Prairie Steward

Farming For Your Future Environment

The Newsletter of the Saskatchewan Soil Conservation Association Inc. — Winter Issue No. 52, 2008

SSCA Celebrates 20 Years at Annual Conference

By Juanita Polegi, PAg

Twenty years is a milestone for any organization and the SSCA is no exception!

In 1987, the Manitoba – North Dakota Zero Till Association held its Annual Meeting in Regina. Following that event, the idea that Saskatchewan should have its own soil conservation association was pursued with gusto by a small group of people. A meeting was then held in Saskatoon to develop the constitution and bylaws for a new provincial soil conservation group. The first annual meeting of the Saskatchewan Soil Conservation Association was held in1988.

Twenty years later, the SSCA is holding its 20th Annual Conference in Regina – the largest production oriented conference in the province! Pre-conference activities include a **wine & cheese reception at the Ramada Hotel on Monday February 11.** A number of dignitaries will be invited to the reception including former SSCA Presidents and Board Members. Former staff will also be invited to attend. A display of artifacts depicting the history and accomplishments of the SSCA is sure to generate lots of interest. **The reception is open to everyone with an interest in the SSCA** and who enjoys an evening of mixing, mingling and reminiscing!

Fuelling the Farm is the theme of the Conference which begins the next morning, **Tuesday February 12 in the Queensbury Centre at IPSCO Place**. Key Note speaker will be Dr. David Kohl. Dr. Kohl is a renowned agricultural economist from Virginia Tech University. He is best known to prairie farmers for the feature articles he contributes to the Royal Bank's newsletter. The title of Dr. Kohl's presentation is Straight Talk About Global Agriculture.

As with previous conferences, this one will feature a mixture of research scientists and farmers speaking on a wide variety of topics. Some of the session titles include: The Impact of Direct Seeding; Grains & Grazing; New Farm Technologies and Developments in Nutrient Management.

Farmers and researchers with experience growing crops such as camelina, prairie carnation and soybeans will share their knowledge about these crops in the Potential New Crops session. Concurrent to that session is the session in which grazing management will be discussed in addition to a new technology for selecting feed barley.

The results from a study at Scott on Alternative Cropping systems will be presented in the Interaction of Crop Rotations and Seeding Systems session. A farmer will also share the crop rotation he has established on his operation.

The **SSCA Annual Meeting will be held at 4:30 p.m.**. All SSCA members are encouraged to attend. This is an opportunity for the membership to hear about the Association's activities through the year and review the

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In This Issue

A personal perspective: two of SSCA's successes

By Blair McClinton, PAg
SSCA Executive Manager

SSCA turned 20 years old this past November. From our humble beginning at the 1987 Manitoba-North Dakota Zero Tillage Farmers Association meeting in Regina, few could have predicted the changes we would see in the Saskatchewan agriculture industry. At the time, no one would have predicted that 20-years later over 60% of Saskatchewan farmland would be direct seeded.

As the SSCA's longest-serving employee, I have a unique perspective of SSCA's history and achievements. It's a history of good planning, a bit of luck and hard work from dedicated people. Here are a couple of interesting stories (at least to me).

1992 Direct Seeding Conference

Many have recognized SSCA's 1992 Direct Seeding Conference in Prince Albert as our coming out party. This was the first time SSCA dedicated its annual conference to a single approach to soil conservation. We made the decision to do this at the conference planning meeting in Prince Albert. Our planning committee mostly consisted of SSCA staff (Garry Meier, John Kiss and I) and Saskatchewan Agriculture extension staff (Barry Swanson, Roy Button and Eric Johnson). One of our goals for that Conference was to design a conference program that would interest farmers. We were tossing around a few conference themes, when someone (I believe it was Roy Button) said that we should focus on direct seeding if we wanted to interest farmers.

Looking back at it now, this looks like it should have been an obvious choice. However, it was both risky and controversial at the time. Our instincts on the ground level were telling us that this was the right thing to do but policy-makers in Regina were very sceptical of this decision at the time. I do credit John Kiss, SSCA's Executive Manager at the time, for trusting our instincts and defending the committee's decision.

The success of the event even took us by surprise. We planned the event to hold between 250 and 300 people. Agricultural events larger than this were unheard of at that time. We had received 300 registrations, two weeks before the conference. I remember the excitement we all felt as we watched the numbers grow. We had over 400 preregistered by the event date, the only unknown was how many people would try to walk-in.

The event itself was held during a cold spell with daytime highs of -30 C. Even with the bitterly cold temperatures, over 600 farmers came to the event. The Direct Seeding Conference seemed like a ray of sunshine that broke through all the "doom and gloom" messages in the Ag industry at the time.

Direct Seeding Manual

While the direct seeding conference was an example of good planning, the Direct Seeding Manual was developed almost by accident. What started out as a series of individual projects with two different organizations, evolved into something whose value was far greater than the sum of its parts.

In the spring of 1992, SSCA was being asked to develop some technical publications related to direct seeding. I started working on a crop rotation guide and David Struthers, a consulting Agrologist, was contracted to develop a weed management guide. Sometime over the summer, Garry Meier told me that Gord Hultgreen, PAMI, was working on a residue management and seeding equipment guide. I had one of those light bulb flash moments and thought that maybe we could combine our efforts. I

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Blair McClinton, Executive Manager
Marilyn Martens, Office Manager
Juanita Polegi, Project Manager

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

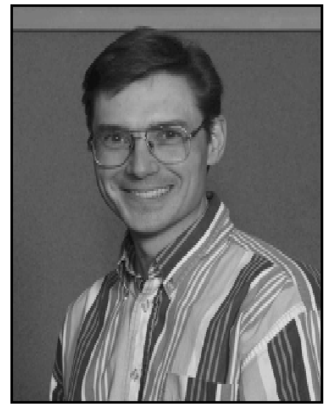
President's Report

By Edgar Hammmermeister, PAg
President, Director SE

The year 2007 was a year of extremes, a year of averages and a year of blessings. Saskatchewan certainly saw the extremes in moisture from the drought in the South and West, to the excesses seen in the North and East. A long pulse of high heat during July snuffed the hopes in many areas, reducing once bumper yields to ones that were just "average". And yet there were still areas that had very good yields. A blessing has been the increase in all crop prices. Many crop prices have entered into "uncharted territory" and this has brought great relief for some farmers and a growing optimism for many that has not been seen in over 30 years. It is nice being in a "seller's market" for a change.

The extra income will have many demands. Certainly the "honey do" list will need attention but there is catching up to do on the farm as well. Equipment upgrades and replacements are possible. There is an opportunity to invest in technology to improve efficiency but what about "agronomy R & D"? The word "agronomy" is not often used any more but good agronomy has a major impact on your bottom line. Considerations include how to push crop rotations and when, new crops, methods to improve crop nutrition efficiency and pest control. At one time, there was considerable amount of public research dollars invested into identifying and improving beneficial management practices (BMP). These dollars have tapered off to essentially zero now. It does puzzle me as the dollars invested give many multiple returns on the investment from which the entire economy receives benefit. The loss of these research dollars will hurt Canada in the long term as our competitors continue to invest. The timing may be even more crucial as Canadian agriculture will be facing increasing scrutiny and pressures from environmentalist concerns. We need good agronomic science. In Manitoba, farmers face the threat of policy limiting phosphate use based on very limited data. In Alberta, the canola industry is shuddering with the expansion of the "cancer of canola" clubroot disease. What are the risks to Saskatchewan canola growers (what with all the oil field equipment moving back and forth)?

In the mean time, farmers now are increasingly forced to "experiment" on their own. All kinds of new ideas will be brought to your attention. There will be fertilizer supplements and application technologies. There will be biologicals and exotic crops. I encourage you to explore the opportunities but to do it with deliberate steps. Research the "innovation". Testimonials are helpful but are not enough. Ask about the science supporting the concept and talk it through with University and government researchers. Ultimately, the science needs to be there for the practice to be sustainable over the long term. Try things out but watch your committed acres. Not every idea will work.



Edgar Hammermeister
SSCA President

Good luck in your research. Enjoy the winter meeting season and I look forward to seeing you at our 20th Annual conference in February in Regina.

SSCA Board of Directors at Work for You

The SSCA Directors are highly visible at the Annual Conference. Each has many tasks to complete during the Conference to ensure the event is successful. As with all Boards, however, there is a lot of work that goes on through the year that is not quite so visible. The following report is an indication of the effort the Board members are making to keep the membership informed of the many duties the Board undertook for the period from July 1 to November 30, while representing you, the members:

EDGAR HAMMERMEISTER, PRESIDENT

July 4 - Speaking engagement - Canada's Climate Change Policy and evolution of a Carbon Market, National Farmer's Union - Saskatchewan, Summer meeting

July 5-6 Soil Conservation Council of Canada - Summer Meeting, Dawson Creek, BC.

July 25 Planning meeting conference call for the SSCA Crop Advisors' Workshop

August 30 - Conservative Party Supper - meet and greet Agriculture Minister Gerry Ritz

Sept. 26 – SSCA Technology Journal Steering Committee meeting, Saskatoon

Nov 5-6 - SSCA Fall Board Meeting - Moose Jaw

Nov 8 - SSCA Technology Journal Meeting conference call

Nov 28 - Web Conference - Prospects for a Carbon Market (in the USA)

LAURA REITER, 1ST VP

APAS summer meeting in North Battleford

Spent time trying to find a replacement for the DAL position that is now open

SSCA Fall Board Meeting in Moose Jaw

DOYLE WEIBE, 2ND VP

SSCA Fall Board Meeting in Moose Jaw

ERNI HALL, DIRECTOR AT LARGE

SSCA Fall Board Meeting, Moose Jaw

Approached many of the local ag suppliers about the Crop Advisors' Workshop

KEN ABRAHAMSON, DIRECTOR AT LARGE

SSCA Fall Board Meeting, Moose Jaw

Weed Control Research Update 2007 fron

By Ken Sapsford PAg
Research Technician

When you work with weeds, you know there is always more that we can do to control them as they are always adapting. Some of the areas that we are presently working in on weed control research at the University of Saskatchewan are:

1. Pre-seed and split applications of Everest for control of wild oat and green foxtail
2. Spring applications to control foxtail barley

cropping issues developed. In 2007, Everest was registered at a lower rate of 20 gai/ha for light infestations of wild oats >100/m2.

