Prairie Steward

Farming For Your Future Environment

The Newsletter of the Saskatchewan Soil Conservation Association Inc.

Spring Issue No. 60, 2011

Adapted Crop Plants

By Dr. Chantal Hamel
Agriculture and Agri-Food Canada
Semiarid Prairie Agriculture Research Centre (SPARC)
Swift Current, SK

Needle-and-thread and chickpea are among my preferred plants. The first amazes me by its elegance, wide distribution, and by the determination of its seeds to disperse. No wonder this plant was chosen as Saskatchewan's grass emblem; it is a great success of nature. Chickpea, in contrast, is very fragile and give producers hard time despite prayers and applications of herbicides, fertilizers, and up to five foliar applications of fungicides per growing season to control ascochyta blight. Chickpea amazes me because I am a research scientist, and researchers love problems.

The problem of chickpea might be its poor adaptation to our soils; needle-and-thread is perfectly adapted, highly dependable, and always beautiful. It is true that in the semiarid Prairie, drought timely kills the chickpea plant at the end of summer, which results in superior seed quality. But while this represents an opportunity for farmers, it is by no means evidence of adaptation.

Soil condition, along with climate, makes the difference between success and disappearance in unmanaged plant ecosystems. In cultivated fields, we are spending great effort and money to maintain crop plants in environmental conditions to which they are not adapted. But the poor performance of crop plants is becoming problematic at this time in the history of Earth, and the necessity to produce more crops with less impact dictates the re-evaluation of our way to grow plants. One way to increase the sustainability of agriculture is to reduce the dependence of plants on agrochemicals by using crops and genotypes well adapted to the environment where we grow them.

An environment is more than a set of temperatures and precipitations. The numerous microorganisms inhabiting the soil are an important part of a plant's environment. Some microorganisms are pathogenic and negatively impact plant performance, whereas many others are beneficial. They enhance plant growth in various ways, for example by producing growth hormones, reducing disease incidence, increasing plant tolerance to stresses, or helping plants capture water and soil nutrients. Beneficial effects lead to efficient use of resources by crop plants and negative effects by inefficient resource use. Interestingly, soil microbial quality is not a fixed parameter, but rather, it varies and fluctuates in response to environmental conditions, including the presence of a plant. Plants have a large influence on soil microorganisms and crops can trigger positive feed back, such as seen in successful rotation sequences, or negative feed back, for example, root rot build up in monoculture.

A negative feedback effect of chickpea on durum wheat was found in a field experiment conducted at the Semiarid Prairie Agricultural Research Centre (SPARC-AAFC) in Swift Current from 1999 to 2006 Kabuli chickpea. The poor yield of durum after a chickpea crop (Fig. 1) could not be explained by differences in soil water or fertility, as none were found. We hypothesized that previous crops modify the biological quality of the soils with impact of the following crop of durum wheat.

As chickpea crops had performed poorly, we chose this species as test plant; we would seek chickpea genotypes with beneficial influence on

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In This Issue

President's Message

By Doyle Wiebe, PAg
SSCA President

There is no doubt that 2010 will go down into the annals of history as one of the rarest of events for Saskatchewan farmers. For many to be actually weighing the risks of not being able to seed this coming spring, speaks to the changing times we have talked about being in for many years.

> **"We have built a well recognized name due to our practice of not limiting the dissemination of new technologies and information to only members."**

So too for the SSCA. As we reported last year that staff time was being cut back, that difficult decision was followed by another in August to fully eliminate the salaried executive manager position. There were further reductions of activities as some projects were completed and one postponed - i.e. we have been contracted to coordinate the fourth measurement of Saskatchewan Soil carbon to enhance the data used by the pending carbon trading system. The extreme soil moisture situation this fall did not allow for this to happen in the proper scientific manner that it would need to.

The board of SSCA has decided to focus our resources on three themes:
1. Technology transfer - to members and other farmers
2. Public awareness of soil/water/environment related issues
3. Public Policy development and advocacy

With our limited resources we are doing work in all three areas as these resources permit.

Our most formal technology transfer activities include this annual conference, the Prairie Steward newsletter, the E-journal along with email updates. We do hope to make better use of new electronic technologies including now traditional email - please provide us with your address - as well as social media like facebook and ?? (we'll see). The Crop Advisors

> **"To be the recognized driver and facilitator of change that leads to conservation agriculture being practiced on prairie agricultural land."**

Workshop did not happen last year, but we are looking at ways to make it happen again for both CCA's and farmers to attend/view.

As you know from being here the other major change for the association was changing our conference from a stand-alone 2 day event to this 1 day event during Crop Production Week. This event significantly reduced the resources we were having to provide to put the event together as well as take advantage of what we thought would be a larger base of participants. If we continue with this format it will disadvantage those from the southern parts of our province as we had been rotating between Regina and Saskatoon. However, the economics of putting on a stand alone event was going against us. We will still be attempting to provide opportunities for farmers from various regions of the province to participate in events that we put on.

Our newsletter the Prairie Steward will be undergoing some further changes as we try to make it more relevant and useful for our members. The transition of management to more director input delayed the last issue, but we do currently plan to still

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Direct Seeding Hotline
1-800-213-4287
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HEAD OFFICE

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(306) 695-4233 Fax: (306) 695-4236

Marilyn Martens, Office Manager

SSCA's mission is "to promote conservation agriculture systems that improve the land and environment for future generations."

SSCA's Vision is "to be the recognised driver and facilitator of change that leads to conservation agriculture being practiced on prairie agricultural land.

Getting Value from 'Variable Rate Fertilizers'

By Stewart Brandt
For Northeast Agricultural Research Foundation (NARF)

Precision farming is a term used to describe a group of technologies that allow farmers to control how they farm more precisely. They include things like;

-Reducing overlap of equipment and doubling up inputs

-Varying what is planted (variety and seed rate)

-Varying fertilizer nutrients or pesticides (kind and rate)

-Managing harvest operations to optimize quality

Precision farming offers huge potential to produce food more efficiently. Benefits include;

- Conservation of non-renewable resources of energy and fertilizer nutrients
- Reduced environmental impact of agriculture
- Less land needed for agriculture, leaving more for wildlife
- Lower cost for high quality food for consumers
- Economic benefits to equipment suppliers, consultants and other agribusiness
- Increased returns to farmers

With precision farming, costs go up so farmers must see the potential for higher returns to justify investing. Some aspects of precision farming like auto-steer and sectional controls on seeding, fertilizing and spraying equipment are easier to validate, and their acceptance is growing steadily. For others like variable rates, benefits are more difficult to verify and farmers are more cautious towards their adoption. Addressing this risk is the focus of a project being conducted by NARF (Northeast Agricultural Research Foundation) with funding support from the ADOPT (Agricultural Demonstration of Practices and Technologies) program.

ADOPT is a joint program of the Saskatchewan Ministry of Agriculture and Agriculture and Agri-Food Canada, whose purpose is to accelerate the transfer of knowledge to SK farmers and ranchers. NARF is a farmer directed organization headquartered at Melfort, SK whose objective is to develop, validate and demonstrate technologies that have value for farmers in north-eastern SK. NARF has been involved in evaluating how farmers can benefit from precision farming for more than a decade. The current project started in 2009 and is ongoing.

Six co-operating farmers in the Melfort-Tisdale area provided land for the project. Soil variability on these fields was evaluated and mapped, and revealed that some of these fields were quite uniform, while others were very variable. For example, soil organic matter on one field was between 7% and 7.5% while on another it varied from 3.5% to over 20%. Salinity was mapped on these fields as well, but only one had a small area where salinity was high enough to affect crop yield.

Soil maps along with cropping plans formed the basis for variable fertilizer rate maps developed for each field. This information was used to vary nitrogen (N) and in some cases phosphorus (P) rates across each field. Each field also contained at least one and preferably two no-N and fixed rate N strips. Maps containing the variable rate and check strip information were uploaded into the rate controller in the tractor cab. Co-operating farmers then seeded and applied fertilizer based on this map. Comparisons of yield between these strips and adjacent variable rate strips were used to evaluate benefits of the variable rate. At harvest, farmers calibrated their combine yield monitors before harvesting and mapping yields across these fields. After harvest, the yield maps were evaluated by the crop consultant who had mapped field variability and generated the prescription fertilizer maps.

There were a few 'growing pains' in 2009, with some equipment issues and the very late harvest that year. Despite this, most sites generated useable data, and considerable progress was made. The abnormally wet spring of 2010 presented a new set of challenges and in the end, only two sites were yield mapped. Others either weren't seeded or were abandoned as being too unreliable.

