

Soil Conservation in Saskatchewan, We've Come a Long Way

By Doug McKell, PAg
Indian Head, SK

In terms of soil conservation we have indeed come a long way. But it is just as important to have a look and remember from where we came and why it was necessary to come this far. We teach our children to study history so we can learn from our mistakes and try not to repeat the follies of our ancestors. Humans tend to have short memories, which is why we have suffered several major wars, depleted our resources and caused the pollution that we have over the past hundreds or thousands of years. So to understand why it was necessary to learn about and practice soil conservation in Saskatchewan we need to go right back to the days when the prairies were being settled. For in Canada it was politics as much as agronomics that shaped our prairie agriculture. It's almost frightening how agriculture and politics almost destroyed our essential soil resource.

For many millenniums Saskatchewan developed into a grassland prairie with a delicate soil balance governed by the carbon cycle through the elements of nature such as buffalo, weather, and wild fires. The early explorers had variant opinions as to the agriculture potential of the prairies. John Palliser said in his 1863 report, "the great American desert into British North America constitutes a barrier to extension of the continuous western settlement". However the Dominion of Canada agent, botanist John Macoun, made the claim, "the absence of wood did not reflect soil deficiency", and he argued that the area was well suited for agriculture. So government bureaucrats were in a dilemma. Who should they believe, the pessimistic report of Palliser or the optimistic review from Macoun. Well Macoun had a town named after him and Palliser is blamed every time we suffer a drought in Saskatchewan so I guess we know which viewpoint was favored. The ever-present American expansion across the west also factored into the government's decision to promote settlement. Eastern Canada politicians had to find a way to get settlers to move west to keep the Yanks out, and agriculture seemed to be the hook. Pamphlets were produced that advised prospective immigrants, "the absence of trees was really a farmer's blessing since it made clearing the land unnecessary".

Well back in the 1800's people actually believed what the government said, and the promise of rich, cheap land brought a flood of adventurous settlers eager to find more elbow room and make their fortunes from the prairie soil. And with them came the tools for farming that were what was understood at the time to be necessary for field cropping, the plow and the disc. But little thought was given to developing any other practice because for the most part, farmers made money doing what they were doing. In fact economists have made the claim that the period of maximum profitability for agriculture occurred around the time of the American civil war.

"Breaking the land", became the metaphor that epitomized the early days of prairie settlement. But tillage with plows and discs was the only way known at the time to convert grassland to cropland. And the subsequent breakdown of organic matter provided more than enough nutrients to grow annual grain crops. It was like a precocious child given a fortune in the form of an organic matter bank, and left with little supervision to monitor the withdrawals and deposits. But there was another practice which happened rather innocently that, compounded with tillage from heavy implements, would hasten the affects of soil degradation. Summer fallow.

Until 1885 the conventional farming practice was to plow and seed every year. Then an event occurred which would change that conventional thinking for a hundred years. The Riel Rebellion. Riel was mostly an annoyance to the Canadian government at the time. But the movement towards metis self governance was tolerated until the execution of the Orangeman – Thomas Scott – who did everything possible to make himself the enemy of Riel. His demise caused a flood of demand for government action to put an end to this unruly western mob. The Prime Minister at the time – Sir John A. MacDonald, commissioned Major Sir Frederick Middleton to lead an expeditionary force to Saskatchewan to squash this band of unruly metis. The plan was to send the soldiers by rail to Qu’Appelle where they would commandeer horses from another patriot, ex Major Bell who was operating a 50,000 ac farm in the area. On April 6th, 1885 Middleton set off North to Batoche, with the plan to quickly quell the uprising and return in time for Bell to start seeding. Well we all know now that Riel and his rebels were more of a match than was expected. The stubborn rebels didn’t succumb easily and Major Bell didn’t get his horses back until well after the spring seeding season. Now as any farmer knows, if land isn’t cropped there are more than enough weeds happy to take over the space. Faced with this scenario, Bell decided it would be prudent to plow the land to control the weeds and prepare for the next crop year. So an interesting thing happened the next year. The crop was very good, much better than the crops that were grown on continuously cropped land! Bell decided that he would put half his land in fallow the next year and thus the concept of “summer fallow” was initiated and as such one of the most destructive practices to the soil was born.