Due to the residual characteristic of this product, can it be applied as a pre-seed or pre-emergent application and still control wild oat and green foxtail? Will a split application of two reduced rates of Everest control wild oat and green foxtail?

From 2005 to 2007, 12 trials have been conducted in Saskatchewan looking at this issue. This is a **summary** of all of those trials

The split application rates controlled wild oat equally as well as the post emergent applications. Over all 12-site years, the pre-applications did not control the wild oat over the 80% that is requires for registration. However, the pre-applications controlled wild oat >80% on 50% of the site years. This indicates that if we applied Everest as a pre- application at a reduced rate, we may not need to come back with a post emergent application, depending on the year.

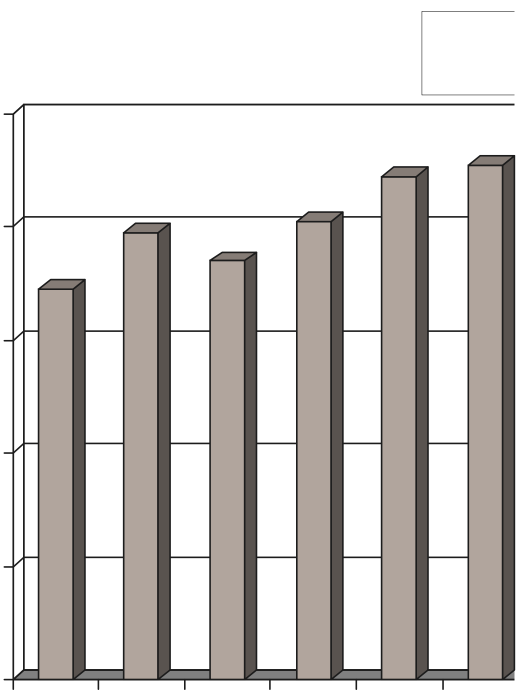


Figure 1: Summary of Everest trials on wild oat control at the University of Saskatachewan, 2005-2007.

3. Timing of spring applications to control winter annuals
4. Winter annual cleaver control

Pre-seed and split applications of Everest for control of wild oat and green foxtail:

Everest was registered for wild oat control with a post emergent application at 30 gai/ha (grams of active ingredient per hectare). Following the drought years of 2000 to 2003, soil residual concerns and re-

(Figure 2). Not all treatments were in all trials every year. There were 4 pre-treatments 10, 15, 20 and 30 gai/ha, 6 split treatments, pre/post, 10/10, 10/15, 10/20, 15/10, 15/15 and 20/10 and there were 3 post emergent treatments, 15 gai/ha (green foxtail rate), 20 gai/ha (low wild oat rate) and 30 gai/ha (high wild oat rate). All rates used were never higher than the registered rate for high populations of wld oats.

Spring applications to control foxtail barley:

Foxtail barley (Hordeum jubatum), a perennial grass native to western North America, has increased in relative abundance three and a half fold on the Canadian prairies since 1970 (Leeson et al. 2005). Foxtail barley propagates mainly by wind-borne seeds and has become a more serious weed problem whenever tillage intensity

n the University Of Saskatchewan

and frequency are reduced (Moyer et al. 1994). Previous studies have shown that fall applications of glyphosate resulted in the best control of foxtail barley (Blackshaw et al. 2000). However, if glyphosate is not applied in the fall, the question becomes, "is early or late spring application of glyphosate the best alternative?" Trials were conducted at the Goodale Research Farm near Saskatoon to evaluate a systems approach involving glyphosate application and seeding dates and in-crop herbicides for control of foxtail barley in wheat (2005) and flax (2006).

Conclusions:

1. Late May glyphosate applications appear to be the best time to control foxtail barley in the spring but crop yield reduction will likely occur in some years.
2. Early May glyphosate applications should be followed with a post-emergent application of Assure II in flax to improve seedling foxtail barley control.

Timing of spring applications to control winter annuals:

With farm size increasing and the need to cover more acres in a shorter period of time, extension personnel have been asked if it is OK to leave the weeds grow until just before they seed or is it OK to apply the glyphosate early and not seed that field for two to three weeks. When the only weeds present are winter annuals, we have found that they should be controlled as early as possible to avoid yield loss regardless of the planting time on that field. Winter annual weeds like flixweed, shepherds purse, stinkweed and narrow leaved hawk's beard will use a lot of water from the soil and if they are allowed to grow till the middle or end of May, they have already reduced the yield potential of the crop.

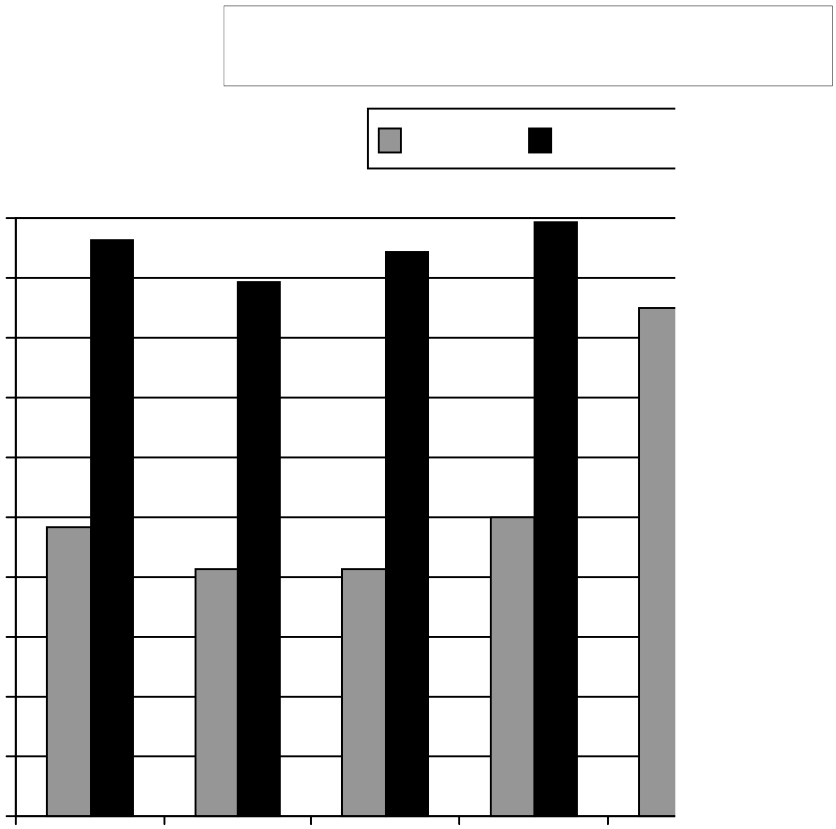


Figure 2: Winter annual cleaver control at two locations, 2007.

Winter annual cleaver control:

With changes to our farming practices that include reduced tillage and direct seeding, we have seen weeds like cleavers survive the winter as a winter annual as we are creating a favorable environment for them to survive. In the spring when we are applying our pre-seed burn-off, the cleavers are in the 8 to 15 whorl stage and the control of these weeds is uncertain. In 2007, we conducted trials at two locations with 7 different combinations of herbicides.

Products like CleanStart, glyphosate + Attain and glyphosate + UAP-0401 controlled the cleavers early, 9 Days After Application (DAA). By 19 DAA, all product controlled winter annual cleavers. CleanStart has a very fast burndown compound in it and the cleavers began to re-grow late in the trial. This could be due to leaf burn that is too quick to allow the glyphosate to enter the plant and translocate to the root to kill it completely.

This is a look at some of the trials we are conducting at the U of S. Other work is being done in the areas of a systems approach to dandelion and Canada thistle; Group 2 resistant kochia control; minor use registration including products for chickpea, lentil, hemp and mustard; and control of Canada fleabane just in case we have glyphosate resistance develop.

Right Product, Right Rate, Right Time, and Righ

By Terry L. Roberts

A native of Alberta, Canada, Dr. Roberts grew up in a family-owned retail fertilizer business. He received a B.S.A. degree in Crop Science (1981) and a Ph.D. in Soil Fertility and Plant Nutrition (1985) from the University of Saskatchewan.

This article was originally presented as a paper at the International Fertilizer Industry Association (IFA) Workshop on Fertilizer Best Management Practices, March 7-9, 2007, in Brussels, Belgium. It is reprinted here with permission.

The concept of agricultural best management practices (BMPs) is not a new one. First introduced almost 20 years ago, scientists at the Potash & Phosphate Institute (PPI) defined BMPs as those practices which have been proven in research and tested through farmer implementation to give optimum production potential, input efficiency, and environmental protection (PPI, 1989; Griffith and Murphy, 1991). Today, the emphasis appears to be more on environmental protection than optimal production potential as current definitions suggest BMPs are practical management practices or systems designed to reduce soil loss and mitigate adverse environmental effects on water quality caused by nutrients, animal wastes, and sediments. Common BMPs directed towards mitigation include strip cropping, terracing, contour stripping, grass waterways, special manure handling, animal waste structures, ponds, minimal tillage, grass filter strips, and nutrient application. Agronomic BMPs leading towards optimizing production potential include: variety, planting date, hybrid maturity, row-spacing, seeding rates, plant population, integrated pest management, weed control, disease control, and nutrient management.

