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Long-Term Direct Seeding Effects: Can we measure them and are they economically important?

By Guy P. Lafond,

Indian Head Research Farm

Making changes in farming practises requires commitment, time and resources. Producers are interested in knowing the long-term benefits of these changes and especially their economic impact. We had the opportunity in 2002 to get some indication of the magnitude of the long-term agronomic and economic benefits of direct seeding.

We measured the response of spring wheat to nitrogen fertilizer on two fields with very different direct seeding histories i.e. 20+ years vs 1 year. The test areas were close enough together to eliminate differences in precipitation as a controlling variable. We used one rate of phosphorus fertilizer (20 lbs P_2O_5/ac). Table 1 provides some general information about the two sites and also some pertinent agronomic information. Both areas were seeded to canola in 2001.

The results from the 2002 study demonstrate clearly that agronomic and economic benefits with direct seeding do accrue over time and have a significant impact on economic performance (Table 2).

The first important observation is the overall yield when no nitrogen fertilizer N is applied. On the long-term zero tillage area (L-T ZT) the yield was 42.6 bus/ac vs 26.2 on the short-term zero tillage area (S-T ZT).

The second important observation is that maximum yield was obtained with 53 lbs N/ac (60 kg N/ha) on the L-T ZT versus 80 lbs N/ac (90 kg N/ha) on the S-T ZT.

The third observation is that the protein content of the 0 N treatment on L-T ZT (13.3%) was higher than the protein content of the S-T ZT with 107 lbs N/ac (120 kg N/ha).

The fourth important observation is that the net returns were higher for the 0 N treatment on the L-T ZT than for any other N treatments on the S-T ZT area.

The fifth observation is the highest return recorded for the L-T ZT area was $83.51/acre versus $42.82/acre for the S-T ZT area.

The results of this study give rise to a number of very important agronomic questions. When the spring nitrate-N levels are compared between the two areas, the differences are small, relatively speaking (Table 1). According to soil test recommendations, the amount of nitrogen required for

both areas is similar i.e 39-50 lbs N/acre for the L-T ZT vs 50-60 lbs for the S-T ZT area and yet the outcome was dramatically different both in terms of grain yield and grain protein. This implies that new refinements to our soil test recommendations for nitrogen fertilizer are required. It is also apparent that measuring for residual nitrate-N levels can only provide a partial answer to the N fertilizer recommendation. The other important question is, within the L-T ZT area, can we find areas that differ significantly in productivity and would we expect differences in the response to nitrogen within those different areas? This requires new approaches and methods since the approach using soil testing may not allow proper separation or delineation of these management zones. These results also point to the need to refine our approach to overall land management.

Acknowledgement: This study was made possible with the cooperation of Jim Halford of Vale Farms Ltd, the Indian Head Agricultural Research Foundation, Saskatchewan Agriculture Food and Rural Revitalization, N.M Paterson Co and Agriculture and Agri-Food Canada.

Table 1. Soil and Agronomic Information for 2002.

Variable	Long-Term Zero Tillage Field	One Year Zero-Tillage Field
Spring Wheat Variety	CDC Teal	CDC Teal
Seeding Date	May 28th , 2002	May 28th , 2002
Harvest Date	September 16th, 2002	September 16th, 2002
Herbicide Use		
Pre-Seeding Burnoff	May 24th, 2002 Round-Up at 1.0 li/acre	May 24th, 2002 Round-Up at 1.0 li/acre
In-Crop Herbicide	Buctril M (1 li/ha) + 0.2l/ac MCPA Ester - June 24th	Buctril M (1 li/ha) + 0.2l/ac MCPA Ester - June 24th and Horizon 0.095 li/ac - July 5th.
Pre-Harvest Round-Up	September 6th Round-Up at 1.0 li/acre (applied by air)	September 4th Round-Up at 1.0 li/acre (applied by ground asplicator)
Seeding Implement	ConservaPak Seeder on 12" spacing	ConservaPak Seeder on 12" spacing

Spring Soil Test NO3-N (kg/ha) 0-30cm	55	41
Spring Soil Test PO4-P (kg/ha) 0-30 cm	60	25
Spring Soil Test K (kg/ha) 0-30cm	895	1200
Spring Soil Test SO4-S (kg/ha) 0-30 cm	73	69
Soil pH	7.9	8.0
Salinity Rating	Non-saline	Non-saline
Target N levels for 42 bus/ac assuming average growing season precipitation (kg/ha)	39 - 50	50 - 63
Soil Texture	Clay loam	Clay loam

Table 2. Economic analysis of nitrogen rate response study as a function of long-term and short-term direct seeding conditions.

Treatment	N Rate (kg/ha)	Yield (bus/ac)	Protein (%)	Gross ($/ac)[1]	N Fert cost ($/ac)[2]	N Margin ($/ac)	Other Var. & OH costs ($/ac)[3]	Net ($/ac)
LT - ZT	0	42.6	13.3	$169.55	$0.00	$169.55	$114.53	$55.02
	30	44.8	13.7	$183.68	$7.29	$176.39	$114.53	$61.86
	60	49.1	14.0	$205.73	$14.58	$191.15	$114.53	$76.62
	90	51.5	14.2	$219.91	$21.87	$198.04	$114.53	$83.51
	120	49.8	14.4	$216.63	$29.16	$187.47	$114.53	$72.94

ST - ZT	0	26.2	10.9	$87.77	$0.00	$87.77	$114.53	$-26.76
	30	32.9	11	$112.52	$7.29	$105.23	$114.53	$-9.30
	60	40.2	11.6	$141.50	$14.58	$126.92	$114.53	$12.39
	90	47.9	12.3	$175.79	$21.87	$153.92	$114.53	$39.39
	120	47.7	13.1	$186.51	$29.16	$157.35	$114.53	$42.82
1 Gross return = grain yield * price with protein premium - (freight + handling [1.47/bu])								
2 Fertilizer cost = $277/mt urea ($0.273/lb N)								
3 Variable and overhead costs, except for N fertilizer, according to SAF costs of production for direct seeded spring wheat Black soil zone								

President's Message: Challenging Times

By Don Horsman

SSCA President

In the article I wrote this spring, I ended by wishing that you all get sufficient rain. So much for my ability to influence those rain clouds. As we all know, it has been a very difficult year: everything from total drought to frost to rain at the wrong time to crops that would not dry down. Fortunately, there were some Saskatchewan producers who had excellent crops and now with good prices, they will have one of their best years ever. We always need to find some positives in our lives.

At the beginning of November, 2002, SSCA staff and board held a planning session at Bruno, Saskatchewan. We spent the day examining the role of SSCA and activities we use to deliver our message of soil conservation. Our main activities are the direct seeding conference, Prairie Steward, web site and meetings/tours. There was good discussion and this led to a consensus regarding our priorities. The Direct Seeding Conference was seen as the most important activity of the SSCA. This is evident by the support we get from the producers at each conference. The Prairie Steward was also seen as an important extension activity but there was some thought that, as we spend more time developing our web site and as producers get more familiar with it, there may be something of a transition. This transition may be one of moving away from the hard copy to where producers would access the Prairie Steward along with other information on the web site. Staff will be striving to make the web site more accessible for our members and to add to it so that it comes up more often through search engines.

Carbon was also confirmed as an important issue for SSCA to pursue. However, having reaffirmed our commitment to extension activities which focus on soil conservation, it was noted that there might be a conflict of time and resources as the carbon activities become more involved and demanding. We, therefore, are exploring ways of remaining a leader in the carbon issue without taking away from our core activity of extension work on soil conservation.

In addition to the activities mentioned above, SSCA will be involved, through its membership in the Soil Conservation Council of Canada (SCCC), in the greenhouse gas mitigation program and the Agricultural Policy Framework (APF) environmental chapter. These are both initiatives of the federal government and will eventually have an effect on agriculture in Saskatchewan. The greenhouse gas mitigation program is an extension program and SSCA will deliver this program in Saskatchewan. SCCC is holding a meeting in Edmonton Dec 10-12 in order that activities start in 2003. The APF is in the formative stage and Saskatchewan has not signed on to this program at this time. There are five areas or chapters as they are called--1. Food safety and food quality 2. Science and innovation 3. Business risk management 4. Renewal (international trade & development) 5. Environment. If Saskatchewan signs this agreement it will be the cornerstone of policy and program delivery.

All this points to a challenging winter for the Board, staff, and members of SSCA. I hope you find the time to add your input on policy and I also hope we all get that nice blanket of snow to add to next years moisture reserve.

Executive Manager's Report

By Blair McClinton, PAg

SSCA Executive Manager

Over the past decade, SSCA has promoted the concept of using direct seeding to create soil carbon sinks as a way to offset greenhouse gas (GHG) emissions. In addition to carbon sinks, a variety of practices are being developed to further lower agricultural emissions. In the future, SSCA will become more involved in helping producers not to adopt practices that store carbon but also help them reduce their GHG emissions.

Unlike other economic sectors, greenhouse gas emissions from agriculture are not from burning fossil fuels. The major emissions in agriculture are Nitrous oxide (N_2O) and Methane (CH_4). While N_2O and CH_4 emissions are small compared to CO_2, these gases are a concern because they are much more potent greenhouse gases. The greenhouse warming potential (GWP) of N_2O is 310 times that of CO_2 while CH_4 is 21 times that of CO_2. N_2O emissions are closely associated with nitrogen applications from both fertilizer and manure.

Nitrous oxide (N_2O) management

Nitrous oxide is formed as a part of the nitrogen transformation processes in the soil, namely nitrification and denitrification. The rate of N_2O emitted to the environment is highly sensitive to conditions in the soil and farming practices. Management practices that minimize nitrogen build-ups and discourage waterlogged conditions that favour denitrification. In many settings, the practices listed below can help reduce N_2O emissions and improve the N fertilizer efficiency.

1. Optimize nitrogen applications:
2. Optimizing nitrogen application rates to match crop use is the most effective way to minimize N_2O emissions. While not perfect, soil testing is the best method to determine the target nitrogen rate. Split fertilizer applications, based on late spring growing conditions, allow producers to fine tune their application rates. Variable-rate fertilizer applications also have the potential to better match the amount applied to the crop's needs.