While the project is not progressing as rapidly was we had expected, progress is being made. Plans are to take what we have learned to date to refine the project for 2011. If the weather co-operates we expect to be much closer to finding the answer that has eluded us to date: Can variable rate fertilizer increase farmer profits?

Acknowledgements; Financial support provided by ADOPT, and Agri-Arm is gratefully acknowledged. The support provided by collaborating farmers in providing land and by Crop Pro Consulting in soil sampling, mapping and assistance in data interpretation was crucial to achieving progress to date and is gratefully acknowledged.

TOPsoil, the SSCA e-newsletter

The SSCA has been sending out a one-page e-newsletter this winter to update members on coming events and activities related to conservation agriculture. Marilyn Martens, our office manager has 80% of the e-mail addresses for SSCA members. We encourage members, who would like to receive TOPsoil to send your e-mail address to Marilyn at info@ssca.ca.

A total of six issues of TOPsoil have been published to date in September, November, December, January, late-January and March. We hope to send one more e-newsletter in April, before seeding. The e-newsletter is timely and has no printing or postage costs for the SSCA. However the Board has received no feedback from members about TOPsoil. Your comments on the content, frequency and format of TOPsoil e-newsletter would be most welcome. We would like to publish more stories from SSCA members in TOPsoil and the Prairie Steward.

Things we don't like doing, # 4: Cleaning out the sprayer tank

By Tom Wolf
Agriculture & Agri-Food Canada
107 Science Place, Saskatoon, SK
S7N 0X2 (306) 956-7635,
tom.wolf@agr.gc.ca

We all know the importance of cleaning out a sprayer tank and boom. It protects a sensitive crop. It protects people working with the sprayer. It protects the sprayer and its components. But cleaning the sprayer is a pain. Some herbicide label instructions are cumbersome, requiring many flushes with full tanks of water. Many applicators look for shortcuts and hope they get away with it. But it doesn't have to be hard guesswork. The following is a checklist that may help.

Be Prompt and Thorough

Remove pesticide from mixing and spray equipment immediately after spraying – it makes the job easier. The main areas of concern are the tank wall, sump, plumbing, and filters. First, spray the tank completely empty while still in the field. It's OK to cover previously sprayed areas – all herbicides must be crop-safe at twice the label rate to be registered by the PMRA. Reduce the rate to be certain. Second, add 10 x the sump's remnant of clean water, circulate, and spray it out in the field as well. Repeat. These two rinsing steps will take care of the majority of the cleaning and won't take very long. Having a clean water tank on the sprayer and a wash-down nozzle makes this job easier.

Visual Inspection

Herbicide residue may precipitate out of solution in some parts of the sprayer or plumbing. A thorough visual inspection can identify these problem areas and ensure that they are cleaned properly.

Tank Wall

Removal of residues from tank walls is best accomplished with a direct, pressurized spray. Make sure all parts of the wall have been in contact with clean water. Use a wash-down nozzle if it provides complete and vigorous coverage of the interior tank surface.

Sump

Empty the sump as completely as possible by spraying it out. Any spray liquid or herbicide concentrate remaining in the sump area will be re-circulated in the sprayer. In this case, the only way to remove the remaining herbicide is through dilution by repeatedly adding water and each time draining the sump as much as possible.

Plumbing

Plumbing can be a significant reservoir of herbicide residue. Removal from plumbing can be achieved by pumping clean water through the boom while ensuring that all return and agitation lines also receive clean water and all residue is flushed out. This may require opening and closing various valves several times, and repeating the process with new batches of clean water.

Dilution

The most effective use of a volume of rinse water is to divide it equally across several repeat washes. For example, a single 600 gal wash is as effective as two washes with 70 gallons each, and three with 30 gal each, assuming a 10 gallon sump remainder. More wash cycles allow for less water in total.

Filters

Nozzle screens and in-line filters can be a significant reservoir for undiluted or undissolved herbicide and are one of the most overlooked parts of sprayer decontamination. Remove all filters and nozzle screens and thoroughly clean these with fresh water. Run clean water through plumbing leading to the screens.

Nozzle Bodies

Multiple nozzle bodies may represent a source of concentrated herbicide. When cleaning a spray boom, rotate through all nozzles in a multiple body to ensure clean water reaches all parts of these assemblies. Remove screens that may have been used with herbicide, even if just for a short while.

Tank Cleaning Adjuvants

Adjuvants such as ammonia can assist the tank decontamination process. Ammonia does not neutralize herbicides, but it does raise the pH of the cleaning solution which helps sulfonyl urea herbicides dissolve. When decontaminating after use of an oily (EC) formulation, the use of a wetting agent such as AgSurf will assist in removing oily residue that may trap SU herbicide on tank and hose material. Commercial cleaners are available.

Rinsate Disposal

Always spray out the tank in the field. Do not drain the tank while stationary unless you are certain it is free of pesticide and that you are away from sensitive areas and waterways.

A new area of research that addresses this issue is biobeds. Biobeds contain a mixture of soil, compost, and straw which fosters microbes that are capable to degrading pesticides. Initial results show that placing dilute pesticide waste into biobeds breaks them down more quickly and prevents them from reaching ground waters more effectively than placing them onto soil.

Sprayer cleanout may never be the best job on the farm. But looking at it in a smarter way can prevent frustration and save time.

Math Anxiety: Fertilizer Calculations

By Dr. Robertson Mikkelson
Western North American Director
International Plant Nutrition Institute (IPNI)
Merced, California

This article was reprinted with permission from the January 2011 IPNI INSIGHTS newsletter.

YOU MAY KNOW people who suffer from math anxiety. They avoid situations where mathematics and calculations are required. However, avoiding math is simply not an option when working with agriculture. The International Plant Nutrition Institute (IPNI)... in cooperation with university specialists...has recently published a "how-to" workbook that presents commonly used mathematical concepts in agriculture. It begins with simple arithmetic and advances all the way to complex modeling. More details are available at the end of this newsletter.

Most of us do not use sophisticated math on a regular basis, but a review of commonly performed calculations will be the subject of this and future *INSIGHTS*. We'll start with some of common calculations that are made when dealing with fertilizers.

Fertilizer Notation

Commercial fertilizers are required to show on their label the minimum percentage of nutrients that the manufacturer guarantees to be present. The chemical analysis is composed of at least three numbers separated by dashes. The first number indicates the percent N, the second number indicates the percent P as P_2O_5, and the third number shows the percent K as K_2O based on weight.

The nutrient content of the fertilizer is indicated by these three numbers, but the tradition of using the oxide form of P and K can be a bit confusing and is set in fertilizer law. From the percent N value on the label, it is not obvious if the N is present as nitrate, ammonium, or urea. Similarly, the P in most commercial fertilizers is chemically present as phosphate (PO_4), but this number is mathematically converted to P_2O_5 equivalents for display on the fertilizer label. Potassium fertilizers are never present as K_2O, but the K present in the fertilizer is mathematically converted to reflect this chemical equivalent.

These conversions are done by comparing the ratios of molecular weight between them.

Some common questions regarding solid fertilizers can be answered with relatively simple math. Here are a few examples.

Converting K to K_2O and K_2O to K:
K = 39 g/mole K_2O = 94 g/mole
(39 + 39)/94 = 0.83 lb K/lb K_2O 94/(39 + 39) = 1.21 lb K_2O/lb K
Converting P to P_2O_5 and P_2O_5 to P:
P = 31 g/mole P_2O_5 = 142 g/mole
(31+ 31)/142 = 0.44 lb P/lb P_2O_5 142/(31 + 31) = 2.29 lb P_2O_5/lb P

How much actual N, P, and K are contained in 200 lb of 10-20-10 fertilizer?	
10% N x 200 lb = 20 lb N	
20% P_2O_5 x 200 lb = 40 lb P_2O_5	40 lb P_2O_5 x 0.44 = 17.6 lb P
10% K_2O x 200 lb = 20 lb K_2O	20 lb K_2O x 0.83 = 16.6 lb K

How much fertilizer is required to replace the nutrients removed in 5 tons of switchgrass?
One ton of harvested switchgrass removes 22 lb N, 5 lb P, and 48 lb K
Nitrogen:
22 lb N/ton x 5 ton = 110 lb N removed
Phosphorus:
5 lb P/ton x 5 ton = 25 lb P then convert P to P_2O_5 25 lb P x 2.29 lb P_2O_5 /lb P = 57 lb P_2O_5
Potassium:
48 lb K/ton x 5 ton = 240 lb K then convert K to K_2O 240 lb K x 1.21 lb K_2O/lb K = 290 lb K_2O

What is the nutrient content of a blend of 50 lb of 11-52-0 (MAP) and 50 lb 13-0-44 (KNO_3)?
In the final blend, the 50 lb of MAP will contribute 5.5 lb N and 26 lb P_2O_5. The 50 lb of KNO_3 will contribute 6.5 lb N and 22 lb K2O.
The final 100 lb blend will contain 12 lb N, 26 lb P_2O_5 and 22 lb K2O.
The composition of the fertilizer blend will be 12-26-22.