Both soil conservation and agronomic-based BMPs can work together to meet objectives of optimal production potential and mitigation of adverse nutrient-caused environmental effects on water quality. While BMPs may differ depending on objective, to be used by farmers they must also be economic … the practices and management they employ must be profitable and sustainable. Nutrient management deserves special attention because it is critical to both optimizing production potential and to environmental stewardship.

One of the challenges we face in the fertilizer industry is that much of society does not trust us. Many believe that fertilizers are applied indiscriminately, that the industry is only interested in increased profits … through unwarranted fertilizer sales … and that farmers are willing recipients who

Dr. Terry L. Roberts

unnecessarily over-apply nutrients to ensure high yield crops resulting in excessive levels of plant nutrients to the detriment of the environment. This, of course, is not true, but the perception is there and that drives policymakers towards regulating nutrient management, water quality guidelines, total daily load limits, and other policies or practices aimed at restricting or eliminating the use of fertilizer.

Part of the solution in gaining the public's confidence in our ability to manage nutrients responsibly is through encouraging the widespread adoption of fertilizer BMPs. As an industry we need to be unified in the promotion of BMPs designed to improve nutrient use efficiency and therefore environmental protection, without sacrificing farmer profitability. The North American industry has been advocating management practices that foster the effective and responsible use of fertilizer nutrients with a goal to match nutrient supply with crop requirements and minimize nutrient losses from fields (Canadian Fertilizer Institute, The Fertilizer Institute). The approach is simple: apply the correct nutrient in the amount needed, timed and placed to meet crop demand — right product, right rate, right time, and right place. These are the underpinning principles of fertilizer BMPs.

The following summarizes these guiding principles for fertilizer management. A more in-depth discussion is available in Roberts (2006).

Right product: Match the fertilizer source and product to crop need and soil properties. Be aware of nutrient interactions and balance nitrogen, phosphorus, potassium, and other nutrients according to soil analysis and crop needs. Balanced fertilization is one of the keys to increasing nutrient use efficiency.

Right rate: Match the amount of fertilizer applied to the crop needs. Too much fertilizer leads to leaching and other losses to the environment and too little results in lower yields and crop quality and less residue to protect and build the soil. Realistic yield goals, soil testing, omission plots, crop nutrient budgets, tissue testing, plant analysis, applicator calibration, variable rate technology, crop scouting, record keeping, and nutrient management planning are BMPs that will help determine the right rate of fertilizer to apply.

Right time: Make nutrients available when the crop needs them. Nutrients are used most efficiently, when their availability is synchronized with crop demand. Application timing (pre-plant or split applications), controlled release technologies, stabilizers and inhibitors, and product choice are

t Place … the Foundation of BMPs for Fertilizer

examples of BMPs that influence the timing of nutrient availability.

Right place: Place and keep nutrients where crops can use them. Application method is critical for efficient fertilizer use. Crop, cropping system, and soil properties dictate the most appropriate method of application, but incorporation is usually the best option to keep nutrients in place and increase their efficiency. Conservation tillage, buffer strips, cover crops, and irrigation management are other BMPs that will help keep fertilizer nutrients where they were placed and accessible to growing crops.

There is not one set of universal fertilizer BMPs. By definition BMPs are site-specific and crop-specific; they vary from one region to the next and one farm to the next depending on soils, climatic conditions, crop and cropping history, and management expertise. BMPs can be implemented in large, extensive farming operations and on small family farms. Right rate, right time, and right place offer sufficient flexibility that these guiding principles can be applied to fertilizer management for rice production in Indonesia, banana production in Latin America, maize production in the U.S. Corn Belt, or any farming system used throughout the world.

Fertilizer BMPs should help ensure that fertilizer uptake and removal by target crops is optimized and fertilizer loss to the environment is minimized. Fertilizer BMPs should increase nutrient use efficiency, but maximum use efficiency is not the primary objective. The goal is to use fertilizers efficiently and effectively in providing adequate nutrition for crops.

If maximizing fertilizer efficiency was the goal, we just need to work lower on the yield response curve. For a typical yield response curve, the lower part of the curve is characterized by low yields since few nutrients are available or applied (**Figure 1**). Nutrient use efficiency is high at the bottom of the yield curve because any addition of a limiting nutrient gives a relatively large yield response as much of the applied nutrient is taken up by the nutrient-limited crop. If highest nutrient use efficiency were the only goal, it would be achieved here in the lower part of the yield curve and by applying the first increments of fertilizer. Lower rates of fertilizer appear better for the environment, because more nutrients are removed by the crop, leaving less in the soil for potential loss. But lower yielding crops produce less biomass and leave fewer residues to protect the land from wind and water erosion and less root growth to build soil organic matter. As you move up the response curve, yields continue to increase, albeit at a slower rate, and nutrient use efficiency typically declines. However, the extent of the decline in nutrient use efficiency will be dictated by the BMPs employed as well as soil and climatic conditions.

Fertilizer nutrients are essential for modern agriculture to meet its crop yield and quality goals, but fertilizers must be used responsibly. Development and adoption of BMPs for fertilizer are necessary for the fertilizer industry to demonstrate its commitment to product and environmental stewardship, and to help the farmer produce sustained, profitable yields. Every farm and field is different. Fertilizer BMPs must be adaptable to all farming systems … one size does not fit all. Right nutrient, right rate, right time, and right place provide a framework for a farmer to select those BMPs best suited to the farm's soils, crops, and climate and to the farmer's management capabilities.

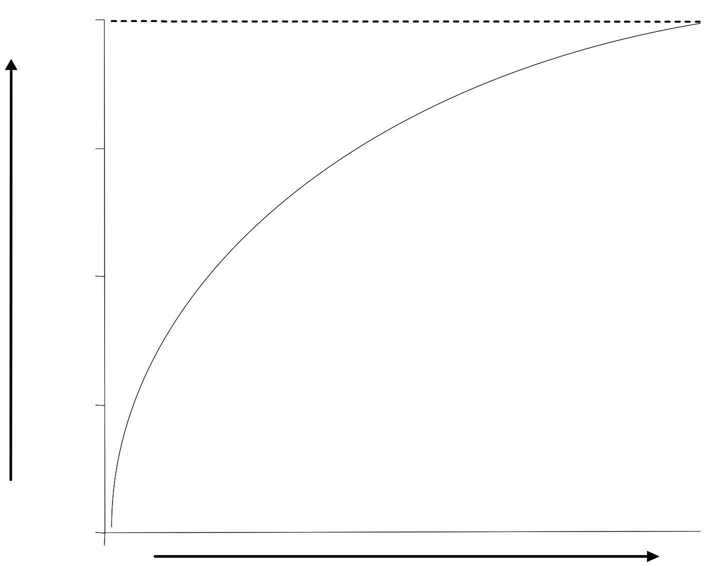


Figure 1: Relationship between yield response and nutrient use efficiency (adapted from Dibb, 2000)

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The CLC Riparian Management Project

By Garry Mayerle, PAg

The Conservation Learning Centre draws their Greencover Canada project to a close with a new technician. The technician, Garry Mayerle, is new to the job but he is an old face both to the project and to SSCA. The project is entitled *Riparian Management in a Cultivated Landscape Along The Carrot River*. Dean Sturby, who farms just north of Armley,

Figure 1: Aerial view of Sturby's home half withthe Carrot River meandering

and right along the Carrot River, is a cooperator in a demonstration to enhances riparian areas, initiated by the project. Sturby co-operated by squaring up annually cultivated fields with perennial coverage including various forage species and hybrid poplar. He also grassed a water run as part of the demonstration. Sturby believes that doing the right thing for the environment today may mean some sacrifices, maybe limit expansion, but will pay dividends over time.

Sturby and his wife Nicole seeded 1200 acres in 2007. They are in the process of establishing a mixed farm and in the future, hope to include a 50 cow calf herd as part of the operation. This demonstration has a good fit for them as they hope to fall graze their cows on stubble and stock piled forage in the riparian areas. Sturby is confident this will work for them as he farmed with his Dad and brothers in the past and they pastured fields cut for silage to extend the grazing season in the fall. Their farm site is at one end of a half section where the Carrot River passes through, so fencing this field will work well for them.

One of the characteristics of waterways, streams and rivers is that they are very sinuous or winding and meandering. The Carrot River, of course, is no exception to this. In this project we are suggesting to annual grain producers that they can enhance riparian areas and their own bottom line by squaring up their fields - putting small, irregular shaped areas of their cultivated acres along these waterways into perennial types of vegetation. This will allow the riparian area to do a good job of filtering runoff water as it moves into the watershed.

The economic benefit to the producer by managing riparian areas like this is reducing overlap in field operations and in the application of costly inputs such as: seed and seed treatment, fertilizer, and pesticides. Furthermore, overlapping applications of some of these inputs may tend to result in higher loading of these products in the ecosystem. Being so close to the waterway could possibly present more environmental risks. As field operation equipment tends to become bigger with the economies of scale, the savings to squaring up fields can be even more significant.