   As a source of available nitrogen, manure is also a major source of N_2O emissions. As with fertilizer-N, the best way to minimize emissions is by matching the application rate to crop use, avoiding over-applications.

   Timing is as important as the rate of application. The amount of N_2O released is related not to the amount of N applied, but to the amount of N unused by the crop. Applying just prior to the time of maximum uptake by the crop or using split applications reduces the amount of time N is in the soil before crop uptake. The simplest management change to improve nitrogen timing is to apply fertilizer or manure in spring rather than fall.

3. Reduce tillage intensity:
4. Recent research in western Canada has shown that N_2O emissions are lower in direct seeding systems than under conventional tillage. Optimizing nitrogen applications in a direct seeding system is probably the most effect overall strategy to minimize N_2O emissions.
5. Use nitrification inhibitors:

While still experimental, certain chemicals, called nitrification inhibitors, applied with fertilizer or manure, suppress the conversion of ammonia to nitrate potentially reducing N_2O emissions.

Methane (CH_4) management

Methane, also known as natural gas, emissions in agriculture are primarily associated with livestock. The highest percentage of CH_4 generated by Canadian agriculture comes from ruminant animals (i.e. cattle, sheep, goats). These animals have a fore-stomach (rumen) where microbial fermentation partially digests feed material in the absence of oxygen. Five to 10 percent of the Carbon in the feed is released at this point as CH_4. Practices that improve feed conversion in cattle also reduce CH_4 emissions

Methane is also emitted from manure. The amount emitted is greatly impacted by methods of storage. When manure decomposes in the presence of oxygen, CO_2 is released. If manure is stockpiled, inadequate aeration within the pile may lead to CH_4 production. As well, higher amounts may be released from stored liquid manure because of limited aeration. Once manure is applied to the land, adequate exposure to the air means little additional CH_4 is produced. Emission from manure accounts for about 20% of the total CH_4 emitted by livestock. Pig manure plays an important role here because of the large number of animals in Canada and because of how the manure is stored. Managing emissions from manure takes two main approaches: either reducing anaerobic decomposition through improved aeration or directly capturing the CH_4 to use as an energy source.

More information on managing greenhouse gas emissions in agriculture is available through the Soil Conservation Council of Canada's website at www.soilcc.ca.

Nitrogen - Split Application

"A risk management tool for poor soil moisture conditions"

By Rich Swdyky, PAg

Conservation Agrologist

A tool in crop production that is gaining in popularity among Saskatchewan producers in recent years is the split application of nitrogen fertilizer. Many producers view the technique as a risk management tool for dry land cropping. The gain in popularity has been brought on by the advent of new technology, increased research into post emergent fertility, and most of all the poorer soil moisture reserves and the drier seedbed conditions that we have been faced with during spring seeding, especially in the last few years.

In most cases nitrogen fertilizer is the most costly nutrient in any fertilizer program. Placing all the nitrogen requirements into drier soils at seeding time is like putting all your eggs into one basket. By doing so, producers must rely on adequate rainfall to provide the crop growth necessary to utilize the nitrogen placed at seeding. Split application is the process of matching nitrogen supply with crop demand, and then supplying the remaining nitrogen as moisture conditions improve and yield potential increases.

Split application of nitrogen in dry years gives producers greater flexibility in their fertilizer program. This practice minimizes the risk of placing all the nitrogen into the ground at the time of seeding. By providing nitrogen to the growing crop when it can utilize it, producers facilitate increased efficiency of nitrogen use. Split application reduces the exposure of nitrogen in the soil to elements that can create losses such as leaching and denitrification. It also reduces the amount of product a producer must handle during the busy seeding period. Finally, proper timing and placement of nitrogen will help manage and reduce nitrous oxide emissions. Nitrous oxide is, of course, one of the greenhouse gases that contribute to global warming.

The following graphs show the biomass accumulation and nutrient uptake for both canola and wheat. Both graphs are consistent in showing a slower response rate of biomass accumulation and nitrogen uptake in the initial three week period following emergence. As we enter the three to five week period after emergence, the plant enters the vegetative phase of its lifecycle where the rate of biomass accumulation and nitrogen uptake is vastly increased. Following the five week period after emergence, we see a reduction in both biomass accumulation and nitrogen uptake as the plant begins the next phase in its lifecycle.

The graphs indicate 75 to 80 percent of the crops' nitrogen requirements are taken up within five weeks after seeding. This nitrogen plays a key role in determining crop yield and, as such,

nitrogen split applications require timely management decisions. If the scenario of dry seedbed conditions and poor soil moisture reserves exist and a producer decides to split apply nitrogen, then enough nitrogen must be placed at seeding to facilitate plant development without hampering growth. If moisture conditions improve shortly after seeding, the second nitrogen application must be made some time within the three to four week period after post emergence. The amount of nitrogen applied and the timing of the second application will depend on the amount of nitrogen fertilizer placed at spring seeding and the yield goals set by the producer. In essence, placing the second application at an earlier stage, rather than a later stage, will have a greater impact on yield. The degree of impact will depend on the amount of nitrogen placed at seeding. As the staging increases, additional nitrogen will likely contribute to enhanced protein production.

Although split application is a good risk management tool, producers should be aware of potential problems. In most cases, the second nitrogen application is made at the time of post emergent spraying. This creates time constraints for producers, unless adequate help and equipment are available. In many situations, producers undertake post emergent spraying for weeds in the morning or evening when the wind is down, and place the second nitrogen application during the day when the wind tends to be stronger.

Second, since June is the wettest month of the year, a period of downtime may result. Producers could miss the window of opportunity to apply that second nitrogen application. To avoid problems with delayed application, producers must ensure that adequate starter nitrogen is applied at seeding. This avoids nitrogen limitations between seeding and the second nitrogen application.

A producer who undertakes post emergent fertilizer application may access the necessary equipment from a local Ag retailer, or choose to retrofit existing equipment. There are many methods that can be used to apply post emergent nitrogen, including surface banding, broadcasting, coulter injection, and spoke wheel injection.

Surface banding involves the placement of a concentrated band or stream of liquid fertilizer on the soil surface. High clearance sprayers, pull type sprayers, floaters, or specially designed pull type applicators can be utilized to dribble 28-0-0 (urea ammonium nitrate) onto the soil surface. When retrofitting a sprayer to apply liquid, producers require dribble band nozzles. The nozzles have one to three orifices to create the desired stream. European nozzles have also entered the market, and include up to eight orifices. The cost to modify a sprayer ranges from as little as a few dollars to as much as $30 per nozzle.

Surface broadcasting of nitrogen fertilizer applied post emergent can be accomplished with both liquid and dry fertilizer. Urea ammonium nitrate (28-0-0) needs to be sprayed at low rates on the plant surface, as crop injury will result with increasing rates. Ammonium nitrate (34-0-0) or urea (46-0-0) can be broadcast on the soil surface. Although ammonium nitrate is preferred over urea due to its lower volatility, many Ag retailers do not handle it or are unable to acquire it.

Surface banding provides many agronomic advantages over broadcast application. First, the concentrated liquid fertilizer band decreases contact between the fertilizer and surface residues,

therefore reducing the amount of nutrient tie-up in surface trash. As a result, there are more nutrients available to the crop. Second, the application in a concentrated band reduces the risk of nitrogen loss through volatilization. Finally, surface banding reduces the risk of crop injury as the liquid is being dribbled onto the soil surface instead of being applied onto the crop foliage.

Disc or coulter machine applications place nitrogen fertilizer into the soil once the crop has emerged, and provide minimal disturbance to the soil and emerging crop. Nitrogen placement in the soil with this method improves root access to the nitrogen. It also improves the efficiency of nitrogen use, as volatilization losses and nutrient tie-ups with surface residue are reduced.

A spoke injector places fertilizer into regularly spaced pockets or nests below the surface. Fertilizer nesting results in very low disturbance, and provides similar agronomic advantages to coulter banding.

Split application of nitrogen is a tool that producers can incorporate into their farming operation, especially in years of poorer soil moisture reserves. The key to the success of this system would be to apply enough nitrogen at the time of seeding to carry the crop with out hampering yield, until the second nitrogen application can be made.

Dandelion Control

By Garry Mayerle, PAg

Conservation Agrologist

Dandelion infestations continue to plague some direct seeders. These weeds can really get established and those who are trying to get a handle on controlling them often refer to the "granddaddies" as the ones that are tough to get. Integrated weed control always looks at several ways to put pressure on weed communities. This is important for direct seeders to apply when controlling perennial weeds. A dandelion infestation will not likely be eradicated with one treatment. There are a number of herbicides that can be used that will pretty much control the seedling stage. There are a few combinations of herbicides and/or sequential applications along with proper timing that researchers and experienced producers are beginning to indicate may increase the pressure that can be placed on more mature dandelions.

Like all weeds, but especially perennials, there are times or plant stages when weeds are more susceptible to the various herbicides in the producer's arsenal. Like most perennials, better control of dandelions is achieved when applied after there is some new growth especially for those products, which need to be translocated. With moisture in the spring, dandelions, which have over wintered, have an early spurt of growth rapidly producing seed heads and then growth slows especially if moisture is limiting. When moisture conditions improve and/or other plant competition decreases such as the time that annual crops are senescing or are cut and removed, dandelions will become active again. This gives some clues as to when control options may work best.

Gord Pearse, who farms 15 miles north of Tisdale, has just recently come back to the farm full time to allow his father Terry to slow down. The Pearse's have been direct seeding for many years. Terry served as an SSCA director back in the early 90's and he had already been direct seeding for a few years then. They have also been growing forages for seed production including alsike clover. Perennial crops provide some good opportunities for dandelions to get established and get to the "granddaddy" size. When forages come out of production, it is not always so easy to kill these well established dandelions, especially in reduced tillage systems.

