Manitoba Soil Fertility Facts

Prepared by: **John Heard**, Crop Nutrition Specialist, Crops Knowledge Centre,
Manitoba Agriculture, Food & Rural Initiatives,
John.Heard@gov.mb.ca Phone: (204) 745-8093; Fax: (204) 745-5690

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Don't Count on Nitrogen Credits after Soybeans in Manitoba

Corn and soybean growers in Ontario and the US Corn Belt are accustomed to reducing their corn nitrogen (N) rates when the previous crop is soybeans. Indeed, studies in the US show that when corn follows soybeans, that the corn yield is maximized at a lower rate of nitrogen than if corn followed corn. This difference in N rate is presumed to be a credit from the soybean crop, often about 20-30 lb N/ac. The case is different in Manitoba due to our more diverse cropping rotations.

Firstly, the soybean crop does not leave much nitrogen after harvest. In Manitoba studies we measured that a 46 bu/ac crop took up 199 lb N/ac in the above ground plant but that 176 lb of this was removed in the grain. In fact, residual soil N levels following soybeans are consistently lower than for most other Manitoba crops (Table 1).

Table 1. Residual soil nitrate-N following previous crops (lb N/ac) in Manitoba.

Previous crop	2011	2010	2009
	Residual soil nitrate-N lb/ac in 0-24"		
Soybeans	**31**	**26**	**32**
Corn	54	42	45
Wheat	40	34	34
Canola	40	36	35
Flax	39	34	29

Source: AgVise Laboratories, 2011

Compared to corn stover (which is the comparison made in US and Ontario studies), the amount of soybean residue is less and the C:N ratio is lower, meaning the residue does not tie up or immobilize as much nitrogen from the soil. Immobilization is that temporary loss of N to soil organisms as they work to decompose crop residues with high concentrations of carbon relative to nitrogen (a high C:N ratio).

Manitoba

Immobilization is not permanent loss of nitrogen. This nitrogen becomes available to the crop again when microbes die and decompose. If the C:N ratio is less than 20:1, mineralization or release of N occurs readily. When the C:N ratio is greater than 20:1 then immobilization or N tie up occurs in the field.

We have measured the carbon-to-nitrogen (C:N) ratio of several crops in Manitoba studies. Table 2 shows the C:N ratio and quantity of residue produced. The C: N ratio of corn is high and the residue load is about twice that of soybeans. So the N immobilization by soybeans will be less than when the previous crop is corn but perhaps not unlike that of a previously well-fertilized cereal crop.

Table 2. Typical C:N ratio and yield of crop residues in Manitoba.

Crop residue	Average C:N ratio	Typical residue amounts t/ac
Wheat straw	60:1	1-1.5
Flax straw	55:1	0.5
Corn stover	82:1	3
Sunflower stover	60:1	2
Soybean residue	65:1	1.5
Dry bean residue	34:1	0.5-1
Potato vines	31:1	1.2

Source : Manitoba Soil Fertility Guide

A tried and proven Prairie method of minimizing immobilization loss of nitrogen is through fertilizer placement. Ideally nitrogen is sub-surface banded beneath crop residue which is left on the surface or shallowly incorporated.

Nitrogen credit studies have been conducted in Manitoba using a following crop of wheat with preceding crops of flax versus pulse crops of field peas, lentils, dry beans and soybeans. Compared to the non-legume flax, the soybean crop offered a very small nitrogen replacement value. For example, the “Manitoba N Benefit” calculator at http://umanitoba.ca/outreach/naturalagriculture/articles/nbenefit.html indicates that a 50 bu/ac soybean crop only contributes 6 lb N/ac credit. If soybeans had been compared to corn instead of flax, undoubtedly the N replacement value would have been greater. The issue is that we have a much more diversified crop rotations and corn follows corn much less frequently than in the Corn Belt.

There are lots of advantages to including soybeans in your crop rotation. However, unless you are comparing to a corn-after-corn rotation, there is little nitrogen credit to be gained.

Prepared by John Heard (MAFRI)