How much fertilizer material is needed for a 50 lb N/A preplant application on 6 acres using urea as the N source? (Fertilizer analysis for urea is 46-0-0).
50 lb N/A x 6 A x 1 lb urea/0.46 lb N = 652 lb urea required for the 6 acres

Liquid Fertilizers

Liquid fertilizers are labeled based on the nutrient content in 100 lb of material. These values are calculated the same as with dry fertilizers. However, fluid fertilizers are commonly applied based on their volume (gallons of material) instead of their weight. Converting from a weight of liquid (pounds or tons) to a volume (gallons) requires knowledge of the liquid density. **Density is defined as the mass of material divided by the volume.**

For example, if a 5 gal bucket of fluid fertilizer weighs 60 lb, the density is 60 lb/5 gal = 12 lb/gal. It is important to precisely measure both the volume of the container and the weight of the added fertilizer (without including the weight of the container).

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ADAPTED CROP PLANTS ... CONTINUED FROM PAGE 1

the biological quality of the soil while testing our hypothesis. Genetic variation in the ability of plants to use soil microbial resources would allow the selection of crop varieties with reduced dependence on agrochemicals. With this in mind, we first tested that chickpea genotype influences soil fungal diversity and microbial biomasses. At the same time, we documented the soil microbial resources available for dryland agriculture in Swift Current, SK. Four chickpea genotypes with contrasting phenotypes were evaluated under field conditions.

These chickpea genotypes were grown in 2 m x 10 m field plots at the South Farm of SPARC. The soil, a Brown Chenozem with a silt loam texture, an organic carbon content of 20 g kg^{-1}, and a pH ($CaCl_2$) of 6.8, was planted with wheat the previous year. The four genotype treatments were repeated four times in complete blocks. Seeds were placed 4 cm deep using a hoe press drill equipped with C shanks, side band openers, fertilizer boxes, granular *Rhizobium* inoculant box (5.5 kg ha^{-1} of Nitragin GC®) and a seed splitter, on 10 May 2005 and 6 May 2006. Row spacing was 25.4 cm. Seeding rates were determined based on pre-seeding germination tests, targeting a plant density of 40 plants m^{-2}. Seeds were treated with carbathiin, thiabendazole, and metalaxyl, as per manufacturer recommendations. All plots received a blanket application of 0-45-0. Weed control was achieved using a previous fall broadcast application of ethalfluralin, a pre-seeding burn-off treatment with glyphosate and in-crop application of sethoxydim at mid-seedling stage, all as recommended by manufacturers. Ascochyta blight was noticed on the chickpea crops at the mid- to late-seedling stage, and controlled by two foliar applications of chlorothalonil (Syngenta Crop Protection Canada, Inc.) at 0.5 - 0.65 L product ha^{-1} and pyraclostrobin (Bayer Crop Science, USA) at 0.6 - 1.0 L product ha^{-1}.

Root and rooting soil were taken directly on the plant row at harvest, using a hand corer (2.5 cm diameter x 7.5 cm length). Four cores were taken and pooled to produce one sample per plot. The soil was sieved through 2 mm before determining the structure of the soil microbial community and identifying the fungi in contained, using various protocols.

Most of the cultivable fungi found belong to taxonomic groups hosting several dark septate fungal species. These dark coloured fungi grow inside plant roots asymptomatically, and we know that some of them improve plant tolerance to drought. We detected as many as 17 species of the beneficial AM fungi, at the study site. These 17 species belong to three different Orders of the Glomeromycota, showing that AM fungi diversity in intensively managed agricultural soils may be larger than initially thought.

We found Desi chickpea CDC Anna associated with an abundant fungal and bacterial flora. This cultivar was associated with numerous AM fungal species and with species of the genera, *Bionectria* and *Trichoderma*, which are taxonomic groups renown for the biocontrol activities of some of their species. The roots of CDC Anna also had higher AM fungal colonization level, as compared to the three Kabuli genotypes we also examined, and CDC Anna seemed also to increased soil bacterial biomass. CDC Xena was associated with numerous species of the genus *Penicillium*, which are known to produce antibiotics and antagonize other soil microorganisms, whereas the abundance of various *Fusarium* species associated with root rot characterized the fungal community in plots of CDC Frontier.

Our observation suggests that cultivated Prairie soil host a great deal of microbial diversity including species that naturally improve plant fitness, but also pathogenic species that can negatively impact crops. This leads us to think that selecting crop genotypes for compatibility with the beneficial portion of the bioresources present in cultivated soils of the Prairie would reduce the dependence of crops on agrochemicals and change the tone of prayers rising from the Prairie.

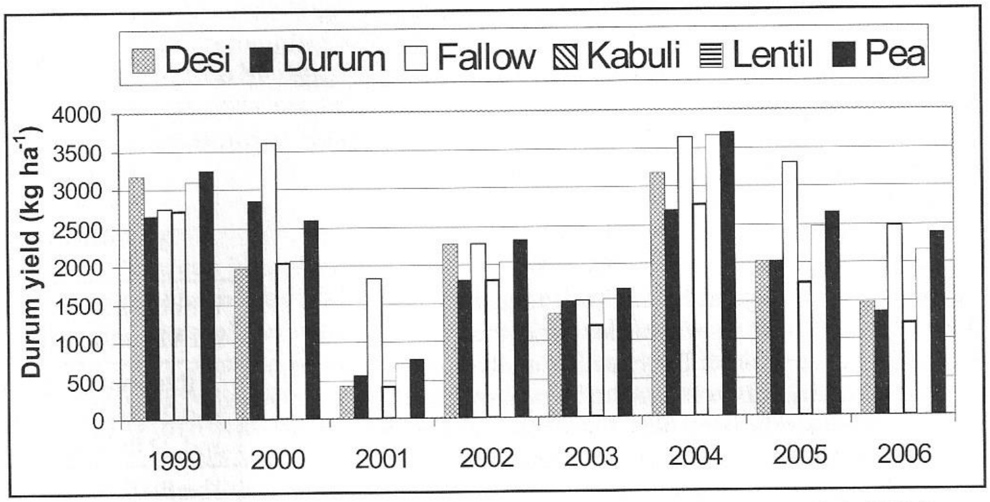

Fig. 1. A preceeding crop of pea increased durum wheat yield, at SPARC-AAFC, in Swift Current from 1999 to 2006. Durum after pea even out-yielded durum on fallow in some years. Kabuli chickpea before durum sometimes led to worse yields than durum after durum. Desi chickpea was a better preceeding crop for durum. All the yield data shown here are from an field experiment where the 3-year rotations (fallow - test crop - durum) were continuously grown in the same plots.

In collaboration with the University of Saskatchewan and the Graduate School of Kyoto Prefectural University, we are now working at improving the adaptation of chickpea to our soils. We are deciphering chickpea signals to soil fungi in an attempt to manipulate these signals in a way to improve chickpea compatibility with beneficial microbial groups and reduce compatibility with root rot organisms. We are also looking at how chickpea genotypes and foliar fungicides, which are abundantly used in the control of Ascochyta blight, modify the soil microbial community and impact a following crop of durum.

Alabama Precision Ag Extension website

By Garry Noble
1st VP, SSCA

If your are searching the net for the latest, unbiased information on precision agriculture technology go to www.aces.edu/anr/precisionag/index.php

Dr John Fulton and the precision ag team members from the Alabama Cooperative Extension System and Auburn University have a website with the latest extension publications and presentations for farmers. The publications are written for a farmer audience and feature current links to manufacturers websites.

Automatic Section Control (ASC) Technology for Agricultural Sprayers is a 5-page publications updated in December 2010. A study by Auburn University found input savings of 2 to 12%, with an approximate average of 4.3% within a field using ASC technology alone. The highest benefit was found in small, irregular shaped fields. Combining ASC and a guidance system was estimated to result in savings in the 20-30% range.

