Eastern Saskatchewan, Canola Council of Canada

Stand establishment is a crucial first step to a successful crop and involves several considerations:

Seedbed
- Needs adequate temperature and moisture, and must be firm enough to allow the seed direct access to the moisture and nutrients, but not so firm that the soil is compact and impedes water infiltration and proper root growth
- Ideally, the seedbed should be uniform (related to proper residue and weed management prior to seeding) which should then translate into uniform crop emergence

Crop rotation
- Using a diverse canola rotation can improve the health and diversity of soil microorganisms

- Address disease pressures in crops that may harbor a disease in non-canola years (avoid pulse-canola rotations if sclerotinia is an issue because soybeans can maintain the fungus when canola is not being grown)
- Different crops produce varying levels and quality of crop residue, rotations may take this into account depending on the conditions of the field (lack of moisture, excess moisture, disease pressure and soil erosion)

Seed selection

- Stand establishment is affected by variety selection, especially in areas with high flea beetle pressure. Since flea beetles have a widespread habitat and cause significant damage early in development, using treated seed is generally recommended
- Varieties have different strengths and weaknesses. Selecting the one which will perform the best in your region, in addition to considering dormancy, vigor and seed purity is important

Weed management

- Managing weeds early is critical to good stand establishment. It reduces the competition for nutrients and sunlight as well as reduces future weed seed production and promotes crop uniformity
- Proper use of products, including product selection, rate and application timing all contribute to how well weeds are managed
- Rotating herbicide tolerance variety systems is important for managing herbicide resistance

Insect pressure

- Many other insect pressures need to be considered. Know when and how to scout for early season insects and know the economic thresholds for when insects should be sprayed
- Insect pressure can vary according to the conditions each year; noting the variation in insect populations and how they change over time can improve the growers' ability to effectively manage insect pests.

Seeding rates

- Seeding rate is as important as assessing the number of emerging plants per square meter in order to adjust the next time accordingly
- Factors that influence seeding rates include soil temperature and moisture and often relate to early and late seeded crops. Equipment has an impact on seed placement and ultimately on what seeding rate should be used

Residue management

- Relates to seedbed preparation and crop rotation; residue management can have a significant impact on plant establishment

Seed placement/depth

- Most common depth target is 0.5 inches, but varies between 0.25 to greater than 1 inch
- Seeding speed, opener design and field uniformity all impact seed placement

Fertilizer placement

- Guidelines for fertilizer placement should be followed
- Understand what the plant needs, how much, and when it needs it (think of the 4R's)
- In many cases logistics trumps best agronomic practices. Producers need to remember that if they are going to make trade-offs, they need to consider making improvements in other areas to offset the negative impacts of compromised fertilizer placement (i.e. using the same blend on all fields, inconsistent equipment delivery, etc.)

Equipment

- Consistent equipment is important to a uniform stand establishment. Seeding depth and metering system is dependent on a well maintained/calibrated seeding tool
- Crop residue can impact the performance of seeding equipment, as well as different environmental conditions (i.e. too wet, or too dry)

These are some of the major considerations in achieving optimal stand establishment. Putting in the effort early in the season will pay off when a crop comes up healthy with a good start toward uniform maturity and a high yield.

CORN MODEL: STAND ESTABLISHMENT YIELD METRICS

Dr. Jeff Coulter, Associate Professor and Extension Specialist, Corn-based Cropping Systems, University of Minnesota

Since corn production has been developing and refining itself for a much longer time than canola, there may be something to learn from the corn model which can be applied to canola. The outline of corn production will include: planting dates, starter fertilizer, stand establishment, hybrid selection, seeding rate and row width.

In regards to corn planting dates there was not a significant difference between late April and mid-May planting dates, yield was slightly lower in the later seeding date and late May planting date was significantly lower than the earlier seeding dates. Grain moisture at harvest was higher as a result of seeding late which then needs to be dried. This is related to the high growing degree-day (GDD) accumulation required for corn crops. A study comparing planting dates, hybrids and fertilizer treatments found that longer maturing varieties have higher yields but higher grain moisture and that additional fertilizer treatment did not always benefit the grower.

Seeding depth was found to be important in corn: seeding too shallow results in weak roots and lodging, while deeper seeding produced stronger plants. Seeding crops at different stages found that the late plants acted like weed competition and did not contribute to yield (reaches silk stage late and there is less pollen available for flowering) and had higher moisture content at harvest. Uniform stands have higher yields. Uniform emergence requires adequate and even moisture in the seed zone, good seed-to-soil contact, adequate temperature, and surface soil free of crust and sidewall compaction. Minimize residue problems by evenly distributing chaff, till in the early fall, and monitor wear on machinery. Uniform plant spacing does not have a huge impact on yield. For corn, higher seeding rates correlate with high-yield environments; there is no yield penalty for too high seeding rate and can be beneficial. Row spacing did not significantly affect yield.

The following are yield increases for various corn production practices:

- 7-14% for longer maturing varieties (101-105 versus 95 day hybrids)
- 5-9% for uniform emergence
- 2-5% for planting date
- 1-2% for plant population
- 1-2% for uniform spacing
- 0-4% for adding starter fertilizer
- 0-4% for row spacing

CANOLA STAND ESTABLISHMENT: FACTORS THAT CONTRIBUTE MOST TO YIELD POTENTIAL

Dr. Neil Harker, Research Scientist, Weed Ecology and Crop Management, Agriculture and Agri-Food Canada, Lacombe

Stand establishment in canola is important because it is related to higher yields and profits, lower harvest losses, lower risk after frost and increased tolerance to flea beetle damage, less demand for a second in-crop herbicide application; earlier and more uniform maturity, and less green seed.

Soil moisture is critical to stand establishment, followed by residue management, depth of seeding, seeding rate, and several other factors. Soil temperature is not as important to yields, and may increase yield loss from waiting for the soil to warm up.

