Early Roots of Conservation Tillage: Recognizing the Need & the First Steps

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Introduction

In discussing this exercise with Bernie Sontag & Glen Hass we came to the conclusion that the question to be considered was "How did we get into this mess?" and "What have we done about it?"

Sources of Information:

- *Soil Science on the Canadian Prairies – Peering into the future from a century ago* - H. H. Janzen
- Saskatchewan –*A New History* – Bill Waiser

Where do we start?

I want to briefly trace some of the steps that led to the deterioration of the once very fertile soil of Western Canada and the resulting soil conservation problems.

1857 – Palliser and Hind expeditions – Palliser Triangle

The expeditions of Palliser and Hind in 1857, a dry year, drew the conclusion that a large tract of land in southern Saskatchewan and Alberta was unsuitable for anything but ranching. This area became labeled the Palliser triangle.

1879 & 1880 – John Macoun

Another expedition sponsored by the Federal Government in 1879 & 1880 led by John Macoun hit a time when there was good rainfall and lush growth. He reported a rich resource ready to be settled and developed. This was great news for the Federal Government for it meant they could push ahead on plans to settle the west.

<u>Settlement of the West</u>

- Homestead Act 1872 – set up an attractive settlement system where the settler could obtain title to a quarter section of land, upon payment of $10.00, residing on the land for six months each year for three years, breaking 15 acres and erecting a shelter.
- Building of CPR Railway – 1881 - 1887

  Canadian Govt. needed the railway built to connect the east with BC and chose the southern prairies route to limit the encroachment of the Americans from the south. CPR received large tracts of land so they needed settlers to buy the land and they needed farmers to produce the wheat to be hauled east.

- In the late 1800's and early 1900's many very large ranches were established in SW Sask. with many of the cattle from US. Severe winter in 1906/07 killed a great many cattle so most of the large American Ranchers pulled up stakes and went home. At the same time there was a wave of settlers looking to settle on homesteads so the southwest was quickly settled and the land broken up. Much of his area was later to become the centre of the "Dust Bowl" where soil drifting was most severe.

Farming Practices

Early settlers grew a crop every year, burning the stubble in the spring before seeding. The land was rich so crops grew well if there was enough rain.

In 1885, the Riel Rebellion was in progress at Batoche and a large armed force was sent to deal with the uprising. Horses were obtained from farmers in the Fort Qu'Appelle area. Much of the land didn't get seeded, so lay fallow for a year. The next year was very dry. Crops on the previous years crop land yielded only 2 or 3 bus per acre. Crops on this fallow land were near 25 bus. per acre. This confirmed the practice that had been used in the US Midwest for a couple of decades and had likewise been introduced by the settlers from the Midwest US. Angus Mackay, a participant in this event and soon to become superintendent of the Experimental Farm at Indian Head, became a strong proponent of the idea.

Summerfallow was to become the key to farming the dry western prairies. The practice of summerfallow, which was to make farming practical in the dry prairies, was the same practice that soon would be the cause of severe wind and water erosion and depletion of organic matter. Coupled with the practice of summerfallow was harvesting with the binder and thresher, which removed most of the plant residue from the field, piled it large straw stacks which were burned before the next spring.

The plow, the seed drill, disc harrows and some form of harrow also came with the settlers from the US mid west.

Dust Mulch

Henry Janzen tells the story of the American innovator who reasoned that moisture was lost from the soil by capillary action, which could be greatly reduced if the surface of the soil was in the form of dust mulch. "Dustmulch" Campbell was brought to Alberta to lecture on the value of this technique. The practice claimed success until some severe prairie winds showed the results. Interestingly this practice, in perhaps a modified form, was practiced every spring in Saskatchewan until very recently. It even had the fancy name of Pre-seeding Tillage.

Weed Control

In the early years weed control was not a big problem but as time went on it became a major problem. Tillage was the only method available to control the weeds, so the summerfallow was the main way to bring about this control. This meant working the soil several times during the summerfallow year. The generally accepted routine was to plow the field as soon as possible after the crop land was seeded, and, since it was usually fairly rough after the plow, it needed to be worked with the disc harrow and harrows. In later years some farmers had a duckfoot cultivator to do some of these tillage passes.

Equipment of Early Settlers:

Plow: The universal machine in various sizes that opened up the west and used annually on most farms until the late 1930's.