The four components of the ASC system are: GPS receiver, spray controller, section control mechanism and wiring harness/cabling/ECU/ etc. The number of control channels on a sprayer controller, with ASC capable software will limit how many sections or nozzles can be independently switched ON or OFF. There are six items listed under the calibration and other considerations section.

This publication has a partial list of companies providing ASC technology. The company name, system name, no. of section controls and website are given, saving you time when you are researching a purchase or making comparison. Most of the company and system names will be familiar to precision ag users in Western Canada.

Considerations for Adopting & Implementing Precision Ag Technologies is a new 2-page bulletin published in October 2010. There are nine guidelines listed for farmers getting started with precision agriculture. Issues to consider are: operational needs, service, compatibility, upgrades, moving monitors, data collection and storage, installation and implementation time, and accuracy requirements. Guidance systems and ASC are identified as precision ag technologies with quick and tangible benefits to farmers.

Guidance Systems: Implement Guidance Solutions, a 3-page publication released in November 2010, will be of special interest to farmers planning or practicing seeding-between-the-rows. The difference between passive and active implement guidance is explained. Passive systems are more popular, and less expensive, but the tractor must steer the implement. Active systems guide the implement independently of the tractor. Lists for suppliers of passive and active systems include the manufacturers name, system name, compatible guidance system and comments.

If you have ever worn a seatbelt to spray, seed or combine, then Guidance Systems: Terrain Compensation is a must read. This 3-page ACES publication was posted in November 2010. Roll, pitch and yaw can occur on field slopes but inertial sensors can maintain GPS position. Six manufacturers and their terrain compensation technology are listed for the benefit of those shopping for guidance systems.

Precision Agriculture: Commonly Used Terms & Applications (August 2010) translates precision ag to English and explains what all those acronyms mean in six pages.

Did you know an adapter cable may be all that is required to use GPS ground speed, rather than transmission or ground speed radar to provide ground speed data for controllers? Using GPS as a Source for Ground Speed Radar Inputs (September 2010) explains how GPS receivers convert numeric ground speed to pulse output for equipment controllers. The two-page bulletin list manufacturers, websites, product names, and output connections (adapter cable).

Sensor-Based Variable Rate Application for Cotton Saskatchewan farmers wear cotton, we don't grow it. However, skip this October 2010 publication and you miss the latest discussion on sensor- versus map-based input application. Learn more about sensors, vegetative indices, rate controllers, tuning, nozzles, rate changes, prescriptions and nitrogen application in 8 pages.

Management Zones I and II (February 2011) offers information to update your knowledge or adopt site-specific management on the farm. The process of management zone delineation and the most common data layers used are listed. A list of typical ag inputs suitable for VRA (seed, fertilizer, herbicides) is given and the data used to delineate management zones for each is provided. The key considerations when implementing a management zone delineation strategy are given.

The Alabama Precision Ag Extension website has sections on presentations given by staff, and under other resources, has some manuals and help guides for precision agriculture technology.

We would like to thank Dr. John Fulton, Associate Professor and Extension Specialist at Auburn University for giving the Prairie Steward permission to publish the link to the Alabama Precision Ag Extension website.

Straight-Combining Canola in Saskatchewan: Cultivar Considerations and Pod Sealants

Chris Holzapfel, MSc PAg
Indian Head Agricultural Research Foundation

The predominantly recommended and preferred practice when harvesting canola is to swath when 40-60% of the seeds have changed color; however, there is interest in straight-combining and an appreciable number of producers on the Prairies do so successfully on regular basis. Recent research in Saskatchewan revisited straight-combining canola with a focus on evaluating varietal differences in shattering resistance and the potential for pod sealants to reduce risks and increase yields in straight-combined canola. Field trials funded by SaskCanola and the Agricultural Demonstration of Practices and Technologies (ADOPT) program were completed over the 2009 and 2010 growing seasons at Indian Head, Melfort, Scott and Swift Current. Five cultivars were harvested using one of four harvest management treatments and evaluated for seed yield, yield loss due to shattering and seed quality. The varieties were four *napus* hybrids (InVigor® 5440, 4362 RR, 45H26 and InVigor® 5020) and one open-pollinated canola quality *juncea* (XCEED® 8571). The four harvest treatments were: 1) swathed, 2) straight-combined with no pod sealant, 3) straight-combined with Pod Ceal DC® and 4) straight-combined with Pod-Stik®. Both sealants were applied with 20 imperial gallons per acre of solution when approximately 30-40% of the pods had changed color but were still pliable and not brittle. Pod Ceal DC is an organic turpene polymer, or pine resin, that regulates moisture movement and reduces pod contraction and expansion by allowing moisture out of the pod but not into it. Pod-Stik is a latex polymer that does not affect moisture transfer through the pod but provides physical reinforcement as the seeds mature inside. Our objectives were to evaluate 1) the importance of cultivar selection when straight-combining canola, 2) the ability of commercial pod sealants to reduce shattering losses and increase yields in straight-combined canola and 3) the overall feasibility of straight-combining canola.

The targeted harvest date for the straight-combined canola was as soon as the seed was mature and had dried to 10% seed moisture content; however, wet weather delayed harvest past the optimal stage in some cases, notably Melfort in 2009 and Indian Head in 2010. Nonetheless, this wide range of environmental conditions allowed us to evaluate both the risks and potential

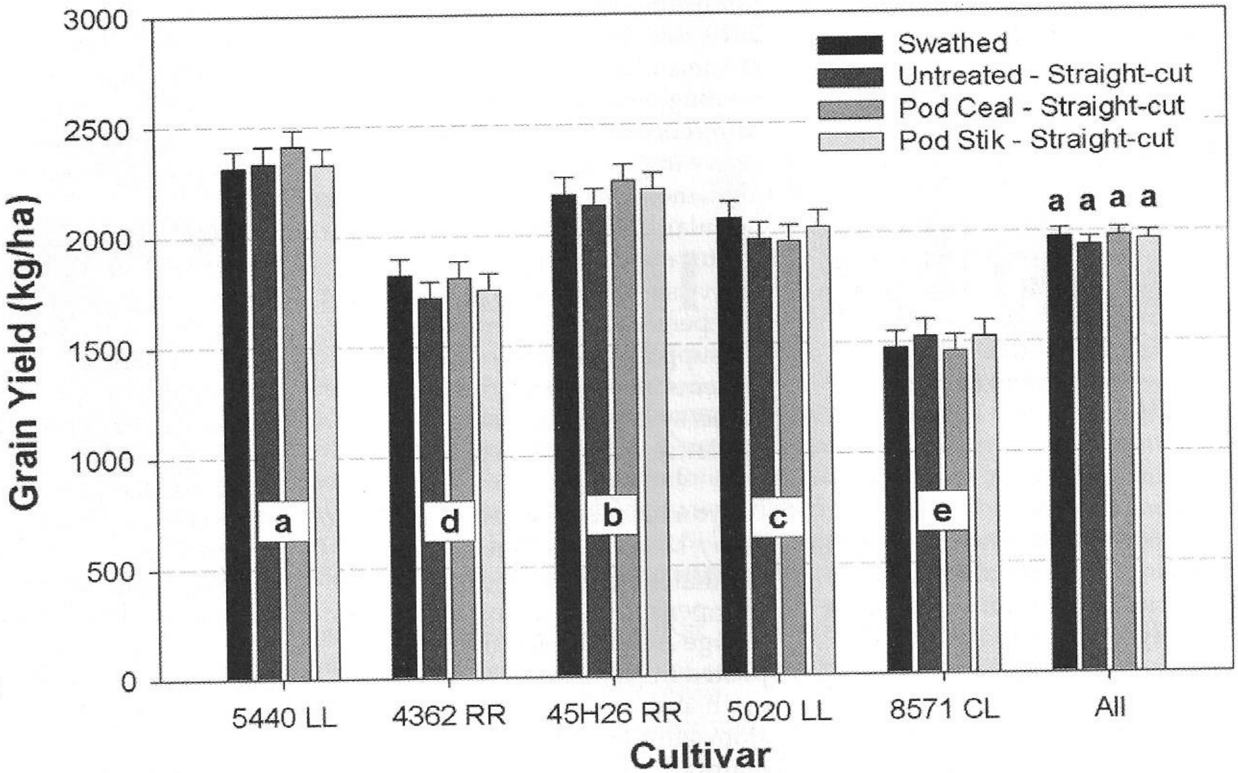

Figure 1. Cultivar and harvest treatment effects on canola yield. Results are averaged across eight site-years, error bars represent standard errors of the means and main effects with the same letter are not significantly different from one another (*P* = 0.05).