Although we are talking only about small areas, there may be some financial returns to these perennial types of vegetation being established. One example of this permanent cover vegetation is a woody species such as fruit trees producing fruit for sale or hybrid poplar which could be sold to the fiber industry after 20 years of growth. Another example is forage production which could be sold for baling and or utilized by livestock to extend the grazing season after harvesting the surrounding annual crop. Many grain farmers in the Carrot River watershed do not have livestock but we are suggesting that there may be a neighboring livestock producer interested in leasing entire stubble fields for fall grazing. The livestock could take advantage of some of the stubble left after the harvesting operation and also the stockpiled forage in the riparian areas. One producer looking for fall grazing in the east central part of the province is suggesting that he is paying the equivalent of the grain producer's land tax bill in exchange for fall grazing of stubble.

At Sturbys, both hybrid poplar and forage were tried as the perennial cover for squaring up around riparian areas. Unfortunately, the hybrid poplar did not survive with the establishment methods Dean tried. He was hoping to use alfalfa as a cover crop around the trees to reduce weed control. He seeded the alfalfa then after the alfalfa was growing he used the local PFRA tree planter to put in the trees in an 8 foot grid pattern. The following

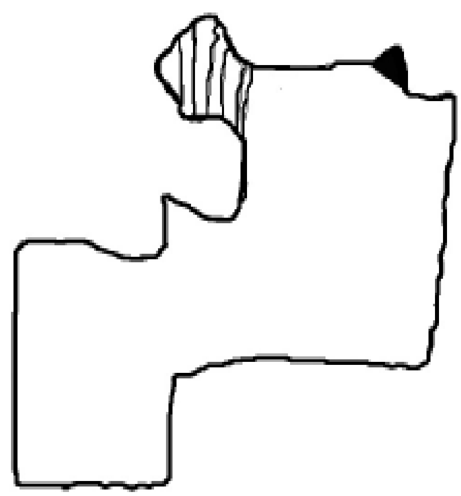

Figure 2: Outline of field from GPS. Top left with lines indicates forage species. Top centre in black indicates meadow brome alfalfa mix.

year the trees looked good but they did not survive the second year. Conditions were good for alfalfa growth and it did not get mowed down so the trees were choked out before they could get enough growth to survive. Sturby feels that a

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SSCA to Launch New Journal

By Juanita Polegi, PAg
Project Manager

Need more in-depth information on issues affecting western Canadian crop production today? Looking for articles on current crop production practices that will educate and stimulate discussion? Then just wait until June when the **SSCA launches its premier issue of a unique agricultural magazine!**

The idea for such a magazine was first bandied about by the SSCA Board back in the summer of 2006. It was agreed that there appeared to be a gap in the relaying of new soil and crop research developments to the farming community. Further discussion revealed that there was really no place for a broader audience to turn to when seeking solid scientific information in a reader-friendly form. The Board decided it would try to rectify the situation and began the long process of developing the idea. After many discussions with many of the agricultural groups and associations in the Canadian prairies, including Alberta's Reduced Tillage Links and the Manitoba – North Dakota Zero Till Association, an application was fleshed out and submitted to ACAAFS (Advancing Canadian Agriculture & Agri-Food Saskatchewan) for funding for the development of one issue.

Approval from ACAAFS was received in the summer of 2007. By early September, the project was underway! Steering and Editorial Committees were formed, conference calls were held, emails sent and the outline of the premier issue was created.

The **key feature** of this new magazine is that the contributors of the major articles are **well known researchers** who will **synthesize the research** on a particular topic area. In essence, as the old adage goes, they will "separate the wheat from the chaff". The unique feature is that the authors will then be able to speculate on what the research means, offering their opinions on the interpretation of the results and on what additional research is required. The researchers are excited about this new format and the opportunities it presents to them for conveying their messages, not only to prairie farmers, but to a much broader audience.

The magazine **will also feature** articles submitted by extension and technology transfer people who will **discuss relevant topics related to production and management.**

The first issue of the new magazine will focus on **Agriculture and its Impact on the Environment.** Several researchers have committed to writing for the magazine. The **projected launch** date is in June during the **Western Canada Farm Progress Show**.

By the time this article appears in print, many SSCA members who are on SSCA's emailing list will have been surveyed about the magazine. The results will be reviewed and taken into consideration when the second issue begins development. Developing a magazine that appeals to both farmers and the public will be a challenging task – but has SSCA ever backed down from a challenge that will benefit farmers? The SSCA Board of Directors is pleased to be the driving force behind such an innovative project. They look forward to seeing you at the launch!

THE CLC RIPARIAN MANAGEMENT PROJECT ... CONTINUED FROM PAGE 8

shade tolerant species like creeping red fescue or hard fescue which is a tuft grass might have worked better. Also he is concerned that currently the local market for pulp is gone and so new markets would need to be available in the next 20 years.

A good way to develop a plan for squaring up fields for seeding is to start off with an air photo map (see Figure 1 for Dean's air photo map). From this, an outline can be laid out to indicate how squaring up the field might look from the perimeter. At Sturby's, the perimeter was established by driving the perimeter (see Figure 2). From this diagram or with GPS, the producer can divide the field up between annual cropped land and the perennial cover crop or, in some situations, he may want to flag the divisions.

In the project at Sturbys, we seeded 5 different species of forages to highlight characteristics of different species and give producers options for various situations. To determine the value of stock piled forage for fall grazing, late fall sampling and testing were also carried out. Al Foster, a forage specialist with Saskatchewan Agriculture, carried out this part of the project. He says that a dry cow in October needs a diet of about 8% protein and 50% TDN to maintain body condition. See Fig #3 to see what sampling in this project found.

Forage Type	Growth	% Protein	% ADF	%TDN
Intermediate Wheat Grass	Primary	4.1	51	44
Intermediate Wheat Grass	Regrowth	12.0	36	60
Volunteer Brome Grass	Primary	4.2	50	45
Alfalfa	Primary	11.6	46	49
Alfalfa	Regrowth	19.0	23	73
Tall Fescue	Regrowth	10.8	46	50
Meadow Brome	Regrowth	10.3	40	55
Creeping Red Fescue	Regrowth	9.4	32	64

Fig 3: Nutritional Quality of Samples, Oct. 06 - Primary Growth – not harvested throughout growing season. Regrowth – harvested for hay in July.

The environment is becoming more and more of a concern to society. So much of what we producers market goes into the human food chain that the spot light on our environmental practices becomes even brighter. Annually cultivating or seeding soil in the riparian areas does put our fresh water supplies at risk. Managing riparian areas appropriately is important environmentally and there may be economic returns as well. When we started promoting direct seeding not many would believe in economic returns. Might managing riparian areas be the same?

Soil Management Results in Year-Round (

By Juanita Polegi, PAg
Project Manager, SSCA

Steve and Stacey Kenyon are self-proclaimed dirt farmers – and they don't own a seed drill! The Kenyons operate a ranch near Busby, Alberta. They run 350 cow / calf pairs year round and 500 yearlings during the summer on 4000 acres of mostly leased land. After a few years of believing they were "livestock farmers" and then "grass farmers", they came to realize that if they didn't take care of the soil now, they weren't going to be any kind of "farmers or ranchers" in the future. At a workshop held near Kelliher in October, Steve said once he and Stacey realized that taking care of the land was a priority, their ranching system fell into place. **"If we look after the soil, that will take care of the grass and the grass will take care of the cattle",** he said.

Steve and Stacey have learned that the human resource element of their ranch needs to be given top consideration when managing their business. "One of the first things we ask ourselves before we make changes is do we have the human resources to allow us to do this?" said Steve. He then indicated that if the answer to that question is positive, he and Stacey then begin their financial and economic analysis of the plan. Steve said, "We ask ourselves, Can we cash flow this and will it be profitable?" Again, if the answer to both questions is positive, they decide then how they can implement the change. Production is dictated by economics and finances. Economics and finances are controlled by human resources**. If the human resource, economics and finance sides of your business are managed, then the production will fall into place.** Steve told the crowd that production is the last thing on his list.

All the answers were positive when the Kenyons considered moving to year-round grazing. They achieve that in a number of ways: intensive cell grazing; dormant season grazing; swath grazing; and bale grazing.

To successfully implement intensive cell grazing, Steve said understanding what is going on in the roots of the forage plants is essential. He follows four basic grazing concepts: graze period; rest period; stock density; and animal impact. They all have a role to play in increasing the ranch's profit.

The only input the Kenyons buy for their grazing system is some seed. Mother Nature supplies the rainfall and the sun. The soil microorganisms play a role in the recycling of nutrients. Steve said their goal is to have every square inch of soil covered by vegetation in order to decrease evaporation and increase plant utilization. He pointed out that one inch of rain on an acre is like capturing 27,000 gallons of water. The trick is to hold onto it.

This highly fertile strip in Kenyon's pasture is the result of nutrient transfer thanks to their bale grazing feeding system

A good grazing system is one that harvests maximum sunlight. The Kenyons strive to get as much growth out of their forages in the short growing season as possible. Maintaining healthy forage roots can give them as much as a two week jump on the grazing season in spring. That translates into about a $20,000 profit for a custom grazing system like theirs. And because the roots are healthy, the plants will continue to grow in to September and another two weeks of grazing in the fall will also contribute to the profit margin. If the pastures are kept in Stage 2 of their growth during summer, maximum sunlight will be collected resulting in greater production. Steve reminded the crowd that in order to build C and N in the soil, sufficient trash or litter must be left behind at the end of the growing season.

In terms of recycling nutrients, Steve pointed out that the cow is an excellent recycler because 80% of the feed she takes in goes back out again. He indicated that a grazing system is the most effective nutrient recycling system compared to cropping or haying.

He urged the crowd to include legumes in their grazing systems to help maintain healthy soils. **"There is more economic loss in agriculture due to the fear of bloat than we would ever get from bloat itself",** he said. "Legumes just need to be managed to reduce the risk of bloat. The N in the air is FREE!"