All the while the Riel rebellion was happening, settlement of the prairies continued. This settlement of the West was promoted by the government as their priority was to fill in the empty spaces in Canada and the growing Canadian population required food. The dominion gov’t of Canada recognized the need for increased production and set up experimental farms across Canada to conduct research into new varieties and techniques that would achieve the goal of increased production. At Indian Head the second expt. Farm was established in 1887 and one of the key programs was to develop the new concept of SF with an eye on higher production. Other programs were aimed at new, better varieties and techniques such as seeding depth and timing, all to produce more grain. The primary focus was on production but the resulting affects on soil quality weren’t totally ignored. A report on soil fertility in a Dominion of Canada Department of Agriculture Bulletin No. 21 (Shutt, 1923) indicated that a potential problem was occurring. He stated, “Saskatchewan - *...there is a marked destruction of the organic matter and dissipation of the nitrogen where the crop-fallow system is followed, and this eventually will injuriously affect the soil both chemically and physically*”. He also stated in a subsequent bulletin that, “*There is a natural destruction or dissipation of the organic mater in the soils from the oxidation and chemical reactions following the tilling, the cultivation of the soil, which results in the loss more or less of this organic matter,*”.

However Shutt’s warning went unheeded as the Canadian government rapidly moved forward to settle the prairies. And the breaking of the land continued

In the early 1900’s through the great war years and all through the 20’s, agriculture was booming. New land was broken and the world would take as much grain as Canada could produce. Farmers weren’t well compensated for their efforts and thus the two issues, marketing and production were still the prime focus of farmers, industry and policy makers, soil quality was not a priority. Then came the depression.

The intensive tillage that being practiced was causing severe loss of organic matter and, in some cases soil erosion. This was not a problem as long as the rains came and subsequent plant growth protected the soil. However, the terrible droughts that plagued the West during the thirties made it evident that farming practices to this point were not sustainable. But as we know now, once erosion starts, it is very hard to reverse. The federal govt finally responded to the widespread drought, land abandonment and degradation with an act of parliament that established the PFRA in 1935. Their role was to, "...*secure the rehabilitation of the drought and soil drifting areas in the Provinces of Manitoba, Saskatchewan and Alberta, and to develop and promote within those areas, systems of farm practice, tree culture, water supply, land utilization and land settlement that will afford greater economic security...*" Offices were set up in Med Hat and Swift Current. Ag Improvement Associations were organized to demo new farming practices. Water development projects were also initiated and farmers were paid up to \$50 for constructing dugouts.

World War II brought a halt to most conservation programs. The grants to AIAs were discontinued. At that time AIA membership had peaked at 33,600 in 228 associations. The weather also improved and the terrible droughts of the 30s virtually disappeared. Throughout the 40's and 50's the focus of govt. programs was back on production as rebuilding nations tried to get back to civilized status. Water development was the other big issue. Farmers continued to grow crops on fallow land but with new technology in tractor power, cultivators and other implements plus plenty of gasoline, it was getting easier to till the land. "garden plot" fields were looked at as being the model and black fallow was seen as the result of good farming. My father has a clock that my Grandfather won in a contest run by the Regina Ex assoc. for the best SF field. Apparently the field was tilled many many times and there wasn't a piece of straw or bit of plant material anywhere to be seen. He won the prize.

But the reason farmers were getting away with these practices was that the weather cooperated, for the most part, the world was still hungry for grain and the OM bank was still providing the withdrawals of nutrients. By the late 50's and early 60's inputs like 11-48-0 fertilizer and 2,4-D were becoming common. But again it was mainly for increasing productivity, not for addressing soil quality. There were a few minor hiccups, like 1961 and 1977 plus the odd year of localized drought, bugs etc. But there always seemed to be a rebound year following. What happened next was related to world economics but also to soil economics.

Now let's get one thing straight. It wasn't me starting farming that caused the downslide to agriculture in Sask. But the timelines are remarkably similar. After getting married in 1979 and working in the Ag industry for a couple of years, I decided it was time to start farming and get on the gravy train that my ancestors had been riding. Then came the worst drought in the Regina area since the 30s. Frost, cutworms, grasshoppers followed me into each subsequent year. We bought a farm near Indian Head. And what happened. The worst drought for years, cutworms, grasshoppers etc. Prices tumbled as the major producing countries started their subsidy wars. Well I thought it was just my fault. But the coffee shop talk proved that most other farmers were experiencing the same calamities. And the soil band was starting to show the signs of bankruptcy.