The following is a summary of impacts of stand establishment factors:

Residue management has a huge impact on seedbed conditions. Too much residue decreases emergence rate.
Plant stand depends on emergence rate (between 50-80%) and the seeding rate (which includes TKW). Aim for 60-100 plants/m^2 or above 7 plants per square foot.
Seed depth: shallow is better for canola. A study showed that seeding canola at 1 cm resulted in greater emergence that canola planted at 4 cm. Shallower seeding results in better root systems. Actual seeding depth varies from what your settings suggest, it is recommended to check individual fields for where the seed actually ended up. In very dry areas, slightly deeper seeding may be required.
Seeding speed impacts canola emergence; slower seeding speed (4mpg versus 7mpg) results in greater emergence but was not as significant as expected.
Seeding rates: greater seeding rates are recommended to growers with low plant stands. Seeding rates takes into account seed size (TKW – seed weight/1000 seed). Higher seeding rates can have other non-yield benefits, such as better seed quality and less selection pressure for herbicides. A second herbicide application is usually not necessary in a good stand. Precipitation in past years has allowed some growers to get away with lower seeding rates, they may not get away with this in a normal year.
Seed size was found to have no significant impact on canola emergence. Greater seed size often resulted in early canola biomass. The days to flowering and to the end of flowering generally decreased with increased seed size.
Stand uniformity: uniform stands have higher yields at both high and low yielding sites.

Vacuum planter seed singulation is currently being researched. Preliminary results have not suggested much of an improvement in yields.

Take home messages for stand establishment:

- Manage crop residue
- Maintain soil moisture using direct seeding and spring rain at seeding
- Buy and plant enough seed (bigger seed is not necessarily better)
- Seed shallow
- Avoid excess seed-placed fertilizer

SPERMOSPHERE EFFECT: CANOLA SEED SURVIVAL
Dr. Chantal Hamel, Research Scientist, Agriculture and Agri-Food Canada, Swift Current

Producing a crop requires a lot of inputs. If plants are healthy, they can make good use of soil nutrients; fertilizer will be wasted if the crop is limited by disease. Seedling disease complex and root rot are two significant diseases in canola, caused by Pythium, Fusarium and Rhizoctonia. The first two pathogens favour damp and wet soils, Rhizoctonia likes dry soils. Most of what is known about microorganisms comes from the study of diseases; however, soil biodiversity is large and many microorganisms are beneficial to plant health. This presentation will explore how microorganisms contribute to canola seed germination.

During canola seed germination, an exudation process stimulates microbial life in a zone around the seed called the 'spermosphere.' During Phase I of seed germination, water is rapidly absorbed and substances leak out from the seed due to loss of membrane integrity. The highest level of this exudation occurs in the first few minutes and hours of imbibition, and again at about 6 hours. By about 8 – 12

hours, membranes are fully hydrated and functional and imbibition and exudation cease. The first hours of seed imbibition are critical. In Phase II, the seed is in a fully metabolically active state. Proteins are broken down into amino acids for new protein assembly, allowing the radicle (the embryonic root of the plant) to grow and break through the seed coat resulting in one more burst of exudation. Phase III is seedling growth.

The nature of the exudate changes during the imbibition process. In Phase I, it changes from small compounds to larger molecules such as peptides and proteins. Phase II sees the release of materials from the mobilization of stored energy reserves. The molecules exuded into the spermosphere stimulate microorganisms, and the microbial interactions that occur play a role in emergence and subsequent yield potential. Microbial population can reach up to 10,000,000 per seed within 12 hours of sowing. Growth can be non-specific (*Fusarium solani and Pythium pisi*) but the organisms which are stimulated the most depend on the timing in the imbibition process, as well as on environmental factors such as moisture and temperature and on the composition of the seed.

There are pathogens in the spermosphere and there is about 12 hour window to infect the seed, but the seed can be protected by other microorganisms. *Bacillus, Burkholderia, Psuedomonas, Enterobacter, Penicilium, Trichoderma, Gliocladium and Cunninghamella* produce antibiotics or have other mechanisms that antagonize seed pathogens. Seeds may also be protected from seed rot organisms by non-pathogenic species which are not antibiotic producers. The concentration of exudate is important for microbial growth and is related to levels of infection by *Pythium, Rhizoctonia* and *Fusarium* and seedling emergence. Spermosphere microorganisms can come from the soil or from the seed. Healthy seeds of canola contain many microbial species. With active spermosphere organisms present, the seed can be protected.

Microbes in the spermosphere have a role in disease resistance and also in the preferential associations that form between microorganisms and the root of the current and subsequent crops. Work on this is just starting in canola. Microorganisms may also reduce the impact of abiotic stress on seed germination. The impact of bacteria can also vary according to the canola genotype. Microorganisms in the spermosphere may also stimulate root elongation.

Currently, a Canola Sustainability-Risk Mitigation project with AAFC is underway that is looking at the relationship of canola productivity and health to microbial species and functions.