Earthworms and micronutrients play a major role in maintaining the health of the soil. Of the many tasks this "Underground Army" performs, some of the most important include fixing N, decomposing litter; controlling parasites and building humus. Steve especially appreciates how they work all the time, never complain and only require room and board! He is concerned about the war Man wages against the Underground Army through tillage, fertilizer, pesticides and over grazing.

Dormant season grazing also requires management throughout the summer. By grazing a pasture lightly during the early summer, the plants in those paddocks are allowed to

Grazing for Alberta Ranch

grow and remain in a vegetative state when the frost arrives. The cattle will graze those paddocks even if there is snow on the ground. **Steve's Rule of Thumb is "If you can't reach through the snow to grab a handful of grass, then the cows can't grab a mouthful".** For dormant grazing to be successful, the pastures need to have both quantity and quality grass. Dormant season grazing has proven to be very cost effective for the Kenyons.

Swath grazing has been receiving much attention recently and the Kenyons have a great deal of experience with it. Steve has become a "customer" of the grain farmer. He said sometimes the grain farmer needs to be convinced that swath grazing is as good for his land as it is for the cows. But once the farmer sees the benefits, he likes what he sees. It's a win-win situation for both the grain farmer and the cattleman.

Controlled access to the swaths is a key element of swath grazing, so Steve finds that fall fencing immediately after swathing is essential. Snow is generally not a problem for swath grazing. "I've had more trouble with swath grazing due to a LACK of snow than too much", Steve said. "I had to haul water for 2 weeks in 2006, a winter of poor snowfall, and that cost me about $3600 in extra labor".

Steve said swath grazing produces 3 kinds of cows – the Diggers, Opportunists and the Cleanup Crew. The cleanup cows eat whatever everyone else leaves behind so are at real risk of losing condition – the "skinnies". A good cattleman has to keep an eye on the "skinnies" when swath grazing and has to be able to react when some of the cows begin to lose condition.

Steve indicated a back-up plan is also a good idea when swath grazing. "Think about all the things that might go wrong with swath grazing such as the farmer wants them out of the field by early April or there's more than an average snow fall or the swaths are frozen for some reason or there's no snow for the cows to lick. How will you handle those conditions? Plan ahead!" he advised.

Cows generally gain condition for Steve when they're bale grazing. He has never encountered a problem with this form of grazing. One thing that helps with the labor in the winter is to pull the twines when the bales are being placed in September. Steve said, "I can pull the twine from 42 bales in an hour in September".

Photo taken near Kelfield, fall 2007. Conditions were very dry but where bales were grazed the previous winter, the grass is still growing

His bales never see the yard. They are placed in rows in the fall and Steve sticks rebar with insulators into the second row of bales, using the next row of bales for the "fence" every time he opens a new bale row. This works well as he isn't fighting with trying to erect posts into frozen ground with each new bale row.

When bale grazing, Steve recommends a 4 day graze. He feels the balance between labor, animal nutrition and feed waste is optimal. He said that in a 4 day graze, every cow is feeding well for 3 days, but they are all forced to clean up on Day 4. Steve believes that at minimum, the herd needs to be offered a 2-day ration at once so that "every cow gets bunk space".

With highly palatable hay, the cows clean it up well with very little waste. However, there is concern about "dead spots" after bale grazing. These occur where there is extra residue covering the ground thereby impeding the growth of grass the following spring. While the grass grows through the bale circles the following spring, it takes a little longer to get going than the grass that had no bale on it. It takes even longer for the grass to grow through green feed and straw circles than hay. Pea straw bales can leave dead spots for up to 4 years. Many producers will try to harrow the residue. Steve doesn't bother. "I would need to own the tractor and harrows, burn the fuel and spend the time turning circles. I see no economic benefit to harrowing", he explained.

The Kenyons don't bale graze yearlings because the young animals either don't gain enough or they waste too much feed.

Year-round grazing has proven successful for Steve and Stacey Kenyon. Ensuring the soil is healthy has promoted forage production for a longer growing season.

Swath and bale grazing have also served to minimize labor requirements and reduce overall feeding costs.

The southeast region of Saskatchewan will host a couple of Steve's "Year Round Grazing Systems" workshops this winter. Each workshop is 3 days in length and is an introductory course on grazing management, economics, finances, cell design, swath grazing and bale grazing. The Workshop in Alameda will be held Jan 11 – 13 (contact Vicki East 634-7074); the one in Yorkton will be held Jan 25 -27 (contact Naomi Paley 786-1686). For more information on the Kenyons' business, visit www.greenerpasturesgrazing.com

Managing Carbon: Do You C What I C?

By Dwayne L. Beck, Ph.D.
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Modern agriculture has become extremely dependent on the use of energy from outside sources. This outside energy is used for manufacturing the tools and inputs used in agricultural production, for most production operations, and to process and transport the agricultural products after they are harvested. In fact, much of the "productivity and efficiency" credited to modern agricultural production is probably related to use of outside energy inputs most of it in the form of what we will call geologic carbon. In addition, what brought most of our European ancestors to the prairies originally was the vast store of geologic carbon contained in the prairie sod. Mining the nutrients and biological energy from this source was made easier and faster through use of geologic carbon in the form of coal, natural gas, and oil.

This dependence on geologic energy links farm profitability closely to the ratio between the price of energy and crop prices. One only has to examine historic price ratios to gain insight. Wheat had an average price of $1.37 per bushel in 1970. Oil was $3.39 per barrel that same year. There is no need to comment on the present ratio. As this ratio has changed, farmers have become more efficient in their farming practices. No-till is part of that change. The savings associated with eliminating tillage are substantial but they are not sufficiently large to offset the ever widening ratio between the price of wheat and oil. For instance, it takes the energy equivalent to one gallon of diesel fuel to produce, transport, and apply 5 lbs of nitrogen fertilizer. Obviously something needs to be done to modify the way we do things. Understanding carbon cycling better is a way to begin this change.

> **"The Tisdale and Nelson book goes on to state that little or nothing can be done by man to directly impact the supply of carbon dioxide to a plant. I believe they are wrong. I further believe that the lack of attention to carbon as a plant nutrient will be viewed as a major shortcoming of the practice of agronomy in the 20th century."**

Managing Carbon

If I were to ask a class of University Agronomy Students "What essential nutrient element is taken up in largest quantities by plants?", the response given by most of them would be "nitrogen". That same answer would probably also be given by most scientists and farmers. In reality the answer is carbon. Carbon, hydrogen, and oxygen constitute the vast majority of the atoms (and the mass) contained in plant dry matter. Carbon is the nutrient element taken up in largest quantities by plants.

Some of the leading books on plant nutrition (Mengel and Kirkby; Tisdale and Nelson; or Stanley Barber) mention carbon, hydrogen, and oxygen only briefly as being essential elements. The Tisdale and Nelson book goes on to state that little or nothing can be done by man to directly impact the supply of carbon dioxide to a plant. Cook and Veseth make a similar statement in their "Wheat Health Management" publication. I believe they are wrong. I further believe that the lack of attention to carbon as a plant nutrient will be viewed as a major shortcoming of the practice of agronomy in the 20th century.

Carbon chemistry is the basis of life as we know it. The search for life on other planets begins with a search for water and carbon containing compounds. Carbon has some very unique chemical properties. In its lowest energy level it has the electron distribution of 1s2, 2s2, 2p2. This would lead us to believe that it would form the most stable compounds when it has a valence of +2. In fact, carbon forms its most stable compounds when it has a valence of +4. This is the result of the promotion of one of the paired 2s level electrons to the empty 2p orbital (there are two half-filled p orbitals and one that is empty). This is subsequently followed by the formation of 4 hybrid sp^3 orbitals when bonding occurs. These hybrid orbitals are the basis for the tetrahedral shape that gives diamond its hardness. This property allows carbon to form rings and long chains with carbon bonded to carbon as the skeleton. Carbon forms more compounds than any other element except hydrogen. The fact that an entire field of chemistry (organic chemistry) is devoted exclusively to compounds of carbon is a testament to the importance this element holds for science.

Most agronomists and farmers recognize that soils high in organic matter differ in their characteristics relative to others that had lower levels of organic matter. Most farmers for centuries had utilized manure as fertilizer. It was valued for adding nutrients like nitrogen and phosphorus and for making the soil easier to till and capable of holding more water. Soil scientist even developed methods of classifying soils that were heavily influenced by the amount of organic matter present. The system still being used in Canada classes soils based on color (brown, black, dark brown, grey). These colors are caused by differing amounts of organic matter. Scientists like Hans Jenny spent a lifetime studying the climatic factors that led to soils in different areas developing different organic matter contents.

"It is not uncommon for organic matter levels in the Pampas and the Great Plains or Prairies to have been reduced to less than one-half the amount present before settlement by Europeans. (If this reduction was from 4% to 2% organic matter, the amount of carbon dioxide released would be equivalent to burning 44 tonnes of coal per hectare)."

Scientists did determine that tillage based farming systems reduced organic matter levels of soils and made them less productive over time. Crops that produce low levels of residue (cotton, soybean, etc.) speeded the rate of organic matter loss as compared to crops with higher residue levels (more carbon). Raising perennial grass pastures and alfalfa on a piece of land increased organic matter levels relative to when it was used exclusively for tillage based cropping.

The introduction of European style tillage based farming over large expanses of formerly undisturbed lands in North and South America, Australia, and Eastern Europe during the late 1800's and early 1900's is a prime example of wholesale mining of stored nutrients. The "homesteaders" were searching for the stored nitrogen and other nutrients and were willing to waste organic carbon in the process. It is not uncommon for organic matter levels in the Pampas and the Great Plains or Prairies to have been reduced to less than one-half the amount present before settlement by Europeans. (If this reduction was from 4% to 2% organic matter, the amount of carbon dioxide released would be equivalent to burning 44 tonnes of coal per hectare). Obviously, the soil was out of balance relative to what it had been in its native condition.