Gord says these big dandelions can certainly use a lot of moisture in the spring. He has found that one of the best methods to put significant pressure on dandelion populations is a ½ liter of Roundup in the month of Sept. He certainly also uses pre-harvest on their farm but Gord says that they have found that this often gives them mediocre results on dandelions. It gets the seedlings but not the established ones. They pre-harvest at 1 L/ac about 1 year in 4 on their wheat, flax, and canary seed acres. Gord feels that often the pre-harvest is too early to get good dandelion control. They are applying their post harvest application later in September, again on an average of about ¼ of their acreage. This means that, more or less, they are alternating between the pre-harvest and the post harvest every other year. Gord says he feels that although this program is not eliminating their dandelion problem, it is keeping them under control. When

Gord came back to the farm, he left an agrologist position with Newfield Seeds. He used to encourage his growers to spray their forage seed fields for winter annuals and dandelion suppression by spraying in October. He has since decided that working until the last day before its too cold has more to do with luck than good management, and would now recommend spraying when possible, even if it is early Sept.

Some research and demonstration findings substantiate what Gord is saying about timing for dandelion control. Roy Button who was Sask. Ag. And Food's Soils and Crop Specialist in NE Sask. ran an ADF project in '93 - '94 spraying a number of different products in May and Oct 20 on 4 different dehy alfalfa fields in NE Sask. One of them was Terry Pearse's. He reported that the only reasonable control of the products he used was Roundup at 1 L/ac sprayed late in the fall. The 2 best treatments applied in the spring were Refine Extra and 2-4-D tank mixed with ½ L/ac Roundup. He said these treatments delayed the dandelions but did not effectively kill them.

Lyle Cowell, agrologist with the Sask. Wheat Pool, had a project on alfalfa termination and dandelion control. He sprayed a number of products on dehy alfalfa fields in May, July, and late September. He rated them the following August finding the best dandelion control by 10 to 20% where the treatments were sprayed in late September. The best product was 2 L/ac of Roundup.

The Crop Development Center at the U of S and Agriculture and Agri-Food Canada at Scott have had a dandelion control project the last few years. It was based on 2 sequential applications. One of these is in the fall followed up with a ½ liter of glyphosate burn-off in the spring. A third product in the sequence could in some cases be the in crop herbicide. Using a competitive crop will also place pressure on the dandelion population. The CDC fall treatments consisting of 4 product or product combinations were sprayed at 2 different times: late September and late October. Ken Sapsford reported on the project in their Weed Control Research - 2001. He suggests that the late October application showed poorer control because it was done after the dandelions had already been hit by a severe frost. Eric Johnson provided the numbers for this last season's ratings at Scott. The very dry conditions these last 2 years have made it impossible to have complete results, as the plots out of Saskatoon were not rated this past year but there are some interesting trends. See Fig. 1 and 2 for a summary of the four best products. It must be noted that these are only preliminary results and the CDC has hopes to carry on an expanded project so continue to monitor their results.

A new registration for dandelion control in the spring has been submitted by Dupont. It is for 4 g/ac of Express tank mixed with ½ L/ac of glyphosate. This is applied pre-seed for cereal seeding. For control of those rosettes larger than about 6" that rate can be increased to 6 g/ac. Watch for specific details after Nov.

Fig. 1 Dandelion Control Saskatoon (Preliminary Results)- Various Products Post Harvest Followed by Preseed 1/2 L/ac Glyphosate

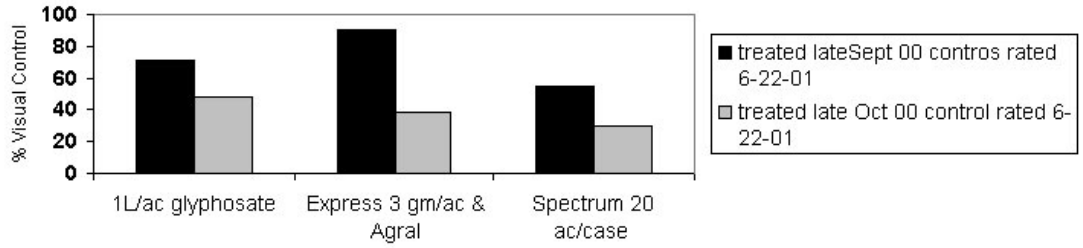
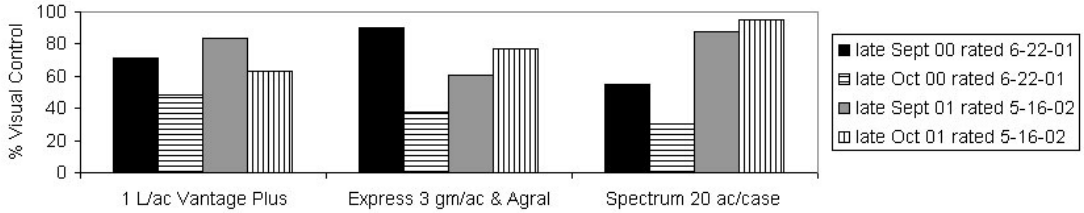
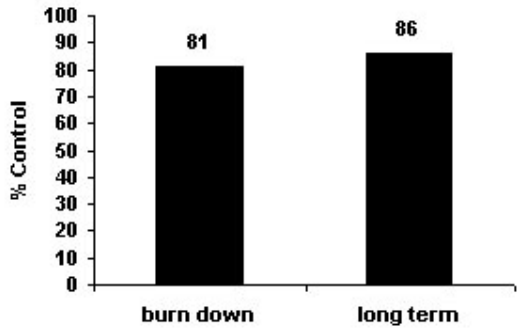


Fig. 2 Dandelion Control (Preliminary Results)- Various Products Post Harvest Followed by Preseed 1/2 L/ac Vantage Plus



Rob Ripley, Technology Development Representative with Monsanto at their Saskatoon research farm suggests that dandelion control is related to staging and growth that moisture induces. He observed in the late 90's that with moisture in the fall, pre-harvest Roundup was giving good dandelion control. See Fig. 3. The last few years have been drier, and there has not been sufficient moisture before pre-harvest to stimulate dandelion growth. Also crops matured earlier so pre-harvest was applied earlier and there was less time for dandelion re-growth. The in-crop herbicide may also have still been retarding re-growth more than when pre-harvest is applied later. The result has been poor pre-harvest control. After the crop comes off the canopy is opened up and dandelion re-growth is stimulated. The result is better post harvest control. Furthermore, Rob also suggests that dandelions seem to be more frost tolerant than other perennials. In conclusion, Rob reiterates that the options for dandelion control are pre-seed, using competitive crops in rotation, in-crop, pre-harvest, and post harvest.

Fig. 3 Roundup Dandelion Control



Timing of a Roundup Burnoff

Eric Oliver, PAg

Conservation Agrologist

All I can say about the 2002 crop year is "Thank goodness it's over!" Actually I had used several other adjectives to describe this past year, but the editor thought this expression of opinion was the only printable one. At least most areas of the province have a good soil moisture reserve for next year, which was not the case at seeding time in 2002. So, as an optimist, one looks towards next year as the one that will bring a bumper crop. In that vein, it is not too early to be planning for the new crop year.

Although we certainly hope that we don't experience a repeat of 2002, there were things we can learn from our experiences. The spring of 2002 presented a situation of very dry soil and cold temperatures. As a result, few weeds germinated by seeding time so few farmers were willing to apply a pre-seeding burnoff. Most were counting on being able to apply the burnoff after seeding but before the crop came up. However, in many cases, the crop started to emerge before many producers were able to apply the burnoff. The questions started to pour in on whether farmers could still apply a Roundup burnoff when some of the crop was already emerged. As it happens, I had a demo project located at the Swift Current Agri-ARM applied research farm site that dealt with this issue.

This demo showed the effect of applying a Roundup burnoff at different times of application to durum wheat, field peas and chickpeas. Each crop had separate plots showing the effect of the Roundup that was applied at pre-emergent, ground crack, 1 day, 2 days and 3 days after ground crack. Ground crack is a term used to describe when the crop is just poking through the soil surface. This demo provided good evidence of what are the consequences of applying glyphosate once the crop emerges.

The chickpeas showed the least effect, but this may have been a result of the very cold environment at time of the treatments and uptake of glyphosate may well have been limited. In both the field peas and the chickpeas, the glyphosate treatment did not kill the crop even 3 days after ground crack. However, don't get too excited over this news, because what it did do was severely stunt the crop and also practically stopped any nodulation. Any nodules that were present on the roots were not fixing nitrogen. The roots also were stunted in development and were curled up indicating herbicide damage.

The peas that had Roundup applied 3 days after ground crack really didn't grow any taller than seven inches. Looking at the peas, the plots looked a bit like steps with the pre-emergent and ground crack plots being about the same height with the crop being shorter for each day after emergence the glyphosate was applied. Now I know you are probably saying that you wouldn't spray a burnoff 3 days after the crop emerged. However, even though there was virtually no difference in plant height between the pre-emergent and ground crack treatments, there was still

a difference in crop development between these two timings. When the pre-emergent peas were in flat pod stage, the ground crack peas were still in flowering stage. That isn't much of a difference, but it does show how some effects are not so evident. The peas that had Roundup applied 1 day after ground crack showed stunting effects and those plants that had come in contact with glyphosate were not flowering or only had one or two flowers in total.

In the durum wheat, it became very quickly evident that wheat has VERY little tolerance to Roundup. The 1 day after ground crack treatment showed significant reductions in plant populations with less than half the plant populations of the pre-emergent burnoff treatment. Essentially, if the wheat was exposed to Roundup at all, it was killed. Where the Roundup was applied on the third day after ground crack, it essentially became chem fallow. There was virtually no wheat left.

The lesson we can take from this is applying a burnoff with any glyphosate once the crop is up is a tremendous risk. Sure the weed control was better by the second and third day after ground crack of the crop, but correspondingly, the higher the damage to the crop. Waiting until ground crack to start spraying a burnoff with Roundup can also be quite risky. The risk being that the growth of the crop seedlings can progress very quickly, especially under good growing conditions. A crop that is just at ground crack stage in the morning can have a high percentage of the crop well out of the soil by the afternoon. The decision on continuing to spray a burnoff rests with the producer on how much risk he is willing to take. However, if there is more than 5% of the crop up at the time you want to spray a burnoff with a glyphosate like Roundup, my feeling is that it is too risky to continue.