In summary

- Canola seeds have a large influence on associated microorganisms
- Spermosphere interactions determine canola emergence and resistance to biotic and abiotic stresses and the resulting environmental and economic performance of canola
- New powerful methods in molecular microbiology will facilitate the study of the microbiome of canola, adding another tool to its management. Management can be through plant breeding for synergistic interactions with soil microbes or for the development of inoculants

Workshop # 1: Stand Establishment I-clicker Poll Summary

Number of attendees polled: 65
Question 1: Which sector of the industry do you represent? 18 /65 responses
too many missing responses to segment information via sector represented

Question 2: In your opinion, which stand establishment factor has the largest impact on yield? 84/65 responses (+19)

(# of responses) category voted on
(35) Seed placement and depth
(14) Seedbed conditions
(10) Seeding rate
(10) Seedbed prep and residue management
(8) Equipment
(2) Seed characteristics
(2) Other
(2) Fertilizer placement
(1) Crop rotation
(0) Weed management
(0) Early season insect management

Question 3: In your opinion, which stand establishment topic should be priority to learn more about? 72/65 responses (+7)

(# of responses)- category voted on
(30) Seed survival rates
(18) Soil pathogens
(10) Seedbed preparation
(7) Fertilizer placement
(4) Previous crop
(2) Other
(1) Early season pests

Rankings of each stand establishment factor and their impact on yield (1 being lowest, 5 being highest):

Seed Placement/Depth (61/65 responded): 48% ranked a 5.
Seedbed Prep/Residue Management (61/65 responded): 41% ranked a 4, 69% ranked a 4 or 5
Fertilizer Placement (61/65 responded): 79% ranked a 3 or 4, 41% ranked a 4
Seeding Rate (62/65 responded): 37% ranked a 4
Seedbed Conditions (60/65 responded): 33% ranked a 4
Early Season Insect Management (61/65 responded): 44% ranked a 2
Weed Management (63/65 responded): 64% ranked 2 or 3
Seed Characteristics (63/65 responded): 83% ranked a 1-3.
Crop Rotation (62/65 responded): 29% ranked a 4, 48% ranked a 2 or 3.
Equipment (64/65 responded): 48% ranked a 4 or 5, 25% ranked a 2.

THURSDAY, OCTOBER 23
WORKSHOP #1
STAND ESTABLISHMENT

G same responses to i-Clicker Question #1.

1. **Why did you choose that answer?**
2. **What management practices are key to optimizing this factor**
3. **What do we know? What don't we know? Where does research need to go?**
4. **What is the least important factor of those listed and why?**

GROUP 1:

1. Uniformity of emergence requires uniform seed depth.
   Achieving the target population is challenging and can always be improved
2. Equipment can enhance:
   Residue management
   Seeding speed
   Drill setting
3. What is the reason for lower plant populations following pulse? Is it microbial?
   What factors will improve seed survival
   What caused the seeds to not emerge – dormancy?
4. Weed management; Seed characteristics - size

GROUP 2:

1. Seed/Placement/Depth – from information this morning
   Easy to mess up and hard to measure so we are lax about it across a number of fields
   Only look at 1 to 4 seeds in one field
   Sample size is way too small
   Small seed and it is hard to find
   One chance to get it right and can't change it later
   Relates to a lot of other factors: residue on opener, fertilizer, soil type
   Very important with currently used seeding rate
2. A lot more monitoring and checking needs to be done
   Farmers are asked to take an extra 30 minutes/field but also saying that early seeding is important
   Yields will vary with topography – what do you do with that data? How do you separate by field?
   Independent openers do a uniform job and it does not a long time to check on them
   Check in wheel tracks for some openers
   Some cool stuff in corn planters but it is costly
3. What do we know?
   Depth varies a lot
   Producers are not likely checking depth enough
   Do people know how to measure consistently? Probably not. There needs to be better tools and instructions

   What don't we know?
   How to accurately and consistently measure depth across fields and farmers

Impact of compaction and change by soil type
Research needed:
Trash whippers to move residue like ones on corn planters?
Seed depth prototype development
Seed and fertilizer separation
Space from seed to seed that is needed for crop uniformity
Impact of doubles and triples in SK and for canola and skip
Opener types and consistency of placement and separation with fertilizer
Automate seed depth-sensors? Coating with something detectable on it on few seeds per fields

4. Least Important factor
   Size is known and can be controlled/managed, but it needs proper management
   Variety, because a variety won't stay around if it doesn't perform well – all have a guarantee on it
   Characteristics
   Weed management, a lot less of an issue now than it was 5 to 10 years ago. It is now common practice
   All are important, and are easily controlled

GROUP 3:

1. Step 1 – Seeding into different residue or non-residue can affect depth. Planters and air drill guys like to buy equipment
2. Residue management often combine tilled versus no-till. Burning as a management. Air breaks to prevent seed bounce, did not see this effect on all openers. Seeding speed and openers are important. Occasionally speed may help in high moisture. Logistics trumps agronomy
3. Row spacing could have an effect
   Soil type can have an effect
   Huge improvements have been made with equipment
   Research is needed:
   Variable seeding depth to moisture?
   Packing pressure (variable is ongoing)
   How is speed variability affecting seeding depth?
   Can't buy experience, good operators may be scarce
   Perhaps some work on strip tillage
   Good understanding of how deep we can go under certain circumstances
   Control traffic farming?

GROUP 4:

1. Mother nature dictates more than we do
   Precipitation affects seedbed conditions
   Too much fertilizer impact is controlled by moisture
2. Timing of seeding over soil temperature as a decision making factor
   Making decisions based on soil moisture (depth, amount of fertilizer, etc.)
   Making decisions agronomic versus efficient
3. Why is there such a low emergence rates (we need to know)?

Were the decay organisms the cause or effect of the seed dying?
Weed management, rarely causes a large reduction in plant stand.