Even though everyone was aware of organic matter and realized it was valuable, no one paid much attention to the carbon part of the carbon cycle. That attitude changed when scientists noticed the concentration of carbon dioxide (partial pressure of carbon dioxide) in the atmosphere was increasing relative to historic levels. A massive amount of effort has been expended trying to quantify the amount of change that has occurred and predict the potential impact that might have. Reasons for this change have been attributed to natural causes, deforestation, use of fossil fuels, etc. Some of it is also due to the impact of tillage on the organic matter in the soil. There were now incentives and funds available that encouraged scientists to look at all parts of the carbon cycle.

"Even though everyone was aware of organic matter and realized it was valuable, no one paid much attention to the carbon part of the carbon cycle."

Scientists like Don Reicosky began to study the carbon system in the soil. He found that there was a large "flush" or release of carbon dioxide in the 3 to 4 days immediately following a tillage operation. On land that remained untilled and had been in grass for several years (after many years of farming) less carbon was released during the season and the release happened later in the year when the weather warmed. Don is most concerned with how and why carbon enters and exits the soil. He really does not care what happens to it after it leaves the soil. But we are intensely interested because our crop needs to find carbon. The more carbon it can find the better.

Let us look at the immobilization side of the carbon cycle. Much of what we know about the impact differences in carbon dioxide partial pressures have on plant growth comes from studies dealing with the greenhouse effect. These data suggest that plants have higher water use efficiencies when grown under elevated carbon dioxide levels. The phenomenon is attributed to the fact that these plants do not have to open their stomata as widely to attain the carbon dioxide they need. Consequently, less water vapor "leaks" out. Many greenhouse operators actually enhance the carbon dioxide partial pressure in the greenhouse atmosphere to reduce water vapor loss from plants. Reducing transpiration cuts down on water condensation on the ceiling and walls. Plants grown in higher carbon dioxide environments are also better able to attain adequate carbon under water stress conditions when stomatal closure occurs for substantial periods of time during the day. The reason for this is that the concentration of carbon dioxide in the air that enters the plant when the stomata are open is greater. These impacts should be most pronounced on C_3 plants as compared to those with the C_4 pathway. The C_3 pathway is not as efficient as the C_4.

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Growing, Optimizing, and Utilizing Grain

by Sheri Strydhorst
University of Alberta

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Alberta cropping systems are heavily dominated by cereal and canola crops. The lack of species diversity in our agricultural ecosystems is a concern as these low diversity systems are fragile and unsustainable. More diverse cropping systems remain productive under fluctuating environmental constraints and require fewer external inputs (Altieri 1995). Increasing the use of nitrogen (N) fixing grain legume species in Alberta crop rotations and intercrops should increase ecological stability, reduce input costs, and reduce the energy footprint of Alberta cropping systems.

Inorganic N fertilizer is a convenient and was a relatively cheap source of N to supply crop nutrients demands (Peoples et al. 1995a). However, only 18–49% of applied N fertilizers are typically used by our crops (Cassman et al. 2002) with the unused portion being lost to water sources and the atmosphere. With growing international concern over global warming, environmental degradation, and loss of natural resources, biological N fixation by grain legumes represents a renewable resource for sustainable agriculture which can partially replace inorganic N fertilizer (Peoples et al. 1995a).

To maximize grain legume benefits, producers need to increase grain legume acreage, use management techniques to optimize N fixation, and understand the grain legume N contribution to cropping systems.

Growing Grain Legume NITROGEN in Grain Legume-Cereal Intercrops

Increased grain legume usage can be achieved through intercropping. Crop mixtures, generally referred to as intercrops (Anil et al. 1998) can provide numerous benefits to cropping systems through increasing total yield and land use efficiency, improving yield stability, enhancing light, water, and nutrient use, and controlling weeds, insects, or diseases (Willey 1979a). In temperate climates, intercropping is more successful when used for forage production than grain production (Anil et al. 1998).

The inclusion of grain legumes in intercrops can reduce the need for N fertilizer in forage production (Geijersstam and Mårtensson 2006). Intercropping legumes with cereals may also minimize N losses commonly

associated with legume sole crops through cereal uptake of soil inorganic N and slower N mineralization during decomposition, due to higher cereal C:N ratios (Hauggaard-Nielsen et al. 2003). Previous studies note that the inclusion of grain legumes in forage intercrops increases protein yields (Walton 1975, Berkenkamp and Meeres 1987, Anil et al. 1998), and improves forage nutritive value (Chapko et al. 1991, Carr et al. 1998).

The management objective of intercrops is to minimize competition and maximize complementary interactions between species (Willey 1979b). Properly managed intercrops are more productive than monocultures because there is better resource use over time (Natarajan and Willey 1980) and space (Reddy and Willey 1981). For example, intercrops can take up nutrients (Willey 1979b) and water (Francis 1989) from a larger soil volume if intercrop species have different rooting habits and rooting depths. Differences in peak demand for nutrients, by the intercrop components, (Willey 1979b) and greater improvement in light utilization can also improve productivity. Reductions in pest outbreaks are attributed to intercrops having a mixture of susceptible and resistant plants which may restrict the spread of the pest (Altieri and Liebman 1986).

Recent studies have found that with proper management techniques, high quality, economically feasible, grain legume-barley intercrops can be grown for forage without the use of N fertilizer (Strydhorst et al. 2007a). Field studies were conducted at three sites in the Parkland region of Alberta in 2004 and 2005. 'Snowbird' tannin-free faba bean, 'Arabella' narrow-leafed lupin, and 'Cutlass' field pea were planted at 0.5, 1.0, 1.5, and 2.0x their recommended sole crop planting density with 'Niobe' barley at 0.25x the recommended sole crop planting density. A barley sole crop was also included for comparison. Increasing the grain legume planting density from 0.5 to 2.0x did not affect forage dry matter (DM) but it increased the proportion of legume in the forage DM from 39 to 63%, protein concentration from 119 to 132 g kg^{-1}, and acid detergent lignin from 36 to 42 g kg^{-1} while it decreased neutral detergent fiber from 465 to 422 g kg^{-1}. Faba bean-barley, lupin-barley, and pea-barley intercrops had 64%, 27%, and 55% higher protein yields, respectively, compared to sole crop barley. Faba bean-barley and lupin-barley intercrops had similar forage DM yields which were 1.5 Mg ha^{-1} and 1.3 Mg ha^{-1} less than pea-barley intercrops and

Legume Nitrogen

sole barley crops, respectively. Intercrops of 'Cutlass' pea and 'Niobe' barley offered the most favorable combination of forage DM yields, nutritive value, and economic returns.

Growing Grain Legume NITROGEN in Grain Legume Based Crop Rotations

Increasing use of grain legumes in crop rotations is a simple, but underutilized, method of increasing species diversity in cropping systems and reducing N fertilizer use. Historically, legumes have been essential cropping system components which supply N, but readily available, and inexpensive, N fertilizer reduced agriculture's dependence on legumes (Havlin et al. 1999). As inorganic N fertilizer becomes more expensive, due to higher manufacturing and transport costs, there is renewed interest in the use of legumes to supply a portion of the N to the cropping system.

Successful crop rotations contain: fertility building and exploitative crops, legumes, crops with different root systems, crops with varied pest and disease susceptibility, a mixture of weed susceptible and weed suppressing crops, green manure crops, and winter soil cover (Millington et al. 1990). The best results are observed when the following elements are combined: legumes with cereals, long-season crops with short season crops, perennials with annuals, and summer annuals with winter annuals. Although not specific to legumes, diverse crop rotations reduce the incidence of insects, weeds, and diseases by breaking the pest life cycle (Altieri 1995). The most effective breaks in pest cycles are achieved when successive crops of the same species are avoided, crops with common pests are not grown in succession, and when extremely different plant species follow each other in sequence.

Optimizing Grain Legume NITROGEN

A survey of N fixation in farmer's fields found that levels of N fixation are only a fraction of the theoretical limits that can be achieved under optimal conditions (Peoples et al. 1995a). Nitrogen inputs from biological N fixation can increase by increasing the percent nitrogen derived from the atmosphere (% Ndfa) and / or by increasing legume growth which will increase total N requirements. Levels of % Ndfa may be enhanced by maximizing the numbers and effectiveness of rhizobia bacteria, reducing soil nitrate levels, and reducing legume and rhizobia sensitivity to high soil nitrate levels (Peoples et al. 1995b). To increase legume N demands, strategies need to be employed which maximize legume growth.

For a particular species, N fixation varies between locations and years due to

differences in soil fertility, effectiveness of inoculation, environmental conditions, soil pH, photosynthetic activity, and legume management (Halvin et al. 1999). A review of many N fixation studies found that faba bean N fixation varies between 8–352 kg N ha^{-1} yr^{-1}, lupin N fixation varies from 95–283 kg N ha^{-1} yr^{-1}, and pea N fixation varies from 33–246 kg N ha^{-1} yr^{-1}. Based on these findings, it is apparent that N fixation can vary greatly.