Mike Kirk Director-At-Large

I was born and raised in the Southwest corner of Saskatchewan and have lived here all my life. I am married with three children, all boys. I attended the University of Saskatchewan - Saskatoon campus. Then I taught school in Frontier, Saskatchewan for two years and was a member of the Board of Education for Eastend School Division #8 for six years, two of those years as chairman. In 1982 my family and my twin sister's family began a Farm Herbicide Retail business, which we called Southland Chemical Sales. This business was operated until 1997 at which time we brought in other share holders and spun a new entity called Prime Pro Ventures Inc. I am currently the president of this organization.

My farming career began at an early age, being raised on a mixed farm north of Climax. The farm is now all grain and special crops and has grown to 8000 acres. I have been involved with direct seeding for ten years and certainly have had opportunity to witness first hand the many benefits that a system such as this can bring to your farm. Our area in the Southwest has been notorious for dryland production and a continual search for more efficient water absorption, retention and usage systems. My involvement with SSCA and their programs came out of this search.

In my life I have many other interests which do include all sports from all seasons. I have had a privileged life in many aspects, with so many opportunities to enrich and expand my thinking and understanding. My commitment to lifelong learning will never wane.

I see so many great things that this organization can perform and I am privileged to have this experience with SSCA.

Conservation & Cows: A Good Combination

By Juanita Polegi, PAg

Assistant Manager

A permanent water supply and rich soils were two of the factors that attracted Dick & Diane Coombs to east central Saskatchewan. In April of 2001, the Bar C Ranch moved its cows and equipment from a ranch near Vanderhoof, B.C. and brought them all to land near Wroxton, about a half hour's drive east of Yorkton. Changes in how the land was managed began almost immediately.

The selling feature of the land the Coombs purchased is the huge permanent slough that covers about 80 acres over 2 adjoining quarters. "With that slough," Dick said, "we're never going to run out of a water supply for our cows". With more than 200 head, ensuring an adequate water supply is a real concern.

When the Coombs first arrived at their new ranch, the slough was just part of a much larger pasture. In order to water or to move from one side of the slough to the other, the cattle had to cross through mud. In no time, the cows and their calves were looking a little bedraggled. "The cows were covered in mud up to their bellies so their bags were covered in mud and the muzzles of the calves were caked with mud", explained Dick. It was a mess.

That same slough is of interest to the Sask. Watershed Authority (formerly the Sask. Water Corporation) because of its large wetlands habitat. Shortly after the Coombs arrived, the Authority got in touch with them. Together with the Coombs, they developed a plan for the area. The plan serves to protect the wetlands while at the same time providing good drinking water to the cows and access to the grasslands around the slough.

The first step of the plan was to run a 4 strand barbed wire fence around the perimeter of the slough, preventing the cows from walking into the mud and water. The next step was to develop a central watering system for the cows. A solar pump was set into the slough and a line was run to 2- 700 gal tubs. The cows much prefer drinking the water from the tubs than directly from the slough. Diane said, "Even when we have locked the cows out of the central system, they reach over the barbed wire to drink from the tubs rather than drink from the slough".

The final step in the conservation plan was to haul 3 loads of gravel to each of the 2 natural crossings on the slough. The dry, solid footing ensures the cattle cross at the same spot every time so they don't damage the shoreline.

Once the cows' watering needs were settled, the Coombs then turned their attention to seeding some grass for pasture and hay. But the Coombs discovered they had some lessons to learn when it came to seeding in Saskatchewan. "Where we ranched at Vanderhoof," Dick said, "the topsoil was about a half inch deep and while we could count on rain just about every day in the summer,

it would take the whole year for the grasses to get established." In 2001, the Coombs seeded a mixture of Orchard grass, Meadow Bromegrass, Timothy, Alfalfa and Alsike clover together with 2 bushels of oats. The heavy seeding rate for the oats took its toll on the grass establishment. "While the grasses eventually did germinate and grow that first year, they were very slow," said Diane. When they seeded more acres to that same grass mixture this past summer, they cut the oats down to 20 lbs per acre. "The grasses had an incredible catch. We believe the difference was the competition from the oats. In fact, on some land where the tame oats were choked out by wild oats, we think the forages came up even quicker," said Diane.

The importance of weed control prior to seeding forages also became evident. Some of the land was badly infested with weeds. Of those acres, most received 1 litre of glyphosate and were then cultivated. The rougher acres weren't sprayed, only cultivated. The areas that received both treatments were much cleaner and therefore the grass establishment this spring was much better than in the area that was only cultivated. Dick said, "We'll be sure to kill everything prior to seeding again!"

The Coombs didn't direct seed any of their forages mainly because they don't have the capability with their own equipment. They both see the value in direct seeding but don't expect to use it on their operation. "We don't grain farm and we don't plan to seed this land very often so we'll continue to use our own drills but protecting the soil and seed with the previous crop's stubble sure seems to be a good thing for the guys with the right equipment," explained Dick. He then went on to explain that near Vanderhoof, range land was direct seeded using a disc with packers pulled by a D8 cat!

The Coombs firmly believe in the value of fertilizing their hay and pasturelands. Back in B.C., their first attempt at fertilizing was on an old stand that was giving them about 25 bales on 70 acres. They weren't very happy with the results from granular fertilizer but they were very impressed with liquid. Once they made the switch to liquid fertilizer, they were able to take off 250 - 300 bales on those same 70 acres and the protein in the hay usually ran over 11%. After haying, the grass plants re-grew so well that they were then able to put the cattle out to graze in the fall until the snow got too deep. The Coombs will apply fertilizer to the stands they seeded in 2001. They intend to once again use liquid fertilizer which will be a blend of lots of nitrogen, some phosphate and some sulphur.

Once the Coombs get the ranch set up the way they want it, the next step will be to provide strategic shelter for the cows using shelterbelts. "Cows need protection from the wind", said Dick. "We'd like to set up little plots of trees around the ranch so that no matter which way the wind blows, the cows can go for shelter". The Coombs approached the PFRA Shelterbelt Centre at Indian Head for some ideas. After meeting with the Coombs and viewing the fields, the Centre came up with a plan for a series of 2 acre shelterbelts, 10 rows deep.

Dick and Diane have been ranching at Wroxton for only a couple of years but they are settled into the area. Diane said, "This is such an awesome cattle area. It's great to have so much available moisture for the grass and the permanent wetlands". Dick agrees. "Out here, we can run 200 - 300 head on just 8 or 9 quarters. Back where we come from in B.C., we would have needed about 3 times as much land for the same size herd".

As Dick & Diane Coombs have converted a grain farm into a ranch, they have initiated a conservation program that enables them to blend their concern for the wetlands and their desire to provide the best possible feed and water to their cows. That shows that conservation isn't just for the combine jockeys.

Forages - but I don't have Cattle

By Tim Nerbas, PAg

Conservation Agrologist

Are you considering seeding forages this spring? Of the approximately 49.6 million cultivated acres in Saskatchewan, 2.8 million acres are presently in tame hay production. There are also 6 million acres of rangeland and 1.1 million acres of improved pasture. These forage resources support a cattle herd in excess of 2.8 million head (cows, calves, yearlings and feeders).

The present drought has made it painfully evident that in order to maintain and eventually increase the livestock sector, more forage is required. Not only are forages an integral part of increasing the livestock numbers within the province, but they also may provide a viable alternative to chemical weed control options.

Over the last 50 years, producers have begun to rely more consistently on the use of pesticides to control weed, insect and disease outbreaks in our cropping systems. These products usually do an excellent job of control, but they have lead to a significant cost in growing a crop and subsequently a reduction in net returns to producers. As farmers, we have become more and more reliant on pesticides. Many of the good husbandry or best management practices (BMP) that could be incorporated into crop rotations have been lost in the shuffle.

One of the strengths of organic farming is its reliance on a variety of best management practices. Organic farmers can't rely on quick fixes in the form of pesticides. However, a new system called Pesticide Free Productionä from the University of Manitoba is looking to add another alternative. Unlike organic production, PFP does not need to be a long-term commitment. If the grower has a weed, insect, or disease outbreak during the growing season and a pesticide application is warranted, the producer can choose to do so. You simply lose the PFP production status for that year on that field. The field could then be placed back into PFP the next year.

Pesticide Free Productionä allows the use of fertilizers and pesticide applications outside the PFP crop's growing season. Crops cannot be treated with pesticides from the time of crop emergence until the time of marketing. But a producer can still use a preseed burnoff with Roundup as well as any post harvest applications required. However, special consideration must be made where residual pesticides are still considered commercially active in the soil. Pesticides are allowed during non-PFP crop years. Genetically modified crops or GMO's cannot be grown as a PFP crop.

Without relying on quick fixes to the same level, the producer must focus on long-term planning. For PFP to be successful the use of diverse cropping and other BMP's must be implemented.

As direct seeders we know the importance of both establishing a healthy crop and having a diverse rotation, one which includes pulses, oilseeds, cereals and if possible, winter cereals. But

forages have always been a crop rotation afterthought. If you have livestock, you seed your worst field down to forages for extra grazing or hay. Otherwise every other arable acre must be in annual grain production. It seems to be an unspoken adage: "I know forages are good for the land but I need a cash crop now".

The benefit of nitrogen fixing plants in agriculture has long been recognized. Virgil (70-19 B.C.) made reference to the nitrogen fixing capability of alder:

"**What was designated of old as the dense 'fat shadows' beneath which the green grass and the tender herb continued to flourish."**

The inclusion of alfalfa or alfalfa/grass mixtures in crop rotations has many benefits, including increased soil organic matter. This perk will take on even greater importance if Canada ratifies Kyoto. Alfalfa also improves soil physical properties, reduces soil erosion, suppresses weeds and provides a disruption to plant disease cycles. Forage legumes have a unique ability to fix their own nitrogen, significantly reducing our reliance on non-renewable energy to produce nitrogen fertilizer. Not only do grain crops yield more after forages, but also the rotational benefit of field peas is greater where alfalfa has been included previously in the crop rotation (Table 1).