GROUP 5:

1. Equipment has influence on all above factors of stand establishment
   Many growers have made improvements
   Many growers don't calibrate drills, set depth, check, and random settings.
   Many growers set seeding speed based on when they need to finish
2. Rules on depth/speed should be replaced by individual management of each piece of equipment
   Current systems limited by speed
3. Interaction between conditions and specific equipment
   Difficult for agronomists to comment to growers, lawsuits
   Equipment manufacturers promote a piece of equipment, but there is no good independent information
   With new air seeders, it is difficult when something goes wrong
   We know there are so many variables, research is too difficult
   Current advice is to plan for 50% emergence, not everyone knows this
   Maybe not individual equipment, but maybe advice for seeder category
   Good data on what farmers are currently using
   Packing pressure for soil types for difficult conditions
   Interaction of soil conditions versus equipment
   Fan speed versus ground speed
   Different types of openers
   What circumstances should you go slower, type of equipment
   How to adapt seeding to current conditions
4. Operator experience
   Get out of the tractor and check
   Understanding equipment and show it handles straw management
   Gap in terms of information on equipment set-up for difficult conditions
   Shallow seeding is the most challenging
   Lots of equipment upgrades with new drills, very difficult to set depth
   Trend seems to be deeper, many seeding wheat and canola at the same depth
   We don't know how to give farmers advice for difficult conditions and to adjust
   Small plots not always representative need better field scale

GROUP 6:

1. There are huge issues, some to do with drill settings, and complicated with residue
   Pretty good at seed placement/depth, but not at residue management.
   Movement toward zero till equals more straw and more of a problem
   Current top issue:
   Increasing combine size
   Have choppers kept up with combine size?
   Increased density of chaff in same spot, especially with controlled traffic equals increased residue issue
   How do you assess current residue issue?

2. Management – combine!
   Need better residue spread to match, now at 40 feet and wind and hillside.
   Spreading chaff equals not enough mass to spread with current technology
   Spring – Look at row cleaners
   Options are not good. Burning is a last resort.
   Tillage options, don't want to go back on 2T.
   Openers – did you look at the opener choice in terms of your **own farm** residue management? Select for your soil type.
   How much residue is too much? How do we know?
   Look to increase rate of residue breakdown: possible microbial component and rotational effects on residue breakdown. Research on what will help increase residue breakdown and then perhaps decrease nutrient addition because of faster mineralization/breakdown
   Add at pre-harvest – something to increase rate of residue breakdown
   C:N – add urea after harvest, irrigate rapid residue breakdown (practiced in India)
   Develop equipment /adapt to this practice
   Find right bug to work at right temperature
3. We know – regarding issues; equipment limitations
   We don't know – how much is too much?
   U.S. has residue index – need to adapt this practice for Western Canada.
   How much emergence issues are due to residue issues. Determine: how much is too much residue, and then know when to confidently apply the "breakdown" product.
   Residue management from combine is better in other areas, need to adapt to our area.
   Want this enzyme to work even over winter – low temps. Need to put value/importance on residue
   Need to still keep straw to feed microbiomes. How much could we remove and still keep soil "happy"
   Work with soil test labs to determine value of straw
4. Research needs to look at possible enzyme breakdown.
   Also needs to look at equipment to do a better job of residue management.
   Make plants shorter to decrease the total amount of residue: genetics; and PGR's (Plant growth regulators), which will be an issue because consumers will not want "growth regulators" in their food
   Rotation – need to look at previous crop and its effect on the degradation of residue

WORKSHOP #2: EMERGING PESTS AND MANAGEMENT STRATEGIES

INTRODUCTION: EMERGING CANOLA MANAGEMENT OPPORTUNITIES

Keith Gabert, Agronomy Specialist, Central Alberta, South, Canola Council of Canada

Aster yellows became a pest in 2012 with over 60% infection. More is known about aster yellows than ever before

Blackleg resistance rated materials was so good that some growers have never seen it and/or have forgot how to look for it. It is starting to creep back.

Cabbage seed pod weevil started in 1998 in the Lethbridge area, which still remains a hot spot. It is responsible for more than 50% of field insecticide applications. Insecticide application is timed around flowering.

Clubroot was first identified in canola around the Edmonton area. There is not a large tool box to manage it; it is managed by resistant varieties and minimizing soil transfer.

Cutworms are difficult to predict, often it is not known where this pest is going to show up.

Flea beetles can occur in any field, in any year. It is a continual pest which needs to be scouted for.

Lygus bugs are a perpetual problem in Alberta and Northern Saskatchewan. They can do a fair amount of damage to a canola crop.

Sclerotinia can be found in any field and in any year; tends to be more prevalent in areas of high moisture.

Swede midge is an insect pest which is developing a larger footprint in Northern Saskatchewan. It is a significant pest in Europe, and can determine whether you will grow canola in an area or not. It is a major issue in Ontario.

Weeds – Liberty or Roundup works well against weeds. There are problem weeds that may alter management practices and there are issues of herbicide resistant weeds.

DEVELOPING PEST MANAGEMENT DECISION-MAKING PROTOCOLS FOR SWEDE MIDGE IN CANOLA

Dr. Rebecca Hallett, Associate Professor, School of Environmental Sciences, University of Guelph

The adult phase of the swede midge is relatively short lived: 1-3 days. Management of this pest is at the larval stage, and there are issues when it comes to getting enough product penetration to where larvae are feeding. Ontario has 4-5 overlapping generations of this pest; Saskatchewan has 2-3 generations. The pest is present all season long. There is a huge potential for population growth of the swede midge. It is difficult to control when populations are high and when plant stand densities are high; it requires intensive management.

The galling midge lays its very small eggs in clusters usually around a growing point of the plant. The larvae hatch and begin to feed on the plant tissue. After 1-3 weeks the larvae drop or jump down into the soil and tunnel to spin their cocoons and pupate. Adults emerge from the soil after 7-14 days, depending on climatic conditions. They can also enter into diapause cocoons to overwinter. This can happen all season long resulting in overlapping generations.

Damage is the direct result of larval feeding. Crops are attacked at the vegetative rosette stage, and when flower buds are produced. They can have a twisted effect. There can also be stunted pods gathered together in a bouquet effect. This pest can spread easily to economically damaging levels. Swede midge likes moist conditions and can establish and spread each year. Swede midge adults are weak fliers, but movement does occur, and natural spread to new plants does occur. Their only host is crucifers. There is a significant relationship between the number of pods and the presence or number of females of swede midge; there is a 43% reduction in pods with a 100 female infestation. Increase in swede midge population relates to multiple generations, suitable oviposition sites through all growth stages, pupae can overwinter and can be dormant for multiple years. Canola rotation which does not

include crucifer crops is an effective way to reduce swede midge populations in the field. A 3 year crop rotation is recommended.