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MATH ANXIETY: FERTILIZER CALCULATIONS
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A complicating factor in determining fertilizer density is that most liquids become more dense in cold temperatures and less dense (expand) in warm temperatures. Luckily, these differences are relatively minor at the temperature range of most agronomic operations.

The density of a liquid is measured by floating a hydrometer in the material. This instrument provides a measurement of "specific gravity", which is the ratio of the fertilizer density and water density. Once the temperature-corrected density of water is known, the density of the fluid fertilizer can be calculated. There are also published tables available that show these density coefficients for various fluid fertilizers.

How many pounds of N, P2O5, and K2O in 200 gal of ammonium polyphosphate (10-34-0) fluid fertilizer? (use a density of 11.65 lb/gal)
200 gal x 11.65 lb/gal = 2,330 lb fertilizer
2,330 lb x 10% N = 233 lb N
2,330 lb x 34% P2O5 = 792 lb P2O5 No K2O present.

How much N is present in 250 gal of UAN liquid fertilizer (32-0-0) at 40 °F compared to 80 °F?
Note: the density is 11.12 lb/gal at 40 °F and 10.99 lb/gal at 80 °F.
40 °F: 250 gal x 11.12 lb/gal = 2,780 lb; 2,780 lb x 32% N = 890 lb N
80 °F: 250 gal x 10.99 lb/gal = 2,747.5 lb; 2,747.5 lb x 32% N = 880 lb N
(This 32.5 lb change in the weight of UAN represents a 1% change in density when the temperature is corrected.)

How much fertilizer should I apply?

How many pounds of K2O are present in 1 ton of liquid potassium thiosulfate (0-0-25)? How many gallons? (use a density of 12.2 lb/gal)
1. One ton of liquid is 2,000 lb; 2,000 x 25% K2O = 500 lb K2O
2. 2,000 lb x 1 gal/12.2 lb = 164 gal

To determine the amount of dry fertilizer to apply, the nutrient recommendation (usually given in lb/A) and the nutrient content of the fertilizer must be known.

How much DAP fertilizer (18-46-0) should be added for a fertilizer recommendation of 70 lb P2O5/A?
70 lb P2O5 x 100 lb DAP/46 lb P2O5 = 152 lb DAP
Since DAP contains 18% N, the 152 lb DAP will also provide 27 lb N (152 x 0.18)

Calculating the quantity of fluid fertilizer to apply may require an additional step to convert the weight of the fertilizer to gallons of product delivered to the field.

How many gallons of UAN (28-0-0) are required to supply 150 lb N? (use a density of 10.7 lb/gal)
1. 150 lb N x 1 lb UAN/0.28 lb N = 536 lb UAN
2. 536 lb UAN x 1 gal/10.7 lb = 50 gal

How much does it cost?

Fertilizer prices are usually provided in costs per ton (2,000 lb) of material. Fertilizer prices are occasionally given in price per pound of N, P2O5, or K2O and not as a specific fertilizer product. The "per pound" terminology is sometimes referred to as a "unit". Without close attention, this difference in pricing and terminology can be confusing. •

If N fertilizer is sold at $0.65/lb, what is the price per ton of urea (46-0-0)? What is the price per ton of ammonium sulfate (AS, 21-0-0-24)?
1. $0.65/lb N x 0.46 lb N/ lb urea = $0.30/lb urea $0.30/lb urea x 2,000 lb/ton = $600/ton
2. $0.65/lb N x 0.21 lb N/lb AS = $0.14/lb AS $0.14/lb AS x 2,000 lb/ton = $280/ton

What is the price of a pound of N if a ton of UAN (32-0-0) costs $500? What is the cost of N in one gal of UAN? (use a density of 11 lb/gal)
1. 2,000 lb UAN x 0.32 lb N/lb UAN = 640 lb N $500/640 lb N = $0.78/lb N
2. 2,000 lb UAN x 1 gal/11 lb = 181.8 gal 640 lb N/181.8 gal = 3.5 lb N/gal 3.5 lb N/gal x $0.78/lb N = $2.73/gal

Beyond the Beginning –The Zero Till Evolution

By Garry Noble
1st VP, SSCA

The Manitoba- North Dakota Zero Tillage Farmer's Association released their 3rd zero-till production manual in February 2011. The 60-page manual, reflects the progress made in zero-till and the long-term benefits, now being realized under this farming system. Beyond the Beginning has 9 chapters which cover: soil biology, role of crops, cover and cover crops, selecting cover crops to improve soil health, organic no-till, fertility issues, carbon management, equipment, pest management, and economics.

The chapters are a blend of farmer experiences and scientists knowledge, which covers each topic from a different perspective.

Soil Biology – There is a growing appreciation for the importance of the soil food web in zero-till. The diversity and impact of fungi, bacteria, mites, algae, nematodes, and earthworms on soils and crops is covered. There is a striking photograph of corn growing on plots which received a soil fumigant and untreated plots. The soil fumigant eliminated the population of the beneficial vesicular-arbuscular mycorrhical (VAM) fungi. Corn yields were reduced compared to the untreated plot, in spite of adequate soil P and side-banded P fertilizer. There is a section on Building a Soil Habitat which suggests how farmers might use cover crops to fill the root zone and provide a diverse food source for soil microorganisms.

Role of Crops, Cover and Cover Crops – Choose the right crop sequence and the synergism between crops can boost yields. Pick the wrong crop rotation and yield loss in the subsequent crop may be explained by crop antagonism. Learn what glomalin is, why it is important and why perennial crops increase glomalin in soil. Cover crops in rotation can mimic a perennial system by providing living roots to sustain soil microorganisms. Scavenging and storing nutrients after the main crop has been harvested is another benefit. In southeast North Dakota, the Conservation Cropping Systems Project has overcome the short growing season for cover crops by no-till seeding cover crops into winter cereal stubble after harvest. Researchers at Mandan are under-seeding oats with hairy vetch, red clover and alfalfa to provide fall grazing for cattle after the oats are cut and baled.

Selecting Cover Crops to Improve Soil Health –Jay Fuhrer, district conservationist NRCS in Bismarck, challenges no-tillers to change their cropping and grazing habits to include cover crop for the improvement in soil health on their land.

Organic No-till- No this is not a misprint, early research trials in Manitoba and North Dakota are finding no-till can be practiced, without fertilizers and pesticides. University of Manitoba scientist, Martin Entz, states establishing a weed-suppressing mulch and growing very competitive crops are required for success with organic no-till.

Fertility Issues – Apply fertilizers from the right source, at the right place, at the right time and the right rate to optimize fertilizer efficiency. Weather and the biology of long-term no-till soils can make predicting the right rate challenging. Reducing fertilizer rates is possible on long-term no-till land where higher soil organic matter levels have increased the available mineralizable N. Crop demand and soil supply are key to determining fertilizer rates. Greenseeker sensor technology, revised N recommendations, the fate of P in soils and the impact of long-term no-till on soil fertility and crop yields in this chapter. Biological fertility with composted livestock manure, green manure crops and compost teas completes this chapter.

Carbon Management – Soil life relies on carbon as an energy source. Carbon accounts for 58% of the make-up of soil organic matter. Plant roots are the principal players in the processs of inputting and building soil organic matter. Soil fungi thrive under no-till, obtaining carbon from plant roots and producing glomalin, which stabilizes soil aggregates and stores carbon. Building soil organic matter can reduce the greenhouses gases: carbon dioxide, nitrous oxide and methane.

Equipment – The chapter covers harvesting, seeding and spraying operations but also includes producer experience with precision farming technology. The design of seed openers has been refined with time and experience. The results of a four-year four-opener study of openers at Aneroid conducted by Eric Oliver, former SSCA staffer are presented. Tom Wolf, AAFC researcher (and SSCA director) provided the expert advice for the section on selecting spray equipment. Dwayne Beck SDSU Dakota Lakes Research Farm shares his advice on Working in Wet Soil.

Pest Management – Five key management practices of IPM are presented: rotation design, diversity within the life cycle of crops, no-till, crop residues on the soil surface and competitive crop canopies. A systems approach can be very effective in reducing weed pressure. Weather will determine disease pressure, but a diverse no-till rotation can mitigate the risk. On-line crop disease forecasting models are useful management tools. Prevention is the first step to reduce the pesticide resistance from developing on your farm.