Table 1: Wheat yields as influenced by previous crop type (University of Manitoba). Note: no nitrogen fertilizer added to any of these rotations over the six-year study period. **W-Wheat; P-Field Pea; B-Barley; A-Alfalfa**.

Crop Rotation	Grain Yield of Wheat (bu/ac)	Nitrogen Uptake by Wheat (lbs/ac)
1.W-P-B-W-W-W	15.8	29.2
2. W-P-B-W-P-W	20.2	43.0
3. A-A-W-W-W-W	24.0	43.7
4. A-A-W-W-P-W	37.5	74.8
5. A-A-A-W-W-W	25.1	41.5
6. A-A-A-A-W-W	33.7	51.4
7. A-A-A-A-A-W	46.1	82.5

A survey of 253 producers in 1992 in Manitoba and Saskatchewan indicated that producers recognized the yield benefits from forages, but few producers were managing forage stands for maximum rotational benefit. Producers tended to maximize forage stand length, only re-establishing when the existing stand had lost productivity. However research has shown that it takes only two to three years to obtain optimum N accumulation and weed suppression benefits

from an alfalfa stand, while the optimum economic duration in Manitoba was determined to be four to five years.

Two factors thought to discourage producers from cycling forages through their rotation more frequently are: 1) problems establishing and 2) problems terminating perennial forage stands. However using direct seeding techniques is a proven way to increase the success of forage establishment, and using herbicides improves the ability to terminate forage stands. For instance, terminating forage stands using tillage is expensive (>$25/ac), time intensive, uses large amounts of fossil fuel, dries the soil and reduces many of the soil improvement benefits of the forage. Using herbicides typically costs less than $20/acre.

One of the unique abilities of forages is to suppress weeds. The competitive nature of forages for light and nutrients, and its frequent cutting reduces the vigour of weeds and their ability to produce seed. Work by Martin Entz at the U of Manitoba showed that wheat grown after alfalfa had reduced wild oat numbers to the same level as using a wild oat herbicide.

That's money in your pocket! So as you plan for 2003, forages maybe the factor you're missing. Oh, did I forget to mention forages are also good for cattle? Best of luck in the New Year!

Liquid Manure: Not a Waste, a Resource

By Travis Goebel, PAg

Conservation Agrologist

Animal manure is a source of plenty essential macro and micro plant nutrients required for crop production. The increasing number of large livestock operations in Saskatchewan is providing local producers with valuable liquid manure from these barns. Liquid swine manure is low in nutrients per unit volume relative to commercial fertilizer. This dilute form of nitrogen needs to be applied to the soil in high quantities usually greater than 3000 gallons per acre (GPA).

An area of concern for hog manure application is the contamination of ground water with nitrates as a result of large quantities of nitrogen added to the soil. Studies to address this issue were done by the ECRF located at Canora. Liquid hog manure was injected in the spring of 2000 by PAMI (Prairie Agricultural Machinery Institute) out of Humboldt who came out with an injection truck. The hog manure treatments were applied at rates of 3000, 6000, and 9000 GPA from a hog finisher barn. Plots were seeded in year 1, to Metcalfe barley and canola in year 2. Aside from the hog manure treatments, there were also plots seeded using three different rates of granular nitrogen fertilizer (46-0-0) at rates of 50, 100, and 150 lbs of actual N/acre. The granular fertilizer plots received 25 lbs/acre P, and 15 lbs K/acre in addition to the N. There was also a summerfallow plot and an unfertilized check. Yield data was taken from the plots and soil testing was done on the different treatments to determine how much nitrate remained in the soil and to see if it was moving downwards through the soil profile. The analysis of the manure, applied to this study, indicated nitrogen levels of 33 lbs of N per 1000 gallons, this translates into approximately 100, 200, and 300 lbs/acre for the 3000, 6000 and 9000 GPA treatments, respectively.

Table 1 clearly illustrates that the nitrates in year one of the study were higher for the 6 and 9 thousand gallon rate when compared to the commercial fertilizer for the 0" -12" sample. It is also interesting to note that the summerfallow treatment at this depth was just as high as the 6000 GPA rate. The higher nitrate seen in the summerfallow is due to the fact there was no crop to utilize the available nitrogen. The samples taken from year 2 of the study show that the nitrate level of the manure treatments are not significantly higher when compared to any of the other fertilizer treatments for the 0" - 12" sample. The samples, in year 1 and 2, show no significant difference of nitrates in the cores obtained at depth 12" - 48". This data indicates the nitrates tend to stay in the upper portions of the soil profile, suggesting there is little chance of ground water contamination occurring from this application. It is important to realize that the fate of nitrates in soil depends upon the soil properties. Different types of soil may require different management practices that may allow for higher or lower safe application rates.

It takes intense planning to manage manure as a fertilizer properly. One of the biggest concerns when dealing with manure is the amount total nutrient composition and the available nutrient composition. Nitrogen (N) is usually the biggest concern because it is used by plants in the

highest quantity. Depending on the type of operation the manure is obtained there is different nitrogen concentrations. Manure from a hog finisher barn, for example, ranges from 15-50 lbs total N per thousand gallons of product. Nursery and farrowing barns contain lower concentrations than finisher barns. The concentration of N is also dependent on the type of storage facilities where the manure is stored. Of the total N in liquid swine manure about 50% - 90% is in the plant available form of ammonia NH_4. The remainder of nitrogen is in the organic form and needs to undergo the process of mineralization to become inorganic and consequently plant available.

Phosphorous is another macronutrient that is present in hog manure. The concentration of phosphorous present in manure is directly related to the amount of solids present. As the amount of solid material increased in the manure sample, the higher the amount of total phosphorous. Common phosphorous levels of liquid swine manure range from 2 - 40 lbs of P_2O_5 per 1000 gallons. The availability ranges from 10% - 50%.

Potassium (K) in manure is readily available for use by plants. The concentration of K is similar to Nitrogen at 8 - 20 lbs/1000 gallons. Liquid hog manure is known to be on the low side for sulfur. Crops demanding high amounts of sulfur may require additional S.

Manure is also a source of micronutrients such as copper, zinc, and boron. The research in micronutrients is not very extensive compared to macronutrients. An efficient way to test for micro nutrient deficiencies is tissue testing.

Manure is an excellent source of essential nutrients but also the organic fraction of the manure increases the soil organic matter of the soil that increases the soils tilth and nutrient supplying power.

Nutrient response data was obtained from the same plots as the nitrate study. The yields obtained from the nitrate study are illustrated below (Figure 1). The yields of barley in year 1 were slightly lower for 6000 and 9000 GPA treatment relative to the commercial fertilizer and 3000 GPA applications. This was due to the effects lodging had on the crop. It is important to note that when applying high rates of nitrogen, either manure or commercial N, the proper variety of crop should be selected. The proper cultivar sown in the first year after application should have properties of short straw, high yield potential and good straw strength to reduce lodging potential.

The yield response is quite significant in year 2 and 3 of the study for canola and barley, respectively. There was no fertilizer of any kind added in year 2 or 3 of the study. The yield response is a consequence of residual nutrients from the first year of application.

Another study conducted at ECRF was done using different manure application dates. Manure was injected either in fall or spring. The trend was toward an increased yield for the applications made in the fall. The reason could be there is more time in the spring for mineralization of the organic N.

The use of liquid hog manure is quite attractive to producers from an economic perspective. The available (inorganic) nitrogen, used in the studies discussed, has a value of approximately $8.40/1000gal. This translates into an amount of $75/acre for the 9000 GPA treatment. The manure is worth much more than this because this does not include P, K, S, micronutrients, or organic nitrogen.

Big Sky Pork is a big player in the Saskatchewan Hog industry and as such has the ability to supply local producers with liquid manure. Big Sky charges $15/acre for any amount of hog manure that is safe to apply. This cost is very low considering there is a yield response 3 years after the application and the cost for this amount of nutrients from commercial fertilizer is in excess of $100/acre. Big Sky Pork has the ability to supply liquid swine manure within a 4-mile radius of their storage facility. The manure is pumped to the field of application and once at the field, a special drag hose is coupled to an injector system. The manure is knifed into the soil using a 20-foot injection system. Applying manure on a stubble field allows more liquid to be applied per acre than a tilled summerfallow field. The minimal till system has higher moisture holding capacity and therefore more product is absorbed and less is left sitting on the soil surface. Injecting manure into the soil effectively manages odor and surface runoff, while minimizing the loss of valuable nutrients to volatilization. As much as 30% more nutrients can be lost if the manure is surface applied compared to injected.

It is important to realize that hog manure should not be viewed as a waste, but rather an economic and environmentally sound nutrient source when managed properly.

Fusarium: It's Coming Your Way

By Dave Larsen, AAg

Conservation Agrologist

"*Direct seeding is responsible for the high levels of disease we have had in the past few years. We never had disease when there was still summerfallow in the area. I have to cultivate my stubble to bury the residue so it won't contaminate next year's crop. My neighbour, who zero tills, is responsible for contaminating my fields with Fusarium"*. Ever hear one of these statements? Probably more than once.

The disease in the last few years that has been causing the most concern for eastern and particularly south eastern farmers has been Fusarium Head Blight (FHB). *Fusarium* species are found throughout the prairies, but the debilitating *F. graminearum* that is responsible for FHB has been mostly limited to Manitoba, South East and Eastern Saskatchewan.

Fusarium Head Blight affects wheat, barley, corn and other small cereal grains. It can cause huge losses in yield and quality through the production of a fungal toxin. There are numerous species of *Fusarium*, but *F. graminearum* is the only prevalent species that has the ability to produce a mycotoxin, known as vomitoxin or deoxinyvalenol (DON). Even low levels of contamination can downgrade the seed to become unacceptable for either human or animal consumption.