By the early 1980's it was becoming obvious that something needed to be done to address the drought and soil degradation that was occurring. Ag Canada, which now had PFRA as a branch, created a Soil and Water Conservation Branch and a new emphasis was placed on soil and water conservation. Farmers began forming self-help groups for community action and information exchange in attempts to reverse the trends. Groups such as the Warner-Dryland Salinity Control Association in Alberta, the Manitoba North Dakota Zero Tillage Farmers' Association, the Huron Soil and Water Conservation District in Ontario, and Soil and Crop Improvement Associations plus the Eastern Canada Soil and Water Conservation Centre across Atlantic Canada are typical of local bodies that were established as farmers looked for appropriate solutions to degradation problems (Sparrow, 1984).

In 1984 the Standing Senate Committee on Agriculture, Fisheries and Forestry was authorized to examine soil and water conservation in Canada. The extensive study that resulted concluded there was an urgent need to develop programs to promote soil and water conservation across Canada. In 1987 the National Soil Conservation Program was started and new programs to demonstrate soil conservation practices were developed. Our organization, Soil Conservation Canada was formed in 1987 as a result. The Council has been actively involved in the design and delivery of the National Soil Conservation Program and the Sustainable Agriculture Component of the Federal Green Plan. While much of the work done by the council has focused on national issues, it has worked closely with regional and provincial organizations to help organize conservation efforts.

Drought was a recurring problem in the last 20 years, and the obvious symptoms was erosion by wind that hadn't been seen since the depression years. But another factor causing erosion wasn't so obvious and that was OM depletion. The soil bank was now overdrawn and agrologists started to understand what Shutt had been warning about in over 60 years earlier. Tillage had oxidized over 30% of the native OM leaving soils unable to produce enough natural food for the yields farmers were used to achieving. SF cropping on fields that were getting to be around 100 yrs old was requiring the same amount of fert as was required to grow stubble crops.

The innovators were picking up on this and were starting to experiment with continuous cropping, snow trapping and even, ... zero tillage. The availability of Roundup and a few high clearance, low disturbance drills started interest in the concept of reduced tillage. The SOS program had a heavy emphasis on zero till as well as noble blades, green manuring, forages, all aimed at reducing tillage. Many meetings were set up with some claims being made that suggested this was the only way to continue farming. Many jumped into the practice both feet first, despite the cautions from most agrologists. Some farmers literally went belly up and soon the practice was controversial, to say the least. Some will suggest the SSCA was given the mandate to promote zero till as the provincial govt. did not want the consequences if a wreck occurred. Agrologists even changed the name to no till or low disturbance seeding or conservation seeding.

Eventually the practice was refined and advancements in machinery technology coupled with the patent expiration of glyphosate and the resultant price decline, started a wave of adoption in no-till in the early 90s. However the promotion of no-till became passé with governments who looked for other avenues to develop agriculture such as diversification, developing the livestock

industry and rural revitalization. Even though the adoption rate for no till was only at around 30%, there was no program federally or provincially that would keep the push on reducing soil tillage. This despite the fact that all scientific and anecdotal evidence was pointing to incredible changes in soil quality from soil which had been in zero till for only 5-10 years. Some prairie conservation organizations that had focused on promoting no till almost went out of business. Then came the Kyoto accord.

In 1997 scientists and governments got together and discussed some disturbing events related to climate that were happening around the globe. And despite what anyone would say about the science, or the research results, when scientists and government get together and spend a few days talking about how there's a problem you can rest assured it will soon be a huge problem. And now most of you have heard about the resulting Kyoto accord and how Canada has signed on committing to reduce our GHG emissions to 6% below 1990 levels by the year 2008, which just happens to equate to around 30% below 1990 levels when you factor in BAU but, what the heck, our negotiators maybe were close to retirement, who knows. But the thing that was in ags favor was that this accord would eventually include the allowance for offset mechanisms that would put the emphasis back on promoting soil conservation strategies that reduce tillage. And thus we have a large number of Climate Change programs such as, Action Plan 2000 and the GHGMP which have put significant dollars back into provincial soil conservation groups like SSCA to promote soil conservation practices as climate change mitigation practices.