Canola provides various suitable oviposition sites throughout the growing season. Swede midge likes to lay eggs on the very early bud stage, secondary and tertiary bud stages which are most vulnerable to damage. They prefer to lay eggs on the 7 leaf stage and early bud stage; spraying should be done around the 8-9 leaf stage. Two carefully timed insecticide sprays may be sufficient if applied at the right time. A possible parasitoid of swede midge may have been discovered in Saskatchewan. The insecticides, Coragen and Matador, have similar efficacy. Consistent results have been achieved with Matador. Coragen needs to be used with a surfactant. Swede midge is not limited by winter; it is not impacted by overwintering temperatures. The earlier canola is planted the better for managing swede midge. Tillage practices have not been successful in reducing swede midge populations; fall tillage needs to be studied further.

DISEASE MANAGEMENT

Dr. Gary Peng, Research Scientist, Agriculture and Agri-Food Canada, Saskatoon

Clubroot was discovered in Alberta canola in 2003; by 2007 there were severely diseased fields distributed around central Alberta. There are few reports of clubroot in Saskatchewan and Manitoba. Saskatchewan has reported incidences of clubroot and Manitoba only has recorded detection of the clubroot pathogen. Clubroot causes bulging on younger roots, but with heavy infestation there will be major symptoms. It can last 15-17 years in the soil. With high pH and moderate heat there will still be clubroot present even with fungicide application. It is very hard to time soil fungicide application. Prevention of introducing clubroot to noninfected areas is a key component in managing this disease. Soil carried by field equipment is the major reason for the spread of clubroot. The spread of clubroot can be reduced by 90% with power washing equipment.

The first resistant cultivar was very effective in managing clubroot, allowing fields with severe infection to grow canola again. Resistant varieties are all single gene-based and may be susceptible to being overcome. There is clear evidence that resistant varieties are being eroded in Quebec. Try to look for resistant source in 100 brassica species – 21 accessions with over 75% reduction in disease. There are 5 different pathotypes identified in Canada. Current testing is being done on 20 sources against a newly identified pathotype that is able to overcome the R gene. It may be a disease that there is no resistant sources for. There is a low diversity of resistant genes for clubroot. There have been found 2 resistant genes – Rpb1 and Rpb3.

In terms of management, crop rotation is questionable because of the long lasting spores in the soil, however; crop rotation may reduce inoculum slightly. It was shown that after a 2 year break of susceptible canola in highly infected soil, there was a 90% reduction in clubroot. The population remained stable for several years. It may be that the majority of spores dissipate over the first several years and the rest remain in the soil for a long time.

Reduction of disease increased productivity of resistant cultivars with a longer than 2 year break of susceptible canola. Early detection of clubroot is recommended followed by prevention of introduction, rotation of resistant cultivars, and a 2 year break in canola production in heavily infected fields.

The incidence of **blackleg** is starting to increase. There are not a lot of basal cankers being observed. Pycnidia are rare unless there are specific conditions. The base of the stem may need to be cut to see the blackening. For 10 years there have been very low levels of the disease, but it is starting to increase which may be due to the weakening of resistance. There are 15 resistant genes identified. An avirulent gene in the population will trigger when a resistance gene is identified. Across the prairie regions, the

patterns are similar: low incidence of AV 1, 3 and 9 will not work against the pathogen. The most common R gene found was Rim3, which will not be effective for the population here. Is quantitative resistance protecting against severe infection as it is not occurring and there is no effective resistance gene? Most fields with severe disease symptoms occur with all cultivars.

WEED MANAGEMENT

Dr. Hugh Beckie, Research Scientist, Herbicide-Resistant Plants, Agriculture and Agri-Food Canada, Saskatoon

There are 60 resistant weed biotypes in Canada. Wild oats is the most resistant weed, spreading at a huge rate to 38 million acres. Grasses make up a large portion of weed resistant biotypes, but they account for only 25% of weeds. Two most important groups are cleavers and the group 2 resistant wild mustard. The majority of growers are fighting herbicide resistant weeds at a cost between 1.1 and 1.5 billion dollars.

The most important weapon in combating herbicide resistant weeds in canola is good biological control. Glyphosate and glufosinate herbicides have effective modes of action in weed control in canola. Kochia is the only confirmed glyphosate resistant weed in Western Canada. There is multiple resistance to type 2. The first confirmed sites were in Southern Alberta in 2011 and there are now 7 counties with glyphosate resistant kochia. In Saskatchewan there have been cases from Swift Current to Rosetown; in 2013 there have been 17 cases of resistance in Saskatchewan. Glyphosate resistant kochia has been found in Roundup Ready canola. In Manitoba, there have been two confirmed cases of resistant kochia in the Red River Valley. In regards to glyphosate resistance, besides kochia, green foxtail and cleavers, wild buckwheat may be the ones to watch for.

Glyphosate has supplanted many of the current herbicides, it has greater efficacy than the combined next 12 chemistries. Mitigating resistance is important. The adoption of zero till, which is especially high in Saskatchewan, relates to higher use of herbicides. Weed seeds become concentrated on the soil surface where there is higher turnover and more resistance. Herbicide rotation has been recommended: but this practice has not been generally adopted with only 60% of growers implementing this over the past 6 years.