The perception that direct seeding creates the perfect conditions for *Fusarium* manifestation is still quite prevalent. Some recommendations include tillage as a means of controlling *Fusarium*. These recommendations are based on long-standing beliefs and not science. There are many unknowns about *Fusarium* control and infection, however, direct seeding does not increase the severity of FHB in tolerant varieties. Results of the last three years of research in the south east area of SK where FHB is well established indicate that environmental conditions, susceptibility of the crop, and tillage practices were the most important factors influencing the development of FHB

Tillage

In 1999, Dr. M.R. Fernandez and Dr. R.P. Zentner initiated a 5-year study in eastern Saskatchewan to identify agronomic factors that may be associated with FHB-infected fields. The objectives of this project are to identify risk production factors that might lead to the development of FHB and to develop recommendations to producers for managing this disease. About 200 cereal fields have been sampled annually for the presence of FHB and species identification. A database has been developed with the results obtained from these analyses and from detailed information on agronomic practices provided by the cooperating producers.

After three years of the study, resistant varieties grown with zero tillage did not have FHB severity any greater than conventionally tilled fields and FHB severity was less than minimum-

till fields. Possible reasons why minimum-till, but not zero-till, resulted in an increase in FHB levels in relation to conventional tillage are presently being investigated.

In Manitoba, where disease pressure is higher, zero tillage did not increase FHB severity over conventionally tilled soil. Studies on FHB conducted at the Brandon Research Centre by Dr. Debra McLaren and Dr. Byron Irvine assessed the impact of tillage and rotation on *Fusarium* head blight of wheat. Preliminary results indicate that there were generally no differences in levels of FHB between conventional and zero tillage regimes under Manitoba conditions.

Environmental conditions

Last summer's drought created conditions that would both help control the spread and facilitate the spread of *Fusarium*. For an infection to occur three factors have to be in place. 1. Disease inoculum has to be present in the susceptible flowering or heading stage. 2. Warm, moist conditions are required to create an infection. 3. A susceptible host has to be present. Eliminating one of these factors will eliminate the risk of Fusarium Head Blight.

The relatively drier, cooler climates in Saskatchewan compared to Manitoba during flowering has prevented *Fusarium* from becoming a major management concern. *F. graminearum* is found mainly in the Black Soil Zone, thus indicating the strong correlation between precipitation and infection. The disease creates the greatest infection when rainfall occurs in July, corresponding to the flowering season. Even with low inoculum levels, enough rainfall will create high levels of infection. With limited rainfall, temperature and inoculum levels will increasingly determine the level of infection. Warmer temperatures with humidity or precipitation will increase the severity of an infection.

A fortunate side effect of drought is an elimination of the environmental conditions necessary for infection and a reduction in the inoculum present. The range and severity of the *Fusarium* infected area decreased in 2002 over previous years. A *Fusarium* survey conducted by extension agrologists and the Crop Protection Lab of Saskatchewan Agriculture and Food found F. graminareum in fewer locations and in lower concentrations than previous years. Infected samples were primarily from the south east and east central areas. It should be noted that samples were taken at the soft dough stage. Wet, humid conditions prior to harvest but after sampling provided conditions favourable for greater levels of infection.

In Saskatchewan, the South East has had the most severe *Fusarium* problems. This area has the highest average temperatures in the province and high average precipitation for the month of July. East Central and North East Saskatchewan are also high rainfall areas but experience cooler temperatures.

The effect of global warming will play a significant role on *Fusarium* severity and the area affected by *F. graminearum*. Increasing temperatures will favour an increase in the severity of infections and increase the areas affected. On the other hand, rainfall is projected to increase in the winter and decrease in the summer. Decreased July rainfall will favour a decrease in the severity of FHB. However, predictions of increased severity of weather patterns and greater fluctuations in precipitation will create conditions in some years that favour severe disease

outbreaks. Increasing temperatures and July rainstorms will also facilitate the spread of *F. graminearum* westward.

Susceptible hosts

One way to control damages from *F. graminearum* is to seed unaffected crops or crops tolerant to *Fusarium*. Ultimately, breeding is seen as the best solution for *Fusarium* head blight control in susceptible crops. Prairie adapted lines are currently being bred with a gene to provide low levels of *Fusarium* infestation. Lines have been developed that are providing good levels of *Fusarium* resistance, however there have been other problems associated with the varieties. Quality problems and other agronomic problems are preventing the lines from being registered. While genetics can provide a valuable tool in production, good agronomics will always be necessary.

There are current varieties that provide more *Fusarium* resistance than others. Hard red spring wheat is generally more tolerant than Canadian Prairie Spring, extra strong or durum wheat varieties. Two-row barley is generally less susceptible than 6-row barley varieties. Within each crop category are differences in variety susceptibilities. Consult seed guides and seed companies for varieties suitable for your region.

Often the best way to deal with a problem is to avoid it. While growing cereal crops in Saskatchewan is necessary, not all cereal crops are equally susceptible. By avoiding spring wheat and barley, you are eliminating most of the problem. However, wheat is an important crop for rotations. Eliminating wheat as an option will limit your ability to develop a sustainable rotation. Fortunately FHB can usually be avoided by growing winter wheat instead of spring wheat crops. Winter wheat develops and matures earlier than all spring wheats. It is not fully understood why winter wheat is less affected by *Fusarium*, however, the cooler temperatures during flowering appear to limit the infection.

If conditions are favourable for infection, your only option may be a fungicide control. However, since it is rare that environmental conditions are favourable for infection for extended periods you can limit the damage to susceptible crops by alternating seeding dates. More specifically, by alternating seeding dates of similar crops you will vary the flowering period. This risk management technique may not guarantee you will miss out on all infection, but it will decrease the risk of losses to all fields.

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The Chunky Soup Debate

By Tim Nerbas, PAg

Conservation Agrologist

Do you remember the old TV commercial for chunky soup? It depicted two people arguing over whether the soup should be eaten with a spoon or a fork. The commercial never picked a winner; it was simply a personal preference.

Over the last decade producers and researchers have pondered, and in some instances argued adamantly, a similar "chunky soup" question - how do we get all the fertilizer down in a one-pass seeding system? Some feel that side-banding is the best way while others argue in defense of mid-row banding. Should we be using anhydrous ammonia (AA) or urea as our nitrogen source? Is it simply a matter of personal preference? Recent research hopes to shed some light on the subject.

Studies were completed on this subject by Masters student Dil Thavarajah under the direction of Dr. Schoenau at the University of Saskatchewan. Field experiments were conducted at four sites within Saskatchewan during the 2000-growing season: Star City, Indian Head, Scott, and Swift Current. Moisture conditions were above normal at Star City and Indian Head compared to the 16-year average, and below and much below average for May and June at Swift Current and Scott, respectively, with above normal precipitation for July. These field experiments are part of a three-year study (2000-2002). The remaining two years of data are still being compiled and should be released in 2003.

Seeding was completed by PAMI. The plot seeder was configured to apply AA and urea in addition to seed and phosphorus requirements. Openers were located at 10-inch row spacing. Side banding openers placed the nitrogen fertilizer 1-inch below and 1-inch to the side of the seed-row at the time of seeding. The mid-row banding component involved using spoons to open up the seed-row with mid-row coulters for the nitrogen fertilizer. The coulters were between every second seed-row. Travel speed was 4 mph.

So what did the research find? The Swift Current site was the least responsive to added N because of the higher available soil N associated with the previous year's fallow period.

At Star City, maximum wheat yields occurred at the 120 kg/ha rate (Table 1). The different N fertilizer forms and placement methods had no significant effect on wheat yield. The canola yield plateau occurred between 80 to 120 kg/ha (Table 2). However, for canola there was a significantly higher grain yield for mid-row banded urea versus side-band placement. The researcher hypothesized that early supplies of N to the seed row may have provided some level of toxicity that was not evident by early season plant counts.

In this project, two check treatments were done to compare the effect of opener type (side-band vs mid-row). At Star City, the mid-row band treatment (0 kg/ha) had significantly greater canola yield when compared to the side-band treatment. The difference could be from better placement of the P fertilizer. The side-band treatment had the P fertilizer banded below and to the side of the seed row compared to the mid-row which had the P fertilizer seed placed. The difference could also be an effect of the opener configuration on the seedbed quality. Wheat was not affected.

At Indian Head the N fertilizer rates, forms, and placement methods had little effect on the research parameters. This is attributed to the high inherent N fertility at this site.

Under the dry conditions at Scott the N fertilizer rates, forms and placement method were the most evident. Yield responses for wheat continued at the high rate or 90 kg/ha. The greatest yield reductions were often the AA trials for both wheat and canola. The lower yields are likely due to the dry conditions that will have favored NH_3 losses during seeding.

For both wheat and canola, side-banding produced significantly higher yields. It also increased the protein percentage of wheat (Table 3). However it was not the focus of this research to determine the most economic rate of fertilizer.

The study also looked at the nitrate and ammonium supply rates. Thavarajah concluded that the early supply of N to the seed-row was more pronounced with side-band placement than with mid-row placement. At rates below 80 kg/ha, no evidence of significant seedling damage was evident using either placement. It should be noted though, that these openers were new with very little wear. At higher rates (120 kg/ha) some injury may occur that may not be expressed in reduced plant counts the researcher hypothesized.

The first year of the three-year project concludes that the rate of N has a more pronounced effect on agronomic characteristics than different N forms and placement methods. Under dry conditions, N forms and placement can have the greatest impact. When soil moisture is good or soil N levels are high, the position of the band in relation to the seed-row is much less important.

So the debate of side-band vs mid-row will likely continue. Like the chunky soup debate, it comes down to your personal preference and your perceived level of risk. But remember that opener wear and air velocity and speed can be disastrous to your potential seed and fertilizer separation.

Table 1: Wheat grain yields for the 2000 crop year (adapted from Thavarajah, 2001).