And now places like the EX farm at Indian Head, which if you were paying attention, was setup to research and promote Summerfallow, is now focusing on and promoting no-till and long term cropping of farmland. A complete 180 degree turnaround.

So that is where we've come from. But where are we going?

As was stated initially, agriculture in Canada is shaped by politics as much as agronomics. Today's soil conservation efforts are affected by a couple of key events.

The Intergovernmental Panel on Climatic Change (IPCC 1990) Findings state that human activities have caused changes to climatic patterns.

United Nations Framework Convention on Climate Change – 1992 resulted in more agreements for nations to take action to address climate change.

Kyoto Protocol In December 1997 at the third session of the Conference of Parties to the UNFCCC in Kyoto Japan, the Kyoto Protocol was established. Canada commits to reducing CO₂ emissions 6% below 1990 levels by the year 2008. The agreement comes into effect on the 90th day after the date on which not less than 55 parties to the convention, incorporating Annex 1 parties accounting for at least 55% of total CO₂ emissions for 1990 ratify the agreement.

Walkerton In May 2000 7 people died and hundreds became ill from drinking town water contaminated with E-Coli bacteria.

North Battleford In 2001 700 people become ill after drinking city water contaminated with bacteria.

These events plus others such as drought, floods, crop prices etc. were instrumental in the Government of Canada developing the third sustainable development strategy for Agriculture

and Agri-Food Canada. On June 20, 2002 the Agriculture Policy Framework was announced. It involves a \$5.2 billion investment over 6 years. The APF is composed of five elements:

- Environment
- Food safety and food quality
- Renewal
- Science and Innovation
- Business Risk Management

The components of environment and agriculture considered as priority areas under the APF include; water, soil, air and, biodiversity. Under each component priority issues are identified and include:

Water

- Nutrients
- Pathogens
- Pesticides
- Water Conservation

Soil

- Soil erosion
- Soil organic matter

Air

- Particulate emissions
- Odours
- Greenhouse gas emissions

Biodiversity

- Habitat availability
- Species at risk
- Impact on wildlife

Any and all programs that will involve soil conservation in Canada will fall under one of the categories listed. Some of the more recent programs that are examples include:

Environmental Farm Plans

- Phase 1 (2003) – Environmental Scans
- Phase 2 (2003-2008) – Establish EFPs
- Phase 3 (2003-2008) – Incentives to adopt BMPs

Greencover Canada

- Phase 1 (2003) Scans identify areas
- Phase 2 (2003-2008) – Conversion of land

National Water Supply Expansion Program

- Phase 1 (2003) – Identify objectives
- Phase 2 (2003-2008) – Incentives to develop solutions for high priority water-supply issues.

The existence of these types of programs at the federal level indicates a commitment to programs that will address conservation issues, including soil conservation, for the next several years. The question remains, however, as to how much funding will be allocated to programs at the producer level and what will be necessary to qualify.

International Efforts.

Other countries with which Canada interacts also have a commitment to protecting their agriculture resources. It is interesting to note the key conservation efforts in a few of these countries as well as in Canada.

US

At the time of this paper the US has not signed on to the Kyoto Protocol. There are conservation efforts being promoted through the USDA, Natural Resources Conservation Service. In the US the Conservation Security Act governs what efforts are sponsored for conserving agriculture resources. The Act encourages conservation through a three tiered program. Producers can adopt practices at three different levels with higher payments for a higher commitment to conservation plans. Most of the practices are aimed at minimizing erosion and protecting water courses and bodies. The word "carbon" isn't specifically mentioned in any of the programs offered to producers but it could easily be included if the US establishes a carbon offset trading program. The feeling by many agrologists and producers in the US is that if producers are required to provide clean air, water and soil then they should be paid for doing so.

Currently there are a few projects in designated areas that pay small incentives for a farmer to try no till. The payments are usually restricted to the first three years with the idea that at that time the farmer will have decided to carry on with the program. There are a couple of groups i.e the Pacific NW No till association and groups in IOWA and Indiana that are working toward carbon trading but nothing on a national or even state wide scale. In the absence of a regulatory program it is unlikely these efforts will expand to a large scale.

South America

In South America the problems of soil degradation due to agriculture practices evolved very similarly to those in North America. And it is interesting to note that the development of farmer organizations also parallels the growth of organizations in Canada, both at the regional and national levels.