Economics – The steps to building an environmentally sustainable farming system with no-till lead to a more economically sustainable operation.

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benefits of straight-combining canola. Averaged across site-years, yield differences were observed between cultivars but not harvest treatments (Fig. 1). There were no interactions between cultivar and harvest treatments, meaning that each of the cultivars was affected by the harvest treatments in a similar manner.

Table 4. Type 3 tests of fixed effects on canola yield at Indian Head, Scott, Melfort and Swift Current (2009-2010) and mean responses to harvest treatments in canola.

Source Treatment Contrast	**Indian Head** **2009**	 **2010**	Scott **2009**	 **2010**	Melfort **2009**	 **2010**	**Swift Current** **2009**	 **2010**	**All Sites‡**
	P values								
Site-Year (S)	–	–	–	–	–	–	–	–	**<0.001**
Cultivar (C)	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**<0.001**	**0.004**	**<0.001**
Harvest (H)	0.289	**<0.001**	**0.006**	0.448	0.072	0.091	**<0.001**	0.985	0.706
C × H	0.867	0.862	0.534	0.749	0.717	0.445	0.095	0.581	0.892
S × C	–	–	–	–	–	–	–	–	**<0.001**
S × H	–	–	–	–	–	–	–	–	**<0.001**
S × C × H	–	–	–	–	–	–	–	–	0.900
	Least Squares Means (kg ha⁻¹)†								
Swathed	3033^{a}	2556^{a}	2788^{b}	2365^{a}	1508^{a}	1492^{a}	788^{b}	1285^{a}	1977^{a}
Untreated	2914^{a}	2078^{b}	3117^{a}	2607^{a}	1181^{a}	1380^{a}	937^{a}	1295^{a}	1939^{a}
Pod Ceal DC	2882^{a}	2175^{b}	3169^{a}	2567^{a}	1225^{a}	1583^{a}	954^{a}	1271^{a}	1979^{a}
Pod Stik	2904^{a}	2030^{b}	3190^{a}	2495^{a}	1291^{a}	1610^{a}	898^{a}	1298^{a}	1965^{a}
SEM	72.5	98	114.9	125.3	91.2	115.7	18.9	54.9	36.6
	Contrasts								
Swathed vs Straight-Cut	0.061	**<0.001**	**<0.001**	0.146	**<0.001**	0.688	**<0.001**	0.964	0.605
Untreated vs Treated	0.772	0.804	0.554	0.583	0.497	**0.014**	0.630	0.879	0.320

†Mean values within a column are not significantly difference from one another if followed by the same letter (Tukey's; $P = 0.05$)

While average yields for the individual site-years ranged from 894-3066 kg ha^{-1}, the relative performance of the cultivars was similar and their overall ranking was consistent (5440 = 45H26 = 5020 = 4362 = 8571). Averaged across site-years, grain yields were identical for each of the harvest treatments, but yields for the individual trials differed between swathing and straight-combining 50% of the time. Higher yields were achieved with swathing 25% of the time and straight-combining was better the other 25% where a difference was observed (Table 1). At Scott and Swift Current in 2009, straight-cut yields were 371 kg ha^{-1} (13%) and 142 kg ha^{-1} (18%) higher than swathed yields, respectively. In contrast, at Melfort in 2009 and Indian Head in 2010, straight-cut yields were 461 kg ha^{-1} (18%) and 276 kg ha^{-1} (18%) lower than swathed yields. In the latter two cases, the yield losses with straight-combining can likely be explained by the fact that, in both cases, harvest was postponed well past the optimal stage by wet weather and crop was exposed to excessive wind and precipitation while mature. At Melfort (2009), large quantities of snow fell in early October and delayed harvest until mid-November while at Indian Head in 2010, frequent rains throughout harvest delayed combining by approximately 10-14 days past the optimal stage. In the cases where straight-combining resulted in higher yields relative to swathing, very little shattering had occurred prior to harvest and, at Scott (2009), seed size was larger in the straight-cut plots indicating that swathing may have been completed somewhat earlier than the optimal stage (data not shown). Whether planning on swathing or straight-combining canola, these results illustrate the importance of timing canola harvest operations appropriately. Focussing on the pod sealants, applying either product did not impact seed yield in seven of eight site-years but there was a 217 kg ha^{-1} (16%) yield increase with pod sealants at Melfort in 2010. No significant differences occurred between the two products tested in any cases.

Seed losses due to pods shattering and whole pods dropping were measured twice using shattering trays; once just prior to harvest and again two or more weeks later. Overall, losses varied widely from one site-year to the next with a range of 0.5-14.2% for the early measurements and 2-28% for the late measurements (data not shown). Differences amongst cultivars were observed occurred whereby losses from 5440 were consistently and significantly lower than for the other varieties. Averaged across site-years, similar shattering was observed for 4362, 45H26, 5020 and 8571; however, results were somewhat variable amongst individual site-years. The low losses from 5440 were evident in the first measuring period (data not shown) but were especially prominent when canola was left standing two or more

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Wetlands as an Asset on the Farm: Carbon Sequestration

By Cynthia Kallio Edwards
Ducks Unlimited Canada

The benefits of converting from conventional tillage to minimum or zero-tillage are known to most people in the agriculture industry in Prairie Canada. Carbon sequestration from reduced tillage is an additional benefit that is just beginning to be realized. New science is emerging that shows that prairie wetlands may also provide an opportunity for farmers in a carbon constrained world.

When the Kyoto Protocol was first negotiated in 1997, Canada was quick to identify the potential for biological sequestration to help address the country's greenhouse gas (GHG) problems. Most of the focus was on forests and the benefits of moving to minimum and zero-tillage within agricultural production systems. Wetlands were not part of this discussion until Ducks Unlimited Canda (DUC) raised the issue.

DUC's approach began with involvement in the Government of Canada's Sinks Option Paper in 1998. This initiative opened the door to continuing involvement in research on carbon sequestration in wetlands. In 2001, DUC embarked on a comprehensive research program in the development of the Agriculture and Wetlands Greenhouse Gas Initiative (AWGI). The AWGI group consists of scientists from eight universities across Canada, as well as researchers from Agriculture and Agri-Food Canada (AAFC), Environment Canada, Alberta Agriculture and DUC. From field studies in Alberta, Saskatchewan and Manitoba, this research examined the functional linkages between prairie wetlands, riparian areas and their adjacent agricultural fields in terms of carbon sequestration and GHG flux. The research was funded by AAFC, Environment Canada, Natural Resources Canada, DUC and the Natural Resources Engineering Research Council of Canada.

As the research projects began wrapping up, the Government of Alberta was in the midst of becoming the first jurisdiction in Canada to require large facilities to reduce their GHG emissions. In short, facilities in Alberta that emit more than 100,000 tonnes of GHG a year are required to reduce their emissions intensity by 12 per cent annually. They can achieve these reductions by: increasing efficiency at the site (reducing emissions overall); paying into the Change and Emissions Management Fund at a rate of $15 per tonne that they are over their reduction target; or purchasing verified carbon offsets from voluntary actions arising from unregulated activities in Alberta.

The Tillage Quantification Protocol was one of the first to be approved in Alberta, and DUC took the opportunity to follow this lead by expanding the protocol list to include wetlands. With the help of Climate Change Central, DUC has engaged ClimateCHECK, in collaboration with a Technical Working Group that includes representation from Alberta Agriculture and Rural Development, Climate Change Central, ClimateCHECK, DUC, Environment Canada and the Prairie Habitat Joint Venture, to develop the proposed Wetlands Restoration Protocol. The objective is to develop a Wetland Restoration Protocol that meets the criteria of the Alberta Offset System and is based on the best available science on GHG emission reductions from wetland restoration in the Canadian Prairie Pothole Region, including Alberta, Saskatchewan and Manitoba. The protocol development follows the established process for coordinating scientific information and consensus-building according to the ISO 14064-2 GHG Project-Based Standard.

Because of the GHG dynamics of wetlands, the proposed restoration protocol will comprise both reduction credits and removal (or biological sequestration) credits. Reduction credits are calculated using a net removal (or sequestration) coefficient, which quantifies the rate of organic carbon storage in soils of restored wetlands in excess of CH_4 or N_2O emissions. Based on the AWGI research, which has most recently been accepted for publication in the journal Wetlands Ecology and Management, it is estimated that restored seasonal, semi-permanent, and permanent wetlands would sequester approximately 3.25 tonnes of CO_2eq. $ha^{-1}yr^{-1}$. This is about three times the average sequestration rate of converting from conventional to zero-tillage.