Treatments	----------N Rate (kg/hectare)----------											
	*0			*40			*80			*120		
	----------Wheat Grain Yield (bus/acre)----------											
	SC	IH	S	SC	IH	S	SC	IH	S	SC	IH	S

Urea SB	16.8	19.4	11.4	28.3	31.8	24.5	31.4	34.0	32.1	34.8	34.8	41.2
Urea MR	20.1	**	13.7	29.4	31.3	22.5	33.8	32.4	34.0	38.0	32.1	35.9
AA SB	16.8	19.4	11.4	26.2	30.2	19.9	34.0	31.2	25.3	35.3	31.4	38.5
AA MR	20.1	**	13.7	26.6	27.6	16.9	31.1	32.6	24.1	36.9	33.7	27.5

* - Fertility rates at Scott were as follows: 0, 30, 60 and 90 kg/ha.
** For the Indian Head site, no mid-row (no N) check treatment was used in the plot design
SC - Star City; IH - Indian Head; S - Scott; SB - Side-band; MR - Mid-row

Table 3: Wheat protein percentages for the 2000 crop year (adapted from Thavarajah, 2001).

Treatments	----------N Rate (kg/hectare)----------											
	*0			*40			*80			*120		
	----------Wheat Protein %----------											
	SC	IH	S	SC	IH	S	SC	IH	S	SC	IH	S
Urea SB	14.9	15.9	14.2	14.6	16.6	13.4	15.2	16.8	14.5	16.4	17.1	15.2
Urea MR	14.5	**	14.6	14.6	16.8	13.2	15.0	16.7	14.2	15.8	16.8	14.8
AA SB	14.9	15.9	14.2	14.9	16.4	13.6	15.9	16.2	13.7	16.7	17.4	15.1
AA MR	14.5	**	14.6	14.7	16.3	13.8	15.3	16.8	13.7	16.1	16.7	14.1

* - Fertility rates at Scott were as follows: 0, 30, 60 and 90 kg/ha.
** For the Indian Head site, no mid-row (no N) check treatment was used in the plot design
SC - Star City; IH - Indian Head; S - Scott; SB - Side-band; MR - Mid-row

Table 2: Canola yields for the 2000 crop year (adapted from Thavarajah, 2001)

Treatments	----------N Rate (kg/hectare)----------											
	*0			*40			*80			*120		
	----------Canola Yield bus/ac----------											
	SC	IH	S	SC	IH	S	SC	IH	S	SC	IH	S
Urea SB	30.3	41.0	11.0	41.9	38.2	21.4	40.8	37.3	22.2	40.1	46.9	27.1
Urea MR	36.9	**	11.6	38.4	36.0	19.6	35.4	47.1	22.2	46.4	51.1	24.8
AA SB	30.3	41.0	11.0	38.3	40.6	16.2	45.4	40.1	17.9	46.0	50.6	25.5
AA MR	36.9	**	11.6	40.9	35.3	14.4	46.0	37.6	15.2	46.9	38.3	19.6

* - Fertility rates at Scott were as follows: 0, 30, 60 and 90 kg/ha.
** For the Indian Head site, no mid-row (no N) check treatment was used in the plot design
SC - Star City; IH - Indian Head; S - Scott; SB - Side-band; MR - Mid-row

Travis Goebel Joins SSCA Staff

I am very excited to be on board with the Saskatchewan Soil Conservation Association team. I will be taking on the role of Soil Conservation Agrologist for the east central region of the province based out of the Sask. Agriculture, Food & Rural Revitalization office in Yorkton.

My agriculture career started on a mixed grain and livestock farm near Neudorf. I am still involved on the farm during the busy summer months.

I received a Bachlor of Science in Agriculture degree from the University of Saskatchewan in 2000. During the summer months of my university career, I was employed as an assistant field biologist for Zeneca Agro where I gained experience in many different aspects of field research. The research included seed treatment, fungicide, insecticide, and herbicide efficacy studies. My career continued in research, after graduation from the Uof S, with ICMS Inc. where I took on the position of Research Agronomist for two years. My time was spent conducting field research trials focusing on crop disease control and as principle investigator for crop residue studies.

I am looking forward to furthering my agriculture career with SSCA. I am anticipating a busy winter, meeting and providing sound answers and information to local producers.

Dr. Brian G. McConkey: Director-At-Large

Brian was born and raised in Winnipeg. His early contact with agriculture was with his cousins on their dairy farm just north of the city. After obtaining a degree in agricultural engineering at University of Manitoba, he went on to pursue his Master of Science in agricultural engineering at the University of Alberta. After brief stints with Alberta Agriculture in Edmonton and Environment Canada in Regina, he accepted a position with Agriculture Canada at the Research Station at Swift Current in 1986. His research in his first few years there focused on subsoiling and snow trapping. In 1990 he went to the Palouse country to take his PhD in Soil Science at Washington State University. Upon returning to the Research Station at Swift Current in 1993, he became leader of the conservation tillage research program. That program took his research into two branches, one of cropping sequences and rotations and the other of soil quality. He has been involved in considerable research on physiological adaptation of various crops for the semiarid prairie and how they could be most effectively placed in direct-seeded crop rotations. His research on soil quality started in the days before Kyoto but it soon became focused on carbon sequestration. He has been extensively involved in policy work on carbon sequestration including being a member of Canadian Delegation at several of the international negotiations on greenhouse gases.

Brian has been married to Adele for 19 years and they have three children: Michelle (15), Laura (12), and Ian (6). His family has been extremely supportive of his work responsibilities as travel takes Brian away from home for about one week out of every two between September and April (and Adele keeps track of this very closely).

Brian says, "Saskatchewan farmers should be justly proud of their successes in developing improved farming systems in the face of so many challenges. We have just come through some devastating droughts without the dust bowl scenes that would have occurred if it hadn't been for the conservation farming practices implemented by Saskatchewan farmers. When you consider everything, the future is bright for Saskatchewan agriculture. I am honoured to be part of the Saskatchewan Soil Conservation Association, making a contribution to make life better for Saskatchewan farm families."

Controlling *Fusarium* Inoculum and Limiting its Spread

By Dave Larsen, AAg

Conservation Agrologist

The reduced amount of inoculum produced in 2002 will help decrease the amount of inoculum present in future years. However, if *Fusarium* was has been a problem in your area, you are still at risk for subsequent infections. Once the fungus is in the area, it is there to stay. The fungus causing FHB survives in the soil, straw and residue as well as native grasses and forage crops. Last season's drought will help to diminish the level of potential infestation, but the areas with the greatest incidence of *Fusarium* tended to be the areas that had adequate precipitation. While the absence of drought in these areas was generally a good thing, it did create conditions that favour the survival of the inoculum.

Fusarium graminearum can produce wind borne spores that spread an unknown distance. The march westward of these spores is blamed for the recent infestation in Saskatchewan. Conditions favourable for a large production of spores in the 1980's expanded the infected area to include many parts of eastern Saskatchewan. The expansion or contraction of the *F. graminearum* affected area through spore transfer will depend on future *Fusarium* levels and spore production.

An adverse side effect of the drought was to create a seed and feed shortage. Areas that were able to harvest the affected crops were generally areas where *F. graminearum* has been present. Introducing *F. graminearum* into areas previously unaffected by FHB through feed or seed can create the potential for infection to occur and spread into previously unaffected areas.

The shortage of feed has caused livestock producers to import feed. The imported seed and foliar material can contain *F. graminearum* inoculum. While not the most desirable feed source, feed shortages and price discrepancies may require using the infected material. *Fusarium* infected material that passes through a ruminating animal will be killed. However, the risk of subsequent infection occurs with wasted feed that doesn't pass through the cattle's digestive system. Special care in handling the feed in unaffected areas should occur. Clean up and dispose of spills by composting the material at 60 to 70 degrees for two weeks.

Fusarium reduces feed quality. While the toxin produced by *F. graminearum* is comparatively harmless, it can cause animals to go off their feed. Non-ruminants are particularly sensitive to the presence of DON. Agriculture and Agri-Food Canada guidelines are 1 ppm for swine, dairy cattle and horses and 5 ppm for growing beef cattle, sheep and poultry. The Federal Health Protection Branch allows 2 ppm of DON in uncleaned soft white winter wheat and 1 ppm in uncleaned soft white spring wheat intended for infant foods. A suspicion of *Fusarium* mould in malting barley can lead to rejection. Several malting companies have a zero tolerance for DON in barley.

Using infected cops for seed can quickly introduce inoculum into a previously unaffected area. Grain with a high level of infection isn't suited for seed use, but lower level infections are possible to use for seed. The decision whether to use infected seed or not should be based on the infection history of your area. In general SAFRR recommends:

- Do not bring seed infected with *F. graminearum* into those regions where this species is not established.
- Seed with up to 5% total *Fusarium* species infection should be safe to plant if it is not infected with *F. graminearum* and if planting in a region where FHB is already known to occur. However, a level of 5% total *Fusarium* infection could still result in significant seedling blight if a seed treatment is not used.
- Seed with levels of 5% or greater total *Fusarium* species may benefit from a seed treatment. Only use seed if it has a strong germination as emergence may be reduced if seed has high levels of *Fusarium* infection (i.e. greater than 10%).
- Seed infected with *F. graminearum* can be planted back into regions where this species is considered established (south-east, east-central regions) as there will be external sources of the disease already present, such as infected cereal residue.
- Seed with levels greater than 5% *F. graminearum* may have other quality problems and is a risk to plant.
- Seed infected with *F. graminearum* should be treated with a registered seed treatment.

Acknowledement

Penny Pearse, Provincial Plant Disease Specialist, SAFRR

Dr. Guy Lafond: Director-At-Large

By Dave Larsen, AAg

Conservation Agrologist

Dr. Guy Lafond, a native of Manitoba, received his BesA from the College de St. Boniface in 1974, his BSc(hons) and MSc from the University of Manitoba in 1978 and 1980, respectively. He received his PhD from the University of Saskatchewan in 1984. From 1984 to 1985, Guy worked as a professional research associate at the Crop Development Centre in Saskatoon working on winter wheat and from 1985 to the present, he has been employed as a cropping systems agronomist with Agriculture and Agri-Food Canada at the Indian Head Research Farm. More recently, in addition to his research, he was seconded to the Agri-Food Innovation Fund acting as the co-ordinator of the Spoke Program under the Specialized Crop area from 1997 to 2001. Guy has published numerous articles in the scientific literature and popular press on various aspects of tillage and cropping systems.

