



Farming Practices and Water Cycling

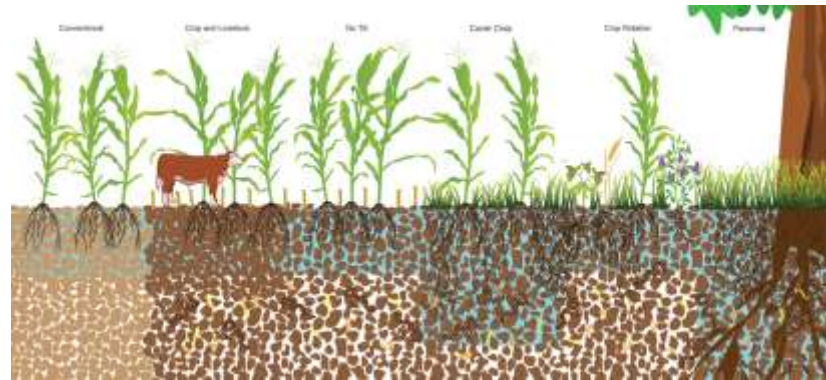
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When many parts of Manitoba go thru a dry cycle like we did in 2018 and 2019 or when downpours cause soil erosion due to run-off, we start to look at agricultural practices that help hold water, mitigate floods, reduce the effects of drought, and stabilize crop yields.

In 2019, Basche and DeLonge published a paper <https://journals.plos.org/plosone/article/authors?id=10.1371/journal.pone.0215702> that looked at the effects of five emerging ag-related practices: no-till farming, cover crops, crop rotations, perennial plantings, and cropland grazing.

The authors felt identifying agricultural practices that enhance water cycling were critical, particularly with increased rainfall variability and greater risks of droughts and floods. Soil infiltration rates offer useful insights to water cycling in farming systems because they affect both yields (through soil water availability) and other ecosystem outcomes (such as pollution reduction in waterways and flooding mitigation from runoff).

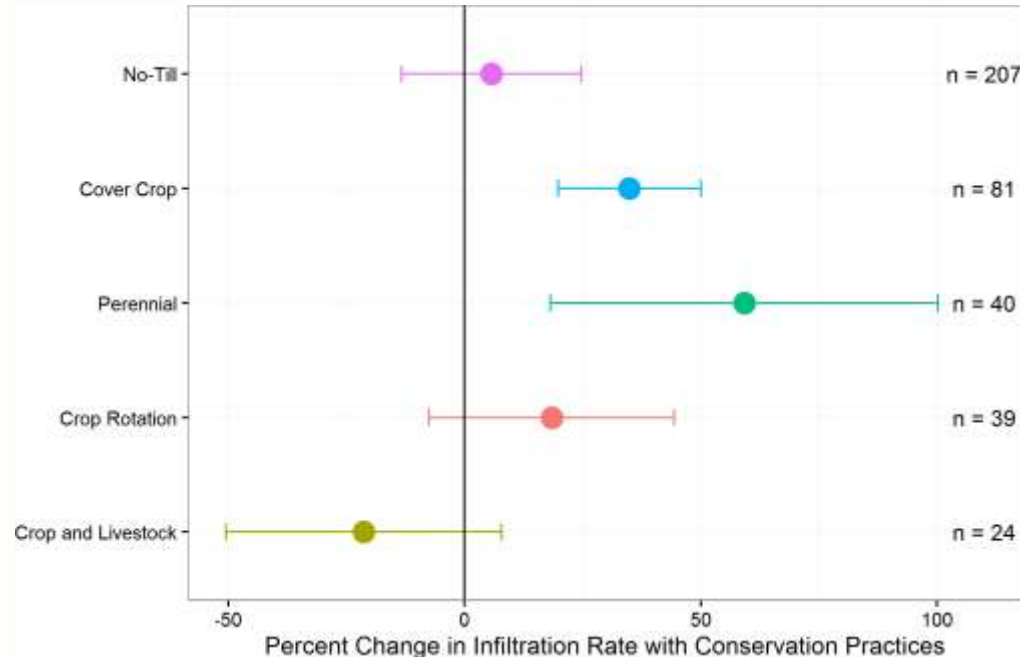
The general belief is that conventional agricultural practices that leave soils bare and vulnerable, and subject to increased degradation, can limit the capacity of soils to quickly absorb and retain water needed for crop growth. Further, it is widely assumed that farming methods such as no-till and cover crops can improve infiltration rates but the researchers felt that the affects of these practices hadn't been systematically qualified across a range of other practices.



To evaluate the impact of these practices - no-till, cover crops, crop rotation, introducing perennials, crop and livestock systems compared to conventional practices and the affect on infiltration rates - they performed a meta-analysis that included 89 studies with field trials by comparing at least one such alternative practice to conventional management.

The solution was roots. Although there were a number of ways to improve water getting into the soil, what they found to be the most consistent were the practices that offer continuous roots.

Introducing perennials (grasses, agro forestry, and managed forestry) or cover crops led to the largest increases in infiltration rates. The overall effect of no-till was not significant but the practice led to an increase in wetter climates when combined with residue retention. The effect of crop rotation on infiltration rate was not significant, but allowing livestock to graze on cropland did reduce water infiltration by an average of 21 per cent. Admittedly, the team found relatively few studies on the practice.



Their findings suggest that practices promoting ground cover and continuous roots, both of which improve soil structure, were most effective at increasing infiltration rates.

Another study - Facilitating Crop–Livestock Reintegration in the Northern Great Plains <https://dl.sciencesocieties.org/publications/aj/articles/111/5/2141> - looked beyond just water infiltration and found that ICLS (Intensive Crop Livestock Systems) practices influenced crop production primarily through impacting soil properties.

The study looked at several things:

- Grazing intensity affects soil surface exposure, sediment erosion, soil compaction ([Hubbard et al., 2004](#)), and ultimately soil organic carbon (SOC) ([Schacht and Reece, 2008](#)).
- Soil bulk density and how it may be increased when livestock graze on crop residues or cover crops ([Lennsen et al., 2013](#)), leading to soil compaction thus confirming the Basche–DeLonge study. However, in the Northern Great Plains (NGP), grazing-related soil compaction is not typical because of the annual freeze/thaw and wet/dry cycles which can reduce this risk ([Liebig et al., 2012](#)).

- Livestock waste (feces and urine) and the benefits of returning organic matter and nutrients to the soil and building soil structure ([Chang et al., 2017](#); [Haynes and Williams, 1993](#); [Soussana et al., 2004](#)).

Overall ICLSs can help increase food production while benefiting soils and the environment. Research on ICLS conducted in the NGP indicates that the crop residue grazing, swath grazing, and annual forage grazing can positively influence crop production; whereas, livestock performance varies with season, forage nutritive value, and grazing management. Furthermore, ICLS's can reduce the costs and risks of agricultural production.

Summary

As we try to open annual crops for grazing (corn and corn residue, fall rye, cereals and cover crops) we realize that there are many potential benefits, the primary benefit being that grazing annual crop residues reduces ongoing feed costs. Other benefits include improved nutrient cycling, retaining applied fertilizer and protecting SOC. Higher SOC can increase water holding capacity and soil water content.

The first report [Comparing infiltration rates in soils managed with conventional and alternative farming methods](#) downplays the practice of grazing annual forages but it does confirm the importance of cover crops and perennial forages in reducing risk factors from events such as droughts, floods and erosion. The second report [Facilitating Crop–Livestock Reintegration in the Northern Great Plains](#) points out some of the economic and environmental benefits of grazing annual forage and crop residue. By looking at the pros and cons of both reports and practices we can use that information to better manage our operations.