By the beginning of the 1900's, farmers in different South American countries clearly recognized that intensification and the expansion of agricultural activities based on conventional tillage (plough and disk harrow) were the main causes of soil and agro-ecosystem degradation. The main problems were soil erosion, deterioration of soil structure, and depletion of soil fertility. Crop productivity was declining, and coincidentally, significant increases of fertilizers and other inputs were being applied in an attempt to restore the productivity of the degraded agro-ecosystems. Improved techniques of tillage and planting were necessary otherwise farmers risked bankruptcy as the soil resource deteriorated (Peiretti, 2001, (b)). However, to achieve this, farmers had to change their opinion on what constitutes good agriculture and how to better relate to their agro-ecosystems. As a result, a group of farmers from several South American countries founded CAAPAS, on March the 26, 1992, during the "First Inter American No Till Congress" organized by AAPRESID (Argentinean No Till Farmers Association).

From the beginning, no-till farming was the cohesive force among the members, and a new farming model, named the MOSHPA (Modern Sustainable High Productive Agriculture) model, was developed through farmer experimentation. The main concept is producing with nature while working within the existing markets, thus requiring a high degree of knowledge, close association with the soil, and respect for the environment. The objectives are to improve productivity, profitability and competitiveness in the short term, within a production system that improves the quality of the soil in the medium and long term (Peiretti, 2001, (a); Trebugge, 2001). These objectives fit well into the paradigm of no till. Initially, much of the work proceeded on the basis of observational information gathered from existing members, with CAAPAS as a facilitating organization and a permanent discussion forum. The annual meetings, involving both farmers and local scientists, are opportunities to discuss problems, evolve solutions, and promote faster development and adoption of the no till farming systems. The expanding membership of the CAAPAS organization is clear evidence of the usefulness of the organization to its farmer members.

The number of hectares covered by no till in American countries associated to CAAPAS, had grown more than five fold during the last ten years, from approximately 10 million hectares to more than 50 million hectares. This represents approximately 75% of the area covered by no till worldwide. Most of this is due to the collective action of farmer and farmer associations, supported by national scientific institutions. However, much still remains to be done. Soil degradation is still prevalent over large areas of the world, and thus the achievements to date are viewed as the launching pad for greater efforts in the future. No till, crop rotations, improved fertilization, and integrated pest management are fundamental to mitigate soil degradation and improved environmental performance, and greater efforts must be made to spread these technologies world wide.

Australia

In Australia the reaction by the federal government to the subsidy wars of the 80s was quite simple. “Sink or Swim”. Farmers in Australia received virtually no help from governments to stay in agriculture. As a result, farm size in Australia increased dramatically and corporate management is quite prevalent. Farmers in some regions have organized into self help organizations such as: The Western Australia No Till Farmers Association (WANTFA), The Southern Australia No Till Farmers Assoc. and the Victoria No Till Farmer Associations are all examples of farmer’s efforts to learn how to adopt no till as a conservation practice.

No till seems to be the unifying factor around the world for the promotion of soil conservation practices. It is the single most significant change in annual cropping practice in the last century that can be shown to reverse the effects of soil degradation. And it is the rallying point around which many farmer organizations are established throughout the world. Interconnected with this practice is the mitigation of greenhouse gas benefits that result from sequestering soil carbon in no till systems. After the allowance of soil sinks into the Kyoto Protocol, governments and farmer organizations in countries with well developed agriculture are looking for offset mechanisms as part of their greenhouse gas mitigation strategy. At the time of this paper there are no established mechanisms in Canada for the trading of soil carbon. However this is a goal of the farmer organizations mentioned above i.e. to develop and implement greenhouse gas

offset trading systems that involve carbon sequestration through no till farming practices. Whether or not this will result in significant returns for farmers is still a debatable issue. However the politics involved with the issue will keep it in the forefront for the next several years.

So once again politics is driving trends in agriculture, and we can rest assured that it won't be the last time either. But one point on which we all must focus, is that whatever the politics or the technologies available to agriculture, the most important task that we face in the world today is that of protecting the soil, water and air. For these are the resources so vital to the sustainability of not only Canada, but the planet, that we can not take them for granted as former generations have done in the past. Yes when we look backward, we have come a long way, but we should not stop here, the journey is ongoing.