There has been some success in herbicide diversification with varying modes of action. Regardless of herbicide rotation; however, an important element in delaying resistance is rotation. There is a strong link between growers having resistance and having diverse crop rotations. Resistance is low in fall seeded and perennials crops. Perennials lower resistant weeds by driving down the seed bank.
Increased herbicide use results in increased selection pressure for herbicide resistant weeds. There is a need to develop systems that decrease the over-reliance on herbicides. All the tools will be needed to fight resistance; this includes the use of old herbicides. Stacking resistances may not help in the long term; the only long term solution is to reduce herbicide use. Government financial incentives may be required for growers. Eliminate chemical fallow as it is a breeding ground for glyphosate resistance. There is a need for better cover crops. A lot of resistance is due to non-target site resistance and increased metabolism, hopefully there will be a resurrection of cover crops. The use of equipment such as the Harrington seed destructor will be important, but its efficacy is debatable on weeds that shatter. Increased technology will be important: drones for mapping; “omics” used to identify genes involved in metabolism and RNAi to look at reverse glyphosate resistance.

Workshop #2: Emerging Pests and Management Strategies I-clicker Poll Summary

Number of attendees polled: 48

Question 1 (which sector of the industry do you represent) had no responses given/ no results captured

Question 2: In your opinion, which pest is currently most difficult for producers to manage in your region? 55/48 responses (+7)

(# of responses) category voted on

(16) Sclerotinia
(11) Herbicide resistant weeds
(7) Blackleg
(5) Soil-borne fungal complex
(4) Root maggot
(3) Swede midge
(3) Cabbage seedpod weevil
(2) Clubroot
(2) Cutworms
(1) Weeds
(1) Other
(0) Flea beetles
(0) Bertha armyworm

Question 3: In your opinion, which pest is contributing to the biggest yield loss in your region, year-after-year? 51/48 responses (+3)

(# of responses) category voted on

(28) Sclerotinia
(9) Weeds
(4) Blackleg
(3) Cabbage seedpod weevil
(2) Flea beetles
(2) Cutworms
(1) Soil-borne fungal complex
(1) Swede midge
(1) Bertha armyworm
(0) Herbicide-resistant weeds
(0) Other
(0) Clubroot
(0) Root maggot

Question 4: In your opinion, which pest issue should be a priority for more information/research to help with its management? 51/48 (+3)

(# of responses) category voted on

(14) Sclerotinia
(9) Clubroot
(8) Swede midge
(6) Blackleg
(5) herbicide-resistant weeds
(3) Root maggot
(2) Soil-borne fungal complex
(2) Cabbage seedpod weevil
(1) Flea beetles
(1) Cutworms

(0) weeds
(0) Other
(0) Bertha armyworm

Rankings of each pest on their priority for more research/information (1 being lowest, 5 being highest):

Herbicide-resistant weeds (48/48 responses): 50% ranked a 5
Sclerotinia Stem Rot (47/48 responses): 34% ranked a 5
Swede Midge (48/48 responses): 33% ranked a 5
Weeds (48/48 responses): 42% ranked a 4
Clubroot (45/48 responses): 33% ranked a 4
Blackleg (48/48 responses): 44% ranked a 3
Soil-borne fungal complex (47/48 responses): 43% ranked a 3
Flea beetles (48/48 responses): 33% ranked a 1, 29% ranked a 4
Root Maggot (48/48 responses): 46% ranked a 2
Cabbage Seedpod weevil (46/48 responses): 78% ranked 2 or 3
Bertha Armyworm (47/48 responses): 96% ranked 1

THURSDAY, OCTOBER 23
WORKSHOP #2
EMERGING PESTS AND MANAGEMENT STRATEGIES

Tablemates having same responses to i-Clicker Question #3.

1. **Why did you choose that answer?**
2. **What do we know? What don't we know? Where does research need to go?**
3. **What practices are key to managing this pest?**

GROUP 1:

1. New and emerging issue – important to understand, low understanding (sclerotinia)
    - Concern with insecticide solution
    - So many questions to be answered
    - Multiple overlapping generations
    - Unknown management
2. Temperature and moisture critical for emergence
    - Overwinter as larval cocoon, temperature larval – pupal; pupal – moisture trigger

GROUP 2:

1. CSPW (cabbage seed pod weevil)
    - Still under economic threshold
    - How accurate is it?
    - Does damage caused result in an entry point for disease?

Root maggot

- Past 5 years has increased
- Lack of treatment
- Overall effect and plant health
- Don't know enough about it
- Rotation, is that the most efficient management method?
- What can you do about them?

Risk Management

- How bad does it have to be?
- Thesholds?
- Beneficials?
- Increased incidence?
- Tired of saying there's nothing to do?
- What crops are more susceptible?
- HATE NOT having an answer – some growers blame varieties.

2. Research

Root maggot – treatment for root maggot. Need Something?

- Cycle of pest?? What are the numbers that cause yield loss?
- Are there areas more prone to infestation than others?
- Prevalent habitat?
- Stem size and seeding rate. Thinner stems are less susceptible
- Monsanto seed production – 1.5 kg/acres seeding rate and seeing high levels.
- Is a smaller root more susceptible to damage?
- Disease?

CSPW Numbers – lots of sap, but not finding insects
Time of sweeping?
How accurate are thresholds?
How accurate are scouting methods?
If there is sap, should I spray even if I am not catching weevils in net?
Timing of sweep/weather conditions.
First time – afternoon/sunny day – some
Next morning, cooler, cloudy – more
Tweaks to sampling method
Factors into analysis of thresholds

3. CSPW
Monitoring – early
Threshold – review
Spraying should be done early (pre-flowering) to protect bees
Matador

Root maggot
Rotation
Not much else….