As carbon offset markets develop, producers need to be positioned to take advantage of opportunities to sell new products into the marketplace. Conserving and restoring wetlands will position producers on the right side of the ledger when it comes to GHG accounting. Alternatively, when wetlands are drained, a large amount of carbon that was stored in the soils and sediment is released to the atmosphere.

As offset systems are developed and regulated as a part of climate change strategies, generating income by restoring wetlands could become an important component of farm financial plans across the Prairies. Restoring wetlands will also provide public goods that may be associated with other emerging markets, including those for: increased biodiversity; protection against flooding and drought; and water quality protection.

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weeks past the optimal harvest stage (Fig. 2). Averaged across site-years, canola quality *juncea* (8571) did not exhibit any advantages over the *napus* canola in terms of resistance to shattering. While there were individual cases where less shattering occurred with canola quality *juncea* than for the averaged *napus* varieties, these were offset by as many cases where higher losses were observed for 8571. Pod sealants had no measurable effect on shattering losses when averaged across site-years (Fig. 3) or in any individual cases, including Melfort 2010 where a yield benefit to the sealants were observed. It should be noted that these measurements tended to be quite variable with high error margins; thus we may not have been able to pick up differences which were possible to detect with the yields. There appeared to be some variation amongst varieties in the relative proportions of seed loss attributable to whole pods dropping versus shattering (Fig. 2); however, averaged across cultivars and site-years, whole pods dropping contributed 36% of the total measured losses.

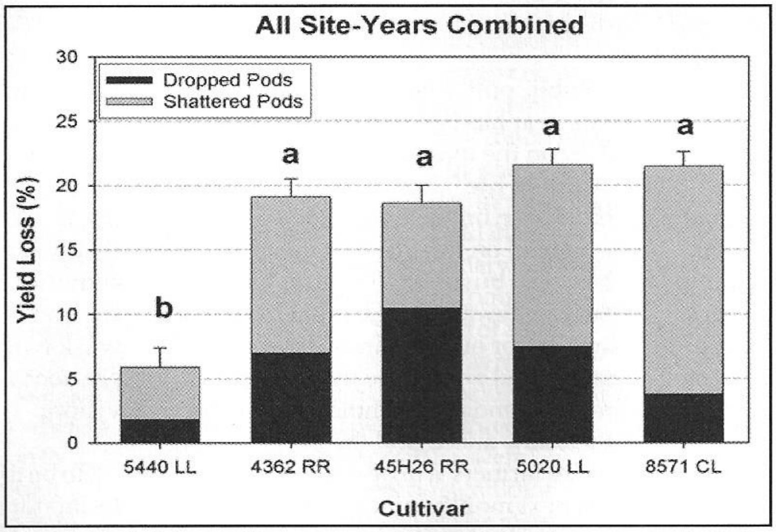

Figure 2. Cultivar effects on canola seed losses from canola left standing two or more weeks past the optimal harvest stage.

Percent green seed and seed size were measured to evaluate harvest treatment effects on seed quality. When averaged across site-years, slightly higher percentages of green were observed in the harvest sample with straight-combining (1.8 vs 1.5% green seed), but for 75% of the individual site-years there was no difference and, in one case, higher green counts occurred with swathing. Seed size higher with straight-combining 63% of the time and, averaged across site-years, there was a small but highly significant increase in seed size with straight-combining (3.2 vs 3.4 g 1000 seeds-1; $P = 0.001$). Overall, there appeared to be slight improvements in seed quality with straight-combining relative to swathing but growers should be careful to monitor green seed and avoid risking a grade loss. The two pod sealants products that were evaluated had no effect on seed quality in any of the individual cases or when all site-years were combined.

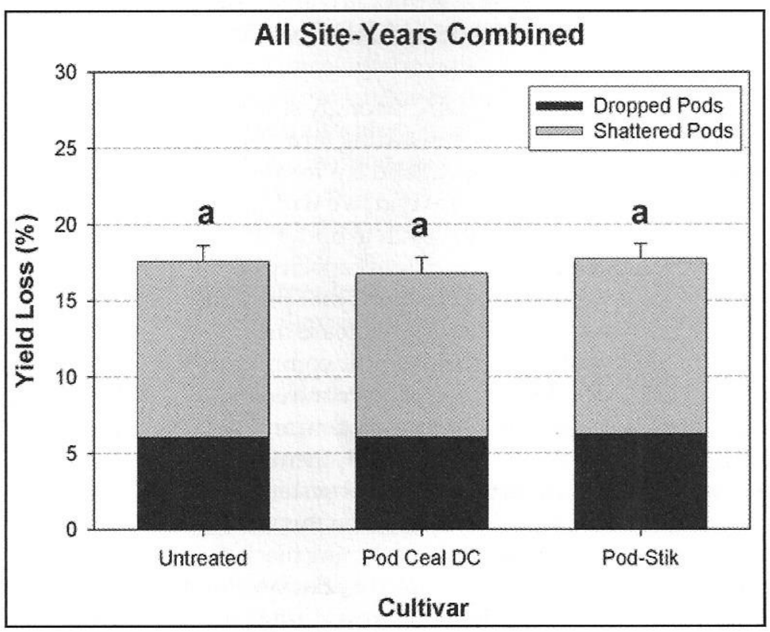

Figure 3. Harvest treatment effects on canola seed losses from canola left standing two or more weeks past the optimal harvest stage. Results are averaged across eight site-years, error bars

To conclude, growers should not be discouraged from straight-combining canola as doing so generally appears to be a viable alternative to swathing. That said, there are genuine risks to straight-combining canola and harvesting the crop as close to the optimal stage as possible is critical to prevent yield loss. Important differences amongst *napus* hybrids were observed in this and previous studies; thus growers interested in straight-combining should seek cultivars that are relatively resistant to shattering. As for pod sealants, our results suggest that these products can potentially reduce the risks of straight-combining; however, they had no impact on grain yield 88% of the time and never resulted in a measurable reduction in seed loss. The results from this study would not justify a general recommendation to apply pod sealants to all canola that is going to be straight-combined; however, if growers choose to use these products they should consider leaving a check strip and evaluating their performance on a field-to-field basis.

For more information on this study contact Chris Holzapfel at either (306) 695-4200 or cholzapfel.iharf@sasktel.net.

PRESIDENT'S MESSAGE ... CONTINUED FROM PAGE 2

publish 3 issues per year. This is a costly activity - mainly the printing and mailing - so we would like to consider also distributing this electronically. The email updates are shorter and more timely items to inform SSCA members. These are "member only" communications and we intend to enhance this activity in 2011.

The E-journal has evolved into a unique publication of agronomic research written in farmer language and available to the general public. Attempts to have paid subscriptions of non-members was not working, so the decision was made that we should ensure good exposure to all interested parties.

Even though the SSCA is one of the largest voluntary paid farmer member organizations in Saskatchewan, member dues only provide for a portion of what we do. We have built a well recognized name due to our practice of not limiting the dissemination of new technologies and information to only members. As much as this may detract some from bothering to join, we do hope that enough of you and your neighbors will both see the value to your farm directly along with the value in knowing that this organization can continue as soil and related issues are not gone because the dusty skies have disappeared.

Public policy development activity this year has been more focused than ever on the long standing and thick "Carbon file". For all the 5 years that I have been on the board, I have been involved on this file and this past year has been busier than ever as the Saskatchewan Government prepares a system for our province. How successful we will be in having our recommendations implemented and then how successful the program will be for farmers will be determined over the next months and years. There are hundreds of millions of dollars at stake over the next 10 years. If for no other reason, every farmer in Saskatchewan who is employing minimum tillage practices should be joining this association as it is leading the effort to make the carbon trading system as beneficial as possible. The more support we have, the more we are listened to.

As I enter my last year on the board, I both reflect on the many things I have learned and the dedication of the people I have worked with as well as look at the year ahead that will present challenges and opportunities. Our largest projects over the years has been due to our affiliation with the Soil Conservation Council of Canada. With project proposals they have made, we could get a call tomorrow that will require us to ramp up activities for several years. Barring such an event, we will continue to work within our means in the most efficient ways possible to pursue our vision:

"To be the recognized driver and facilitator of change that leads to conservation agriculture being practiced on prairie agricultural land."

