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This article is part of a series to promote better understanding of our agricultural soil resources along with practices that can influence soil health.

November, 2015

Soil health lessons from long term grazing and cropping studies

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Measurable changes to some of the important soil health indicators are gradual and the benefits from improved farming practices often show up as increased agricultural production long before they can be quantified in the soil. Fortunately we have several excellent long term grazing and cropping studies in our region, many of which are located right here in Alberta.

Long term grazing impacts on soil quality have been monitored at an Agriculture and Agri-Food Canada (AAFC) foothills native prairie site west of Stavely, Alberta within fields subjected to different cattle stocking densities dating back to 1949.[1] Soils with lighter grazing pressure had good surface litter cover, improved moisture infiltration and reduced soil erosion compared with more heavily stocked sites. By 1992, the cumulative effects of heavy and very heavy grazing had effectively transformed those field areas from a higher soil organic matter (SOM) Black to a Dark Brown and Brown soil type.

Results from long term cropping studies in the Canadian prairie region provide insights into soil changes we might expect with a change in either cropping system or rotation[2]. The University of Alberta Breton plots were started in 1929, comparing rotations and fertilizer management strategies in a Gray Wooded or Luvisolic soil type[3]. This trial has demonstrated long term improvements in things like SOM, potentially mineralizable-N (a prediction of the amount of soil N available to the following crop) and microbial biomass associated with more diverse rotations, appropriate fertilization and straw retention (versus removal through baling).

One of the many excellent long term cropping studies by AAFC is an alternative cropping systems study initiated in 1994 in a Dark Brown Soil type near Scott, Saskatchewan[4]. It compares variations in levels of chemical inputs, rotational diversity and tillage. Results have shown that that no-till improved soil structure and SOM levels compared to tillage based systems (organic or high input with tillage) with the optimum being inclusion of a short perennial forage sequence within a no-till rotation. They also found

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[1] Long-Term Grazing Study at Stavely, Alberta. H. Douwes and W. Willms. Prairie Soils and Crops Journal. Volume 5, 2012. http://prairiesoilsandcrops.ca/articles/volume-5-11-screen.pdf

[2] Case studies of soil quality in the Canadian Prairies: Long-term field experiments. C.A Campbell, H.H. Janzen. Chapter 17. Soil Quality for Crop Production and Ecosystem Health. Elsevier Science Publishers. 1997

[3] The University of Alberta Breton Plots. M.F.Dyck, J.A. Robertson and D. Puurveen. Prairie Soils and Crops Journal. Volume 5, 2012. http://prairiesoilsandcrops.ca/articles/volume-5-10-screen.pdf

[4] Alternative Cropping Systems Study – Scott, Saskatchewan. R. Lemke etal. Prairie Soils and Crops Journal. Volume 5, 2012. http://prairiesoilsandcrops.ca/articles/volume-5-8-screen.pdf

that the no-till system had a higher population of soil mites (Acarii spp), tiny creatures that inhabit the near-surface soil and feed on plant debris, having a positive impact on nutrient cycling[5].

Alberta Agriculture and Forestry initiated a long term dryland rotation study in a Brown soil type near Bow Island, Alberta in 1992.[6] Results have demonstrated the benefits of nitrogen fertilizer and compost for increasing SOM content. Amongst the many things being learned is the net nitrogen (N) benefit from including a grain pulse crop in rotation, often referred to as a pulse N-credit, estimated at over 30 pounds of actual N per year for a rotation with alternate year pulse – wheat.

Several long term irrigated cropping studies have been initiated by Agriculture and Agri-Food Canada over the years, including a 12 year irrigated crop rotation study at Vauxhall, Alberta initiated in 2000.[7] It demonstrated the benefits of several conservation practices on soil quality measures like SOM content and aggregate stability for a number of common irrigated rotations[8]. Conservation practices included things like reduced tillage, cover crops, solid seeding of beans and additions of compost.

Information learned through soil investigations from longer term grazing and cropping studies can demonstrate changes to soil health indicators that are often difficult to quantify in the short term due to the inherent natural variability of agriculture landscapes. These include measurable increases in SOM content, improvements in soil structure and enhanced soil biology that might be anticipated with farm practice changes like no-till and good grazing practices.

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[5] Biological indicators of soil health. C.E. Parkhurst etal. 1997. ISBN 0 85199 1580. CAB International, Oxford and New York, NY, U.S.A.

[6] Lessons from long-term dryland crop rotation study at Bow Island: Long-term study measures soil changes. TopCrop AgAnex, 2012
http://www.agannex.com/canada/lessons-from-long-term-dryland-crop-rotation-study-at-bow-island

[7] Irrigated crop rotation research: Findings from the Vauxhall rotation study over 12 years (2000 – 2011). F. Larney etal. http://www.demofarm.ca/ICPU_2012_pdf/Larney%20ICPU%202012.pdf

[8] Surface soil quality attributes following 12 years of conventional and conservation management on irrigated rotations in southern Alberta. L. Li etal. 2015, *Soil Science Society of America Journal, 79*(3), pp. 930-942.