GROUP 3:

1. Two resistant cleavers have become a problem in canola
Resistant wild oats (Barnyard grass)
BASF – herbicide portfolio
Understanding others' thinking around HR weeds
Discuss challenges
Following same fields year to year, tracking top 5 weeds
2. Resistant mechanisms – particularly wild oats.
Group 2 wild oats mainly metabolism. Now working on identifying non-target site genes
Need to do some/more molecular work
New initiative starting next year out of Quebec
Surveys are always needed
Continue to develop quick tests for turnaround (Jeff Scheonau)
Being able to test faster would be a big help.
Regulatory issues removed some herbicides (60% in Europe). Regulators need to keep an open mind on keeping tools available

Not known
Eg. Kochia gene flow, pollen flow and tumble weeds – How much seed do they drop? Resistance gene dispersal
A lot of work to be done on weed biology and ecology
Hard to get growers to buy in to herbicide resistance on their farm, sometimes an issue with workable options
HR summit in Washington, DC focused on socio-economics.
How do you make growers more proactive?
Human nature is to manage, once it is a problem
Have demonstrated cost effectiveness of proactive management
Losing use of one herbicide increases use of some of the others

2. Where does research need to go?
    Analyzing field to field spread
    Resistance mechanisms
        - Ability to genetically turn off resistance genes
        - How effective in large fields?
        - How robust long term?
        - Applications seem to be broad
        - Regulatory issues

CANOLA RESEARCH OVERVIEW/RESEARCH HUB

Barb Chabih, Program Coordinator, Communications, Canola Council of Canada
Taryn Dickson, Resource Manager, Crop Production and Innovation, Canola Council of Canada

The CCC's Canola Research Hub is the first of its kind and is a comprehensive resource for canola research. A guided tour of the website was provided. The *Canola Digest* is also publishing a science edition for ongoing research projects. This will aid in the reaching the strategic goal of 52 X 25.

The research hub is a library of all 31 Growing Forward 1 research projects. There is a basic search and an advanced search function. In the hub library the projects are grouped under 4 pillars of agronomic research: harvest management, IPM, fertility and plant establishment. Clicking on a pillar lists the research that falls under that pillar. Clicking on the online reference of a particular study provides more information and "Read More" provides a PDF version of the study. In the library, under advanced options, there are more specific search parameters such as: Principle Investigator, funding source, action plan, or organization. Different programs will be added.

- Research database results – provides visualization of the data
- Events and links – such as, *Canola Watch,* a weekly e-publication focused on research
- Upcoming industry events
- Industry links – provides additional information
- Webinars – upcoming and information on those that have already happened
- Digital media link – photo resources and video clip

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RESEARCH SUMMARIES

CANOLA AGRONOMIC RESEARCH (CARP) PROJECT REVIEW

Mitigating Blackleg Disease of Canola Using Fungicide Strategies

Ralph Lange, Program Leader, Feedstock Development and Microbial Bioproducts, Alberta Innovates – Technology Futures

The study looks at fungicides, combinations of fungicides and timing of fungicides in mitigating blackleg. Can fungicides be used as a control in resistance?

It is a randomized complete block design (RCBD) small plot study. It looked at Westar because it is totally susceptible and also looked at moderately resistant and resistant varieties. Fungicides included Headline, Tilt, and Quadris Application was just prior to bolting and later. There was heavy disease pressure. A study in 2011 found that blackleg in Westar was controlled by Headline, and Quadris around Carmen, MB; however, results differed from those in Vegreville. In 2012 results showed significant difference in lots of different products. Disease was severe in Vegreville, but significant reductions were seen. There was not much effect on yield. It is important to do at least six replicates and study larger plots. Split applications were not that effective. The data probably does not support going without a resistant cultivar. There was some effect on r and some mr variety that should be resistant and there was no effect on disease severity. The number of ascospores on a stem affects the disease severity of blackleg. Under 5 ascospores and above 25 ascospores there was no effect on reducing fungicide applications. Apply fungicides in the 6 to 24 ascospore section.

Would applying fungicide on the stubble reduce ascospore loads so that populations do not develop and increase and eventually become resistant to fungicide? With fungicides, susceptible varieties show more effect and there is some effect with moderately resistant and resistant varieties.

Meta-analyses of yields have not yet been done, but there should be a correlation.

GROWING FORWARD 2 (GF2) PROJECT REVIEW

Operational Models to Forecast Canola Growth Stage, Sclerotinia Risk, and Yield in Western Canada

Dr. Manasah Mkhabela, Research Coordinator, Weather INnovations Consulting
Andy Nadler, Agricultural Meteorologist and Western Canada Operations Manager, Weather INnovations Consulting

Weather plays an important role in sclerotinia in canola, although there are other factors as well. The goal is to understand this relationship to be able to better predict the risk of sclerotinia in canola.

Time lapse cameras were used to look at the germination of sclerotia and see how it relates to a disease model. Existing plots and existing studies were used as much as possible. There are also field scale trials going on in larger fields. In 2014 there were about a dozen sites in Manitoba with plans to expand west next year. Observations were made to determine what is going on inside the canopy. Air temperatures are cooler inside the canopy; midday has the greatest difference in temperature. There is also a difference in relative humidity; it is increased inside the canopy. What impact, if any, do these factors have on sclerotinia in canola? Three cultivars were looked at. Emergence of short season varieties was 2 days before medium and long season varieties. What effect does this have? The start of flowering is also 2 to 3 days ahead of medium and long season varieties. The late ripening between early and late canola varies between 16 and 19 days and makes it difficult for disease models and predictions for sclerotinia. Three disease models for each type of variety will benefit forecasting of sclerotinia. Comparing the three cultivars, it seems the short season variety had the highest incidence of sclerotinia.

Plans over the next three years include study trials into Western Canada and to work on provincial field surveys and disease progression. We will be looking for other collaborators and at provincial surveys.

GF2 PROJECT REVIEW

Partnership for an Innovative and Competitive Industry

Dr. Scott Jeffrey, Professor, Department of Resource Economics and Environmental Sociology, University of Alberta

The work being done in this study is motivated by the relationship between agronomic producers and ecosystem services. Beneficial management practices mitigate factors brought about by agronomic processes. Best management practices such as changes in crop rotation, and buffer areas around riparian zones have negative economic impact for growers. It appears there is an opportunity cost. It is important to look at the impact of these roles on the variability of risk for growers and technical efficiency measure.