I am honored to have been able to serve as president of this organization this past year and look forward to the future as we all continue to learn about our most essential farm resource - soil.

WETLANDS AS AN ASSET ON THE FARM: CARBON SEQUESTRATION ... CONTINUED FROM PAGE 12

Another aspect of wetlands pertaining to the broad issue of climate change is adaptation to changing conditions. Natural areas, be they wetlands, native grasslands or bushland, have evolved over thousands of years and are inherently resilient to the impacts of drought, flood, cold and heat. Removing these natural features reduces the ability of the landscape to adapt to changing conditions. Most climate change predictions forecast a hotter, drier Canada where precipitation comes harder and faster than it does now – so the storage benefits of wetlands will be increasingly important.

As we better understand the value of the environmental services (e.g., carbon sequestration) that wetlands provide, we find more compelling evidence for their conservation and restoration. DUC strongly supports the notion of rewarding farmers for the provision of wetland environmental services. To this end, we will continue to: conduct research to understand the carbon sequestration capacity of wetlands and uplands that provide waterfowl habitat; increase the capacity of the scientific community to develop the protocols required to legitimize an offset system; and advocate for the development of robust, legitimate offset systems that make a real contribution towards GHG reductions. By developing market-based instruments (e.g., carbon offset credits), and recognizing and rewarding landowners for stewarding Canada's natural capital, we will secure a more sustainable landscape now and into the future.

Technical Working Group for the Wetland Restoration Protocol in Alberta:

- Cynthia Edwards, Ducks Unlimited Canada (DUC)
- Tanya Maynes, Climate Change Central
- Pascal Badiou, Ducks Unlimited Canada
- Rick Bourbonniere, Environment Canada
- Tom Goddard, Alberta Agriculture and Rural Development
- Bob MacFarlane, Prairie Habitat Joint Venture
- Leslie Wetter, Ducks Unlimited Canada
- Rob Janzen, ClimateCHECK

For more information on carbon protocol development in Alberta see: http://carbonoffsetsolutions.climatechangecentral.com.

Potential to Reclaim Eroded Knolls

By David A. Lobb
Professor, Landscape Ecology
Senior Chair, Watershed Systems Research
Landscape Dynamics Laboratories, Department of Soil Science, University of Manitoba
Winnipeg, Manitoba, Canada

The complete article can be viewed at www.ssca.ca.

A more radical approach to managing soil-landscape variability is rehabilitation or restoration by moving soil. Soil-landscape restoration can be thought of as simply putting the productive soil back where it came from. In this practice, soil is moved from areas within a field where it has accumulated through erosion to areas where it has been lost through erosion (Figure 1e). Where sediments accumulate within fields through wind and water erosion, they are less productive than the original soil. In contrast, where tillage erosion is the major erosion process, the eroded soil is locally available in concave lower slopes and remains highly productive, creating an opportunity for restoration.

Between 2004 and 2006, a large-scale field study was conducted in the undulating and hummocky landscapes of southwestern Manitoba to examine the impact of soil-landscape restoration on crop productivity (Smith 2008). Four study sites (one primary and three secondary sites) were selected to compare crop productivity on severely eroded upper slope positions that had been restored with the addition of 10 cm of topsoil with those that had not. Comparisons were also made between crop yields in lower slope positions where topsoil was removed with those areas where it was not. Crop emergence in addition plots occurred at a faster and more consistent rate than in control plots. Overall, there was a 60 % greater plant population in addition plots. At the primary site, crop yields in addition plots increased by 31 % in the first year post-restoration and continued to increase the following year by 64 %. Yield increases also occurred at each secondary site and ranged from 10 to 133 % in comparison with control plots. The effect of added topsoil on eroded hilltops was more evident during a year with below normal precipitation. At two of the three sites where lower slope positions were monitored, there were no significant reductions in crop yield where topsoil had been removed. When crop yields were normalized across all research sites, relative to regional crop yield averages, yield differences between upper slope treatment plots were significantly greater than yield differences between lower slope treatment plots. Therefore, adding 10 cm of topsoil to severely eroded hilltops resulted in a net benefit in crop productivity within the landscape.

A complementary economic assessment of the practice of landscape restoration was carried out with mathematic simulations (Johnson et al. 2009). Model simulations were carried out using farm survey information collected in the summer of 2007. Since the need for landscape restoration is primarily the result of soil erosion, three tillage scenarios were used in the simulations: conventional tillage with high rates of soil loss, conservation tillage with moderate rates of soil loss, and no-till or zero-till with very low rates of soil loss. As well, two restoration scenarios were also considered: with and without restoration. The without restoration scenario was included to assess the benefit of the restoration practice over the status quo which results in continued soil erosion, loss of soil productivity and declining crop yields. The economic assessment was based on the payback period, which included initial and subsequent restoration costs. Subsequent restoration may be required under cropping and tillage systems that result in substantial soil loss from hilltops, i.e. conventional tillage. The payback period was found to be between 3.8 to 5.7 years under a variety of scenarios. The payback period depends upon several factors, of which the crop rotation is the strongest determining factor.

Research on the practice of landscape restoration also includes examinations of soil properties (Smith 2008, Papiernik et al. 2009), weeds and greenhouse gasses (Erb 2005), and continues with study sites in Minnesota, South Dakota and Manitoba. The findings of these studies demonstrate that soil-landscape restoration is a feasible land management practice for restoring crop productivity on severely eroded hilly land. This practice may be the most effective means of managing soil-landscape variability and a key component of an effective precision conservation strategy.

BEYOND THE BEGINNING –THE ZERO TILL EVOLUTION ... CONTINUED FROM PAGE 10

Producers need to use net return per rotational acre to measure the profitability of different crop rotations correctly.

Beyond the Beginning is unique in that the manual contains, not only the knowledge of research scientists and extension specialists, but also the wisdom of experienced no-till farmers sharing their stories. Each chapter finishes with an interview from a no-till farmer discussing their own management practices under the topic. The stories confirm the no-till strategies and practices given in the manual do work when implemented on farms in the real world.

Beyond the Beginning is not a cookbook with simple recipes to successful no-tilling. The manual explains the challenges and opportunities no-till farmers face as they manage a complex cropping system.

Beyond the Beginning represents the state of the art in no-till. The MNDZTFA has invested time and effort to publish an excellent reference manual for new and experienced no-till farmers.

The Saskatchewan Soil Conservation Association thanks MNDZTFA for providing 500 copies of the manual to distribute to SSCA members.

Beyond the Beginning is available on-line at the MNDZTFA website under Archives, along with their 1st and 2nd zero-tillage production guides www.mandakzerotill.org.

Mechanization and the Global Development of Conservation Agriculture[1]

By *Theodor Friedrich and Amir Kassam*
FAO, Rome, Italy

This is the concluding comments of a presentation made at the 2011 SSCA Annual Conference. The full article can be viewed at www.ssca.ca.

Considering the current world challenges posed by increasing demand for food, feed, fibre and biofuel from crop production, ecological and economic sustainability has to be considered in any intensification and productivity enhancement strategy. Hence, innovations for sustainable agricultural mechanization can only be meaningful and effective within the context of sustainable crop production systems, and never in isolation. Conservation Agriculture includes the basic elements of such a sustainable production system, increasing productivity and production while reducing the need for external inputs and the environmental footprint of farming. CA improves the delivery by agriculture of ecosystem services such as water resources, biodiversity and the mitigation of climate change while strengthening the ecological foundation of cropping systems to also adapt to changing climates. Conservation Agriculture requires adequate and very specific mechanization inputs which could be described as "innovations for sustainable agricultural mechanization", while some of the currently used and promoted technologies will be reduced due to their negative impact on the environment and society. Conservation agriculture is practiced in 2010 on about 117 million ha worldwide, growing exponentially at a rate of actually 6 million ha/year.

Yet, to become fully sustainable, the socioeconomic component of the production system as well as the mechanization structure has to be considered. Improved profitability of farming and farmers' livelihoods form an economic base that also allows the mechanization sector to develop and prosper in a sustainable way. In many developing countries, especially in Africa, supportive and guiding policies are required to attract and encourage the agricultural machinery sector to open up and develop markets for agricultural mechanization in general and for CA equipment in particular and to establish the required commercial and service infrastructures. Without this change in the machinery sector, future agriculture development needs of developing countries for food security, poverty alleviation, economic growth and environmental services cannot be achieved.

1 The views expressed in this paper are the personal opinion of the authors and do not necessarily quote the official policy of FAO

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