The mandate given to Guy when he was hired at the Indian Head Research Farm was to do research on soil conservation. Before coming to Indian Head, he had been working on the winter wheat project with Dr. Brian Fowler at the Crop Development Centre at the University of Saskatchewan. At that time, he realized that if he could get producers to grow winter wheat, they would automatically become familiar with the concept of direct seeding so that the switch to using direct seeding for spring crops would be easier and more gradual. From a research perspective, he made a conscious decision to approach the research in direct seeding by proving that direct seeding could work in order to avoid technological and personal biases regarding this new technology.

Guy has conducted a number of research projects over the last 17 years. The list includes the following:

Interactions of tillage systems and crop rotations - A 12 year study from1987-1998; Feasibility of using anhydrous ammonia during seeding in a No-Till system; Performance of different openers that can separate seed and fertilizer without causing fertilizer damage to the seed in wheat and canola; Impact of packing weight, opener configuration and packer shape on the production of canola, spring wheat and field pea; Refining oat, flax, durum and canaryseed production under No-till; Impact of fertilizer separation on the production of flax and wheat; Development of ways to assign management units to a no-till field in order to apply a variable rate fertilizer application of nitrogen fertilizer; Impact of different nitrogen management, nitrogen form and nitrogen timing on nitrogen use efficiency in wheat, canola and flax and on grain production and nitrous oxide emissions; Impact of nitrogen, row spacing and seeding rates on the yield of spring and winter cereals and flax; Impact of No-till on the production of winter and spring cereals; Impact of different N management and risk management strategies for wheat and canola with respect to delayed applications till after seeding; and the Feasibility of applying all the fertilizer nitrogen at seeding time in winter wheat.

Guy's current areas of interest pertain to new approaches to land management using site specific tools for nutrient management as well trying to develop new tools such as optimum machine size given the irregular shapes of fields and obstacles in a field. He is interested in the use of robotics technology for doing field scouting. He is also interested in the whole area of harvest management. Guy would like to duplicate the success in direct seeding with harvest management to reduce capital and energy costs. With direct seeding, we went from a multi-pass system to a one pass system. He thinks that the future in harvest management is to go from a one or two pass system to a multi-pass system as a way to reduce overall costs, nergy and capital. There is also some fine tuning left to be done with nitrogen management.

Guy has received numerous awards for his extensive work such as the SSCA's Award of Merit in 2001; the Weed Science Society of America Award of Excellence in 1994 and the Manitoba - North Dakota Zero Till Association. Award for Outstanding contribution in developing zero till and direct seeding methods for the Prairie Provinces in 1993

The SSCA invited Guy to be a Director-At-Large in February 2002. Guy believes strongly in what the SSCA has accomplished. He believes the organization will take a leadership role in promoting overall sustainability and that it has the ability to be a very good promoter of appropriate technology.

CLC Happenings

By Laurie Hayes, MSc, PAg

Manager, Conservation Learnig Centre

This is going to be short (like the 2002 growing season) and sweet (not like the 2002 growing season). We had about 4" of rain up to the end of July, got hit by frost on August 1 and have had 7" of rain and 3" of snow since then. We still have 50 acres of wheat standing (our precision agriculture project - naturally!!) and 20 acres of swathed canola. We have harvested one field of Prodigy wheat (yielded 22 bu/ac) and most of the canola (yielded 5 - 10 bu/ac, depending on the variety).

The crop that did produce exceptionally well this year was the caraway. This was the second year of production and we harvested 540 kg (1190 lb) from a 1.4-acre plot. That's 850 lb/ac and, at 68¢ per pound, it was by far the most profitable of our crops. Too bad we hadn't had 250 acres of caraway!!

This year, there has been quite a bit of talk about golden German foxtail millet. Our plot produced very well but experts caution that this crop would not likely produce as well in wet years.

A couple notes of interest:

- An aerial infrared photo was taken again this year, and despite the fact that the SE ¼ has for two consecutive years been one field rather than four, one old field boundary is clearly visible in the photograph. Further investigation using the yield map (whenever harvest is done!!) could prove very interesting.
- In September 2001, we straight cut the Bethune flax (yield 22 bu/ac). The straw and chaff were chopped and spread. Dispersion was very good and quite uniform. In the spring of 2002, we direct seeded canola into the residue. The flax residue did not hinder the emergence of the canola. This is the third time that we have spread the residue back onto the fields and, other than some small patches, we have not seen any problems with emergence of the following spring crop.

As a member of Agri-ARM, the CLC was involved in circulating surveys at field days. The surveys assessed the awareness and concern of producers regarding environmental issues. Information packages will be developed based on the results of these surveys. Further, the findings will be incorporated into a more comprehensive project to develop environmental farm plans for Saskatchewan producers.

The school program continues to be popular, with an estimated 1,800 students participating this year (weather permitting), bringing the **eight-year total** to **~11,360 students.**

We have had 475 groups from 59 schools in 13 different school divisions. Over 190 teachers have brought students to the CLC and 40% have visited multiple times (10% have participated more than four times). One teacher has brought ten groups and one school 51 since the school program began. Since 1997, the number of schools participating has increased 67% from 18 to 30.

Historically, 18% are Grade 1-3 students, 62% Grade 4-6, 14% Grade 7-9 and 6% Grade 10-12. The number of Grade 1-6 students remains relatively constant but there is an increase in junior (42%) and high (116%) school groups. In particular, more groups are taking part in two-day programs. This involves camping at the CLC for two days and covering the basics of soil formation and land uses, ecology and conservation.

This fall, three groups took advantage of the multi-day programs - Lloydminster Grade 10, Meath Park Grade 11, Carlton Comprehensive "Outdoor School" (Grade 11). The Outdoor School group returned for the fourth straight year. For all groups, we incorporated presentations and activities from PFRA, Ducks Unlimited, Saskatchewan Wetlands Conservation Corporation and the University of Saskatchewan experts. Coupled with the CLC's component, these enhanced programs provide students with in-depth looks into many agricultural, conservation and environmental topics.

The above statistics and off-farm requests attest to the quality of the CLC's school program. It is hoped that through this exposure, the next generation of consumers will understand and appreciate the efforts of producers to produce a sustainable and safe supply of food.

There have been many challenges this year and we thank our partners and sponsors for their continued support. Now, it is time to start planning for the 2003 season. See you at the SSCA Annual Conference in February.

Kyoto Update November 2002

By John Bennett

SSCA West Central Director

We certainly are seeing a lot about Kyoto in the papers. Prime Minister Chretiein announced in Johannesburg that the government would introduce legislation, probably before Christmas, that would set Canada on the path to ratification.

Political analysts point out that because of the liberal majority, with its history of party discipline and support by the Block and the NDP, this legislation will likely pass. The Alliance's opposition to the ratification along with the PC on-again off-again opposition will probably not affect its passage. Alberta has mounted a very public campaign to oppose the federal plan. They support reducing emissions but over a longer time period.

Kyoto will probably come into force regardless of whether Canada ratifies or not. Russian ratification is expected to occur in the spring session of the Duma. This action will bring the Kyoto Accord into effect. Russia will have ERU (emission reduction) carbon credits to sell internationally. This "hot air" or "fair air" credit results from the fact that in 1990 (the Kyoto base year), Russia had an active, but emission intense, industrial sector. This industrial sector downsized or collapsed with the dramatic political changes after 1990.

In the last few weeks Canada and several provinces have released their "official" positions on Kyoto. All the plans agree that we must reduce emissions but then the fight begins. I will report on a few points of the Alberta, Saskatchewan and National positions as they affect our membership.

Alberta's position argues that the cost of ratification to the Albertan and Canadian economy would be huge. The Federal government studies suggest that the cost would be minimal and the NGO environmental groups point to economic benefits.

I would not be brave enough to speculate about who is right but we need to realize that everyone is posturing in order to enhance their bargaining position.

Let's look at ratification in terms of benefits and drawbacks to the farm sector. First we must recognize that the scientific debates on whether or not global warming is occurring and whether the changes are anthropogenic (induced by human activity) are over. Aside from a few contrairian groups in the science world, including the American Academy of Science, the scientific community is in agreement that failure to address the issue would be foolish. This means that the global community will be forced into action and the only question is how far and how quickly do we go.

The Alberta option suggests that we should not ratify Kyoto. As farmers we need to understand that there are costs and benefits to ratifying. Our sector is a source of emissions. Therefore there will be a cost. On the other hand we can remove and store emissions in the soil with ag soil sinks

One Kyoto mechanism is an emission market and the carbon sinks created by ag sinks would have value. If Alberta prevails and Canada fails to ratify Kyoto, we may lose this opportunity. Canada has worked hard to have the sink provision included in Kyoto and it may be hard to have sinks recognized if the agreement is rejected and then renegotiated at later date.

Canada's action plan, which was made public just before the JMM (Joint Ministers Meeting) in Halifax, has been criticized for being short of specifics. The one notable provision in Canada's action plan that affects us is the point that would only allow farmers to receive recognition for some of the RMUs (removal units or sink credits) . There is a strong implication that sink credits created by "business as usual" (BAU) would lower Canada's emission targets but the farmers that created them and currently maintain them would get little or no recognition.

We must track carefully the fate of the debate on (BAU) ag soil sinks. Most of these BAU sinks are in Saskatchewan and the Province and its farmers could be short- changed. For a province with the liability of largely coal fired electrical generation, the costs would remain but the benefit of some of its large RM ag sinks would move directly to the federal ledger where they would be used to lower national targets. This would be a disadvantage to both our province and our SSCA members.

The Saskatchewan representative at the Federal-Provincial JMM made some strong statements regarding federal infringement on provincial jurisdictions. The following excerpt is taken from the Saskatchewan government position paper:

"The federal plan should respect provincial jurisdiction, including provincial ownership of natural resources. The plan should provide fair compensation for any national use of carbon sinks developed by Saskatchewan farmers or for any carbon sinks accumulated by provincial forests. The plan should allow for a provincial role in implementation of major climate change initiatives, including monitoring and administration of any proposed emissions trading system."

Farmers need to insist on ownership of what we have accomplished by removing and storing CO2 in our soils. As an association, the SSCA will do its best to see that the value that accrues as a result of actions farmers belongs to the farmers.