Producers can modify management practices to optimize N fixation. In a recent study, Strydhorst et al. (2007b) found that the amount of N fixed by grain legume crops is highly dependent on management practices. Field studies were conducted at three locations, in the Parkland region of Alberta, between 2004 and 2006. Tannin free faba bean, narrow leafed lupin, and field pea were planted at 0.5, 1.0, 1.5, and 2.0x the recommended grain legume planting density, with or without barley as a model weed, and the resulting N fixation was measured. In the absence of weed interference, faba bean N fixation ranged from 70–223 kg N ha^{-1}, pea N fixation ranged from 78–147 kg N ha^{-1}, and lupin N fixation ranged from 46–173 kg N ha^{-1}. On average, weed pressure reduced N fixation yields by 43%. Mean N fixation yields (averaged over all pulse species and site years) were 82, 99, 105, and 111 kg N ha^{-1} for 0.5, 1.0, 1.5, and 2.0x the grain legume planting density, respectively. Increasing the legume planting density increased pulse crop yield by an average of 27% and N fixation yield by an average of 35%. Just as crop yields can be optimized with proper management techniques, proper management techniques can also increase N fixation yields.

Utilizing Grain Legume NITROGEN

Peoples and Herridge (1990) report 16–353% higher cereal yields on grain legume stubble in comparison to cereal yields on non-legume stubble. In addition, cereals following grain legumes typically have increased protein contents (Marcellos 1984, Wright 1990a,b, Campbell 1992, Zentner et al. 2001). Increased yields following grain legume crops are partially attributed to increased soil N levels. In a review, Peoples et al. (1995a) report that soil nitrate-N levels following legumes are 14–77 kg N ha^{-1} greater than levels following non-legume crops. The increased nitrate is attributed to: N-sparing by the grain legume (Chalk 1998, Evans et al. 1991, Herridge et al. 1995); N mineralization from senesced legume leaves, roots, or nodules (Peoples et al. 1995a); and rhizodeposition which involves the release of biologically fixed N products from nodulated roots (Sawatsky and Soper 1991, Mayer et al. 2004).

Despite many reports of increased total soil nitrate levels following grain legumes, increases in total soil N are not

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How Urbanization Changes Environmental Policy

Increasing urban populations often demand environmental policies that are at odds with the needs of rural communities and the conservation of the countryside

By Robert Sopuck, Director
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Smart Green Frontiers Project

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The political dominance of Canada's cities has major consequences for environmental policy, especially outside of the cities. Canada's political elites focus on urban environmental issues, both real and imagined, and as a result, the costs to the countryside are becoming more apparent.

Traditional environmental policy (in the old days we called it conservation) dealt with the use and management of natural resources. From water to wildlife to forestry, the issues revolved around methods of harvesting, resource sustainability and quality and issues of ecosystem management. Although these issues could affect all Canadians, they were largely issues for the countryside.

There were often intense disagreements between the users of the resource (anglers, hunters, commercial fishermen, miners, farmers, trappers, loggers, and the like) and the public sector scientists and resource managers who were charged with ensuring the wise use of natural resources.

This made sense then and still makes sense today, especially when one considers the geographical dominance of the countryside, i.e., there is more country in Canada than there is city. The economic dominance of Canada's resource industries has put paid to the notion Canada has moved beyond being a "hewer of wood and drawer of water." Our rural resource economy is carrying the entire country (just check out our loonie!), and the last time I looked, there were not many mines or oil fields in cities!

Urbanization has serious consequences for rural people. Not only does their political influence diminish, but also they and their resource economies are increasingly at risk from urban-based, environmental policies.

> **"Urbanization has serious consequences for rural people. Not only does their political influence diminish, but also they and their resource economies are increasingly at risk from urban-based, environmental policies."**

Urbanization creates a disconnection from the processes that put food on tables, gas in vehicles, and shelter over heads. Many urbanites obtain their environmental information from television, a medium that is more interested in drama and conflict than in reality. A bit harsh you say? I give lectures to urban audiences, and the naivety about the countryside is breathtaking. When I show a picture of a new clear-cut forest (the usual barren landscape) followed by a picture of a 20-year-old clear-cut (the never-filmed vigorous young forest), people are surprised at how attractive the young forest is. When I ask how many have seen TV pictures of new clear-cuts, they all raise their hands. A similar query about old clear-cuts elicits no show of hands. Forests grow back. Period.

> **"Urbanization creates a disconnection from the processes that put food on tables, gas in vehicles, and shelter over heads."**

Similar examples exist in agriculture, trapping, hunting (especially seals), and mining, whereby these activities are carried out within the bounds of environmental sustainability, and yet the pressure to eliminate or seriously curtail them continues to increase. Usually at this point in the discussion an activist will jump up and ask, "Don't you care about the environment?" or the person will cite an example of a bad practice that caused a conservation catastrophe. These types of objections hide the urban belief that ANY resource harvesting is automatically bad for the environment. Rural people think that any conservation problems that arise are fixable.

Rural people view the world through a much different lens. Whether it is harvesters in the field, stacks of logs at a paper mill, the local smelter's smokestack or racks of lobster traps at the edge of town, rural people experience natural resource use every day, and the renewal of natural resources is also a part of their world. Thus, the rural world view tends towards use and stewardship as opposed to the urban view, which emphasizes no use and regulation.

The urban focus has shifted policy away from real and pressing natural resource issues to those of air quality and climate change. I will not debate Kyoto here, but I was struck by a comment from a glum Environment Canada policy maker who noted, "I guess we're the Department of Air Quality these days;" and this at a time when air quality is actually quite good over much of Canada. This urban focus means that immediate environmental issues such as water management, soil health, and

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MANAGING CARBON: DO YOU C WHAT I C? ... CONTINUED FROM PAGE 13

The best way to understand how something should work is to examine it in a natural system or several natural systems. If we look at carbon cycling in the Bush or the Prairies, the system was in equilibrium. The same amount of carbon entered and left the soil each year (on average). Carbon dioxide was formed as dead plant residue, soil organic matter, and dead animals decayed and as living organisms breathed. Warm-blooded animals are breathing throughout the year but the microbes that mediate most of the decay process operate best when the temperatures are neither too hot nor too cold. They also like the proper moisture. That means that the "flush" of carbon dioxide associated with microbial activity (on the American Prairies) occurs after soils warm in the spring and increases when moisture is adequate. This is coincident with the time of peak vegetative growth of most species native to these regions. This is most likely an evolutionary adaptation because most other fertilizer elements are associated with (bound within) the organic material that is decomposing. If it did not decompose, there would be less nitrogen, sulfur, zinc, etc. for the next generation to use. If organic material decomposed before the period of maximum plant growth, there would be a high probability that many nutrients would be lost from the system (perhaps permanently). Most interesting to this discussion is the fact that carbon dioxide evolution coincides almost exactly with the maximum demand for carbon dioxide by plants. It is easy to visualize the dense canopy of a tall-grass prairie serving as a trap for preventing carbon dioxide from leaving an area until it can be used by the plants forming the canopy.

The rainforest operates in much the same manner other than it does not have its reserves of nutrients stored as soil organic matter. It does not need storage because the nutrients (and carbon) are stored in living materials that cycle quickly. In the prairie most of the biological activity occurs in the soil or near the soil surface. In the rain forest, most of the biology is above the soil. Soil scientists have traditionally thought of rainforest soils as being "poor'. They are poor if you look only at the soil. The rainforest ecosystem consisting of the soil plus the plants and animals is not poor.

"Even with this technology, the productivity of land with a long history of farming is not as good as "new" land. The most striking characteristic of old land is that the level of carbon in the system remains well below that in the native system."

When farming first came to these areas, there was little understanding of plant nutrition. In the rainforest it was advantageous to cut down the vegetation and burn it (slash and burn agriculture). This released the nutrients being stored in the vegetation so they could be used (mined) by the farmer's crop. Making all of the nutrients available at once and at a time well before the crop would use it, led to loss of most of the nutrients. There were enough nutrients remaining to raise the small crop of annual plants for a few years. Soil degradation did not seem important since there were many hectares of forest and very few people, more land could be found.

The process was similar for the Pampas and Prairies. In these ecosystems, many of the nutrients were "locked up" in the soil organic matter. Burning the above-ground vegetation did not have the same effect. Tillage on the other hand was tremendously efficient at "burning" the stored organic matter and releasing nutrients for use by the crop. The benefits and problems are almost identical to the slash and burn system of the rain forest. The nutrients became available for use by annual crops but they were available too early and therefore prone to loss. It just looked less destructive because there was no visible fire. There was burning going on just the same. The land degraded after some years of doing this. Productivity declined. Nutrients leached or leaked from

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HOW URBANIZATION CHANGES ENVIRONMENTAL POLICY ... CONTINUED FROM PAGE 16

biodiversity conservation are relegated to the back burner. The proposed cutbacks to the Canadian Wildlife Service's migratory bird programs indicate a move away from programs of interest to hunters and rural people to programs that deal with climate change. Notwithstanding the public polling on climate change, reducing carbon dioxide emissions will not improve wildlife management, clean up a single waterway (e.g., Lake Winnipeg) or save one species from extinction. Canada is responsible for a mere six per cent of global carbon dioxide emissions, so we could shut down the entire country and still have done nothing. Air quality is important, but Canada must not sacrifice the rest of the environment on the altar of climate change.

Canada's big cities have the vast majority of seats in Parliament, and the cities tend to dominate environmental policy making. Issues of concern to the countryside tend to fall by the wayside. It is time to restore and enhance traditional conservation policies; this is how one delivers the environment goods.

the system into water sources. But it didn't matter, there were lots of grasslands and very few people. Once a parcel was degraded, the farmer simply moved to another one.

At first blush, most practicing farmers probably think this has little to do with their operations today. In areas where the supply of new land became limited, farming practices evolved to include strategies designed to help slow the rate of productivity loss. Mineral fertilizers have allowed raising the content of many elements to levels equal or greater than in the native system, although they continue leaking from the system. Even with this technology, the productivity of land with a long history of farming is not as good as "new" land. The most striking characteristic of old land is that the level of carbon in the system remains well below that in the native system.