In regards to crop yields, if certain amounts of inputs are applied, there is an expectation of a certain amount of output, but there is variability in this due to factors that are beyond control. The amount of inputs does not always give the expected output. The efficiency of a producer will affect output. Some producers get closer to potential yield than others and this could be due to managerial ability. What factors affect efficiency? What accounts for the difference between what expected and what actually occurred? What is related to technical efficiency and what is due to uncontrollable factors? Certain factors are statistically related to the efficiency of producers.

A survey of 650 producers in Western Canada was done to learn about managing practices in early 2012. General information was collected: age, education, soil zone, production practices, inputs and outputs of previous years. In general:

- There was a positive relationship between experience and technical ability
- There was evidence that reliance on off-farm income takes away from efficiency
- Hail insurance related to risk variables and risk attitudes
- BMP variables looked at things such as soil tests, adoption of nutrient planning and links to efficiency levels
- Greater N and P inputs resulted in greater variability of yields
- Greater S input lowered the variability of yields
- Precipitation increased variability of yield and timing of precipitation mattered

The average efficiency level was 62% relative to the best producer, and the average producer was about 40% less efficient. This was found to be more of a range than in other studies and may be a result of a 1 year data set versus multiple years and also because of an abnormal amount of precipitation.

More experience relates to greater levels of efficiency. Precision farming methods and nutrient management practices relates to greater efficiency. These BMP results in less fungicide wasted and runoff. Things that make growers more efficient are also good for the environment.

More data is needed and needs to be combined with the existing data. Stewardship practices, BMPs for buffer strips, shelter belts and rotations need to be looked at.

GF2 PROJECT REVIEW

Variable Nitrogen Fertility Management of Canola at the Field Scale, Based on Analysis of Yield Maps and Spatial and Statistical Variability of Soil Test Nitrogen and Phosphorous

Dr. Alan Moulin, Research Scientist, Science and Technology Branch, Agriculture and Agri-Food Canada, Brandon

Can variables be used to identify limiting factors in the field? There are tools that can pick areas in fields that have these limitations: looked at management zones. Field maps can be made for variable fertilization. The question remains as to how to make this technology work. Increase use of yield maps, guidance systems and field prescriptions. There are lots of elements for sustainability, track where in the fields inputs should go.

- Soil characteristics to identify soil management zones and test to determine recommendations for nutrients
- Grid soil sampling was dismissed because it was too expensive
- Landform analysis fell apart in clay soils
- Satellite images are still used
- Conductivity, ground based sensors are still used

The research is fundamental to agriculture, satellite images are to be used in combination with other technologies in developing management zones. Unmanned aerial vehicles (UAVs) are a hot topic in the U.S. and there is a lot of work to be done to give producers something that is useful. The research on UAVs is dependent on the sensors being used and variables of interest such as disease and insect damage and on software (images have to be stitched together). There are significant challenges on the technical side.

Data shows a general trend in fertilizer variable rate, there is a yield response but statistically there is not a lot of difference. There may need to be more field sites to provide statistical resolution in yield patterns. There is evidence that fields could be put into management zones based on nutrient requirements. There is an issue that growers do not have the equipment to apply the amount of fertilizer that they want to. There will be more field trials next growing season. Acknowledgement was given to Ken Coles and Don Cruickshank, and others.

CARP PROJECT REVIEW

Determining Best Practices for Summer Storage of Canola in Western Canada

Dr. Joy Agnew, Project Manager, Agricultural Research Services, Prairie Agricultural Machinery Institute

The vast majority of grain hauled out in the fall is designed for winter/spring storage, not for summer storage. The project came about as a result of massive crop and transportation issues. The area of concern is the capacity of air to hold moisture being dependent on temperature and can result in summer spoilage. The cooler the air the less moisture it can hold. Temperature gradients in storage bins could result in spoilage related to moisture migration. This did not happen. Winter storage: as cool air hits the side of the bin, the cool air will drop and rise up the center to the top of the bin. The opposite was expected in summer storage. There is not a lot of data of what actually happens inside the bin. The temperature gradient is going to cause issues. Minimize the temperature gradient from the edge of the bin to the centre by aerating or turning the canola to even out the temperature profile.

Three bins were filled last fall and frozen over the winter had sensors installed. It was a live feed showing temperature and relative humidity. Turning the bin helped even out the temperature profile with only 2 degrees temperature gradient. There was a warm edge, cold air further in and warm at the middle. In the turned bin, the core actually cooled. Only some of the seed was taken out and the hotter top flowed into the middle. Seed should be kept below 15 degrees. Aerated bins from July to September had core warming edges cooling, in October it was opposite. Top sensors showed that even though headspace was very hot, the grain 2 feet below was not hot. Relative humidity was low. Air and grain were dry so there was no spoilage. Bins that were both turned and aerated resulted in the most unstable conditions. The cold grain was right next to very warm grain which resulted in conditions that could lead to condensation. Based on this study it was found that it is very hard to re-hydrate canola. There was a lot of heat transfer in the bins but not a lot of moisture migration in the left-alone bin. Insulating factor of grain is a major benefit. There was no discernable difference between sunny and shady sides of the bins. These results were based on dry canola, if grain was around 10% moisture, there definitely could be more issues.

Recommendations were made for canola storage during the summer: keep it cool for as long as possible. The insulating effect of grain is important. You can leave it in the bin, but regular monitoring is recommended.

CLOSING REMARKS

In summary:

- 5% rule does make a difference
- Sclerotinia is still the number one pest of canola in the prairies
- There is room for improved efficiency among agronomic producers
- There is a need to understand efficiencies during a difficult year
- Every acre can be a research acre
- Collect all data even if there seems to be no value, it may be useful eventually
- Data quality is important, prioritize the data and put procedures into place to ensure that it is good data
- Variable rates can improve uniformity of crop but may not increase yield or decrease cost