Disc Harrows: Another universal machine that was the basic follow up machine to the plow and the machine of choice to prepare the fields for seeding.

Harrows: Used widely to break up the soil surface as well as level out uneven fields.

Drill: Single Disc, Double Disc and Hoe.

Power Source:

Oxen and horses were the only source of power in the early years of settlement.

Large steam tractors were widely used to break up the prairie sod, pulling several furrow plows and then used to power the threshing machines. The smaller tracts of land were broken with the plow and oxen.

Innovations:

Noble Blade – The frustration of the frequent dust storms in the Lethbridge area of southern Alberta, led to the invention of the Noble Blade by Charles Noble, Nobleford, Alberta in 1935. The heavy subsurface blade cut off the weeds without burying the trash cover on the soil surface. It was the first significant invention to prevent the extreme soil drifting experienced in southern Alberta and south western Saskatchewan. Many of these machines were sold over the next few decades. They were however, not as successful in the more moist areas of the west because there was not sufficient soil disturbance to get good weed control.

One Way Disc Plow: invented by Charles Angell Sr., Plains, Kansas in the 1920's was a well-accepted replacement for the mouldboard plow. It only partially buried the plant residue and had much lighter draft than the plow. It's use spread to the Canadian plains during the late 1930's and the 40's and was soon widely adopted.

One Way Disc Harrow: An innovation developed here in Saskatchewan in the 40's combining some of the features of the One Way Disc Plow and the Disc Harrow with the addition of a seeding mechanism, soon became the tillage machine of choice for summerfallowing and for seeding for many years. These machines did retain some of the plant residue on the soil surface while providing good weed control.

Deep Tillage or Heavy Duty Cultivator: The Graham-Hoeme Chisel Plow was developed by Fred Hoeme, an Oklahoma farmer, in the mid 1930's to combat the terrible soil drifting problems of the US plains by ripping up the soil, bringing lumps to the surface and making deep ridges. This was the forerunner of the deep tillage cultivators that were introduced in the late 40's and became widely accepted in Western Canada over the next few decades. These cultivators did much to reduce the major wind erosion problems of the 30's. The development and addition of air seeding technology to these cultivators was the next step toward where we are today.

Summerfallowing with the newer types of machines:

It is important to make some distinction between the summerfallow made with the plow and the suumerfallow made by the newer machines. The Noble Blade left a surface well protected against wind erosion. The one-way disc harrow left a less protected surface with the level of protection depending on the frequency of the operations and the operating speed. The faster they were operated the more trash was buried and the greater the soil was pulverized. The soil condition after the Deep Tillage Cultivator depended on a number of conditions. The type of shovels being used made a great difference. Low profile shovels gave very little soil disturbance and buried very little trash but gave poorer weed kill. Conversely, higher profile shovels, particularly if operated at higher speeds buried much more trash and left the field with more prominent ridges. To combat the ridging and often to get a better weed kill, harrows were attached which resulted in more soil pulverization.

The newer methods of summerfallowing, while reducing the potential for wind erosion, did not control water erosion, particularly in rolling land. Filling in water runs after the spring runoff or a heavy rain was a standard procedure.

After glyphosate became readily available at lower prices, chem.-fallow became a viable option in the summerfallow rotation. This practice combined the advantage of moisture storage with good soil management.

Government Action:

While government actions and policies, which were designed to settle the west and reap the rewards, were responsible for setting the stage for the problems of soil degradation to occur, governments did little to remedy the situation until the devastating dust storms of the 1930's, when soil drifting became a national disaster. The first concrete action came in 1935 with the creation of the Prairie Farm Rehabilitation Administration (PFRA), which was set up to arrest soil drifting and promote water conservation in the drought stricken short grass district. Some of the most severe areas of soil drifting were seeded to grass and transformed into Community Pastures. Strip farming was promoted as a means of controlling the drifting problem.

Another significant Government action came five decades later in 1984 when Senator Herb. Sparrow from Saskatchewan led a major Senate committee study of the issue of Soil Conservation and produced the report "Soils at Risk". This report led to the formation in 1987 of the Soil Conservation Council of Canada, with Senator Sparrow as the first president. The Saskatchewan Soil Conservation Association was formed that same year and you will hear much more about this later in this conference.