Most scientists believe that soils with more organic carbon in the system are more productive because of improved soil properties like water-holding capacity enhancement, better structure, and more cation-exchange capacity. These benefits undoubtedly play a major role. Still almost no-one has considered that there might be direct impacts on carbon dioxide partial pressures in the crop canopy as well. In tilled systems, where most carbon dioxide cycling is going to occur soon after the tillage operation, the farmer has no ability to manage his carbon to better suit the plants needs That may not be true for no-till farmers whose carbon cycles later in the season, similar to what it does under natural conditions..

The good news about the recent emphasis on understanding global warming and the carbon cycle includes results like the following taken directly from an annual report submitted by Hatfield and others doing work at Ames, Iowa under no-till conditions.

Single Most Significant Accomplishment during FY 2002: Carbon dioxide and water vapor exchanges measured within a corn canopy during the summer of 2001 revealed that distributions with height varied throughout the day. Concentrations of carbon dioxide in the lower canopy increased to levels near 900 ppm during the night and then rapidly decreased as solar radiation began to penetrate into the canopy during the early morning. Mid-afternoon concentrations were less than 300 ppm indicating that carbon dioxide values may be limiting crop growth. Examination of the patterns of carbon dioxide and water vapor suggested that the soil may be a significant source of carbon dioxide when the canopies completely cover the soil surface. Combining the gas measurements with the biomass estimates of carbon stored in the canopy and the patterns in the above canopy measurements indicates that the soil release of carbon dioxide during the growing season may contribute up to 40% of the carbon stored in the corn crop.

"I am a farmer. I take sunlight, water, and carbon dioxide and turn them into products I can sell."

It is conceivable that carbon cycling could be manipulated through rotation choice, residue management techniques, nitrogen application methods, etc., with the goal of raising carbon dioxide partial pressures in the crop canopy at the time when the crop needs more carbon. This may sound silly until you consider that it is possible (probable) that C cycling effects are partially responsible for the fact that soils with high organic matter content normally produce higher yields than those with less organic matter. Similarly, fields that have recently been converted from perennial crops or from sod into crop production might produce superior yields for the same reason. Almost every seasoned no-till farmer has had instances where a crop yielded much better than expected based on the water saving aspects of no-till alone. Something else had made a contribution.

Perhaps no-till and crop rotations are not ends but rather the best means or tools we have available to manage the carbon cycle in our cropping systems. Maybe this conference should not have as its title direct seeding but carbon managing. If C cycling is to be controlled, low-disturbance no-till now becomes the only option in terms of tillage choice. The focus then turns to optimizing that system.

I am a farmer. I take sunlight, water, and carbon dioxide and turn them into products I can sell.

Post Script:
On previous visits to Alberta we stressed the need to diversify

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rotations and reduce disturbance for the purpose of improved weed control. We have recommended utilizing cover crops to attempt to minimize the leakage of water and nutrients and to mitigate wet soil issues during seeding and harvesting. We have always stressed the need to cycle nutrients and water in a manner similar to the native vegetation. Nothing has changed this time other than we expanded the subject matter to include thinking of carbon as one of the nutrients that cycle.

Animals are an integral part of the natural ecosystem in Alberta. They should be able to be an integral part of the sustainable farming systems. Problems associated with the keeping of livestock are not the fault of the livestock. They do not control how they are managed. Livestock will make it easier to diversify the crop rotation and cycle water and nutrients properly. Developing methods to better manage the carbon in the system will lead to better management of the other nutrients as well.

I encourage readers to visit our web site www.dakotalakes.com for further information or give me a call.

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GROWING, OPTIMIZING, AND UTILIZING GRAIN LEGUME NITROGEN ... CONTINUED FROM PAGE 15

always detected (Peoples et al. 1995a). Some explanations for low total soil N levels following annual legume crops include: (i) N removal in harvested grain, (ii) single legume crops may not result in detectable or significant changes in total soil N levels, and (iii) N released from decomposing legume crop residues can be susceptible to loss or it may be tied up in various forms of soil organic matter.

Although grain legumes provide N to subsequent crops, this may not be the primary factor that accounts for improved subsequent crop performance. In many instances, N fertilizer applications to a crop grown on cereal stubble are unable to make yields equal to those obtained on grain legume stubble (Wright 1990a, Rowland et al. 1994). Research conducted in Saskatchewan, by Stevenson and van Kessel (1996), found that only 8% of the field pea rotational benefit is explained by additional soil N and the remaining 92% is explained by non-N factors: reduced root and leaf diseases, reduced weed pressure, increased phosphorous, potassium, sulfur availability, improved soil structure, and growth substances released from the grain legume residue. Other studies indicate that 29% of the legume rotational benefit is attributed to non-N effects (Janzen and Schaalje 1992).

The scientific community does not understand the N credit associated with grain legumes and therefore producers are unable to make educated decisions as to how much N fertilizer should be applied to crops planted into grain legume stubble (Miller 2007). Excess N fertilizer applications increase producer's input costs and contribute to environmental pollution. On the flip side, deficient N fertilizer applications reduce crop productivity and will reduce farm cash receipts. Establishing the N value of grain legumes in our cropping systems requires more research.

Conclusion

Tannin-free faba bean, narrow-leafed lupin, and field pea are valuable additions to Alberta cropping systems. They require no N fertilizer in their production year and can produce high quality forage in mixtures with barley. A complex interaction of pulse N and non-N rotational benefits contribute to increased subsequent crop yields and protein. Purchased fertilizers or pesticides are unable to achieve the cropping systems benefits that can be achieved with grain legumes.

If producers were to change their crop rotations to include one grain legume crop every five years, this would mean that 20% of our acres would require no N fertilizer in the grain legume year and reduced N fertilizer in the subsequent crop year. There would likely be measurable improvements in soil structure and P,K,S availability. Cereal crops grown on grain legume stubble tend to consistently have higher protein contents which should command a price premium. The combination of these factors would tremendously reduce input costs, increase income, and improve the health of our agroecosystems.

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For a complete list of references used to prepare this article, please visit RTL's web site at www.reducedtillage.ca

A PERSONAL PERSPECTIVE TWO OF SSCA'S SUCCESSES ... CONTINUED FROM PAGE 2

called Gord and told him about the guides we had in the works and my idea to combine them into a single manual. Gord liked the idea. We arranged to meet a few weeks later along with our managers (John Kiss, SSCA and Phil Leduc, PAMI) and the Direct Seeding Manual was born.

At a staff planning meeting later that fall, we decided to develop a one day course based on the Direct Seeding Manual. The course was an intense all day affair. We charged a $25 fee to cover the cost of the manual. Over a three month period in the spring of 1993, 3000 farmers attended one of our courses and took home the Direct Seeding Manual.

Over the next few years, we made a couple of revisions including a major rewrite in 2000. A total of 7000 original manuals were sold. This means that 12% of Saskatchewan farms own a copy.

I have many other stories to share in the future. I hope to share a few with you at our 20th anniversary Conference and Open House coming up in Regina in February.

financial position of the organization.

The **Awards Banquet begins at 6:00 p.m**. The recipients of the SSCA's Award of Merit and the SSCA – DUC's Conservation Farm Family Award will be recognized at that time.

Following the Banquet, the **Crop Management and Cattle & Grain Bear Pits** will be held.

The Environmental Stewardship Equals Positive Economics session leads off **Day 2**. Discussing how consumers think is CJ Katz. CJ is known to CBC Radio fans through her frequent visits to the Morning Edition. Wendy Holm, formerly a frequent contributor to a farm paper, will focus on how conservation farming is sustainable. Shepherd's Grain comes from an alliance of progressive family farms**,** based in Washington state, dedicated to practicing sustainable agriculture. The formation and direction of the company will be examined by Fred Fleming, a Shareholder in Shepherd's Grain.

The New and Emerging Issues session encompasses such topics as the application of nanotechnology to agriculture; the impact China has on the prairie farm gate; and the development of a cellulosic bioproduct economy.

The Closing Speaker, Dr. Graham F. Parsons, is an ag economist who believes that "Next Year" has finally arrived for Saskatchewan. He will share his vision of the province's potential to create wealth and prosper!

The Conference offers 15 potential CEUs for the Certified Crop Advisers and many hours of Professional Development for Professional Agrologists. Early registration deadlines mean big savings for SSCA members and non-members alike. To register for the Annual Conference, call Marilyn at (306) 695-4233.

Side Bar SSCA Milestones

1987 – ManDak holds its annual meeting in Regina and a group of interested farmers from Saskatchewan decide to form the first provincial soil conservation organization

Brett Meinert is President; Glen Hass is the volunteer Executive Director

1989 – Funding from ADF enabled SSCA to hire staff. John Kiss hired as Executive Director

1990 – By January, SSCA had hired 6 field staff and 5 specialists to join John in the delivery of the Save Our Soils program of the Canada-Saskatchewan Agreement on Soil & Water Conservation

1992 – The first conference with a focus on direct seeding, held in Prince Albert

1993- SSCA instrumental in the development of the Conservation Learning Centre near PA

SSCA develops Project Soils and in 1997, releases the French version together with PAMI, developed the Direct Seeding Manual. Over 7000 copies have been sold

1994 – 1100 farmers attend the Annual Conference in Lloydminster

1996 - 2006 – SSCA involved with AAFC in the Prairie Soil Carbon Balance Project

2005 – SSCA launches a pilot carbon trade for farmers through Environment Canada's PERRL initiative

1991 - 14 million acres of Sask farmland in summerfallow

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