Soil Scientists:

Janzen provides an excellent review of the work of Soil Scientists in Western Canada in the period from the 1880's to the 1920's. Their soil testing confirmed the richness of the centuries old prairie soils. They tracked the reduction of Organic Matter and available Nitrogen following cultivation. They sent out warning signals that a fallow-wheat cropping system was not sustainable. In several locations various crop rotation experiments were conducted with the inclusion of legumes and grasses in the rotations. While these rotations met some of the objectives of maintaining soil quality, they by and large failed in the practical reality of a very

rapidly expanding farm population, and an urgent demand for wheat for the export market. Zero-till and direct seeding were among the practices tried, but in the absence of appropriate equipment and any incentive to pursue these practices, they were never developed.

After several attempts to warn of the dangers of these farming practices, with few tangible results, they became fairly silent. The energy required to change a well-established status-quo was too great. Even in the 1970's, stalwarts like Dr. Don Rennie took a lot of abuse for recommending that summerfallow was a wrong practice.

The People – The Farmers:

As one reads the history of the settlement of the west one cannot help but be impressed with the tenacity and durability of these people. During the past few years many of these farms have been honoured for being in the same family for 100 years. A remarkable achievement.

Who were these people? It is hard to imagine putting together a more diverse collection of people than that which occurred over that 25 year period. The promise of a new life, with virtually free land, captured the imagination of throngs of people. Some who came from the US mid west brought some dry land farming experience. Some who came from eastern Canada may have had some farming experience, but under entirely different conditions than they would experience here. Similarly those who came from the British Isles were unprepared for the conditions they would encounter. Those who came from other parts of Europe were equally unprepared. They also had a language barrier, which must have presented a tremendous challenge.

This collection of people was thrust into circumstances for which there was no manual of instruction. Nobody had done it before. For the first few years after they settled, survival was the most immediate need. Farming methods would be developed from a combination of what they knew from other places, what they saw work or not work for their neighbor, what information they could obtain from the Experimental Farms, what various salesmen would tell them, what they were equipped to do with the resources they had, and their own ingenuity. The human factor in the evolution of the soil conservation problem cannot be overlooked.

A number of human social factors can be identified:

- Lack of any awareness that the rich soil they were farming would ever be depleted.

- A major focus was on make a living by growing a crop in an area where moisture was often the limiting factor. The practice of summerfallow to store extra moisture was a logical decision and any change in that practice was illogical.

- Social pressure to do the same as everyone else was doing. The early settlers, by necessity, had to create a closely-knit group to survive, so the pressure to conform to the social norm was very strong. This social pressure to conform has always been strong. I'm sure it has been felt by many of you in this room as you worked to change the way we were doing things.

- There is also a psychological factor. What was the image so many people had of a "good looking" field? I have often heard the statement from people driving by a nice, smooth,

black field “Isn’t that a nice job of summerfallowing or of seeding”. Indeed one of the realities a new adopter of Zero-till had to be prepared to deal with was that the crop seeded on bare summerfallow down the road will have been green for a few weeks before the zero-till crop can be seen from the nearby road.

The ability to deal with these pressures often depends on a good peer support group who share that view. This is one of the important roles organizations like the Soil Conservation Association have played by providing a network of knowledgeable professionals to provide that much needed peer support.

That same peer support was provided in the early farming days in Western Canada by the Experimental Farms and their substations. Farmers visited these stations to obtain the latest information on crops, varieties and farming practices. However, the message carried forward from Angus Mackay in the 1870’s was that summerfallow was the way to deal with the limited moisture resources found on the prairies.

Conclusion:

There is clearly no one item that caused the soil conservation problem but rather a great many interlocking circumstances that collectively brought about the situation.

- Farmers with little or no knowledge of farming and very few resources struggling to survive in this often hostile environment.

- Businesses and governments exploiting the resources of this new country.

- Tillage tool that were inappropriate and inadequate for these conditions.

- A farming system developed around a delicate moisture situation.

- Failure to understand the consequences of the system being used.

- Lack of any alternatives.

The terrible dust storms of the 1930’s were the shock wave necessary to have any effect on changing the way things were being done. Even then it would take several years before changes were possible as new machines were developed, and a new paradigm which seriously considered soil conservation as an objective, would become established. The tools and the systems we know today would take several more decades to evolve with many other stars needing to align to make it happen.