

## Nutrient Value of Crop Residue

*John Hollinger, Organic Ag. Specialist, MAFRI*

Most discussions about the economic value of crop residues focus on the equivalent fertilizer cost of the nutrients within. Although crop residues contain both macro- and micronutrients, only values for the macronutrients nitrogen (N), phosphorus (P), potassium (K) and sulphur (S) are economically significant.

Nutrients in most crop residues are not immediately available for crop use, and their release (called mineralization) occurs over a period of years. The biological processes involved in soil nutrient cycles are complex. As a rough guide, about 10 to 15 per cent of the nutrients are released from cereal straw by the next year, and about 35 per cent from pea residues.

The speed of mineralization depends on the N and lignin (fibre) content, soil moisture, temperature, and degree of mixing with the soil. N is released fairly quickly from residues when the content is higher than 1.5 per cent N (such as in pea residues). In contrast, below 1.2 per cent N (such as cereal residue), soil available N is tied up (called immobilization) by the microbes as they decompose the residue.

Thus pea residue would have short- and long-term benefits to soil fertility, whereas cereal straw would reduce next year's soil supply of available nutrients. Over time, the nutrients tied up in soil microbes and humus are released and available to crops.

Nutrients from residues are not fully recovered by crops. Just like fertilizer nutrients, nutrients released from crop residues into the soil are susceptible to losses such as leaching (N and S), denitrification (N), immobilization (N, P, K and S), and fixation (P and K).

The efficiency of nutrient uptake by crops from fertilizers or residue release is generally thought to be similar (for example, about 50 per cent recovery of N in the above-ground plant in the first year). There is some residual benefit of fertilizers a small amount of the nutrients are taken up by crops two and three years later. Fertilizer placement can significantly affect the efficiency of crop uptake. The impact of residue placement (buried by tillage or left on the surface in zero tillage) on nutrient cycling and efficiency is under study.

Thus the practice of calculating the fertilizer equivalent value of the nutrients in crop residue is a reasonable guide to estimating the partial value of crop residues. Tables 4 and 5 provide average nutrient values for the major crop residues.

**Remember that there is a wide range in actual nutrient contents, and thus samples should be analyzed for more accuracy.** For example, well fertilized crops have much higher nutrient contents in the straw than poorly fertilized crops.

**Table 4. Average nutrient contents in straw\***

<b>Crop straw</b>	<b>lb N/ton</b>	<b>lb P<sub>2</sub>O<sub>5</sub>/ton</b>	<b>lb K<sub>2</sub>O/ton</b>	<b>lb S/ton</b>	<b>Total \$/ton**</b>
Wheat	12	3.7	30	2.8	29.22
Barley	15	4.1	41	2.8	37.25
Oats	14	4.1	43	3.4	37.25
Peas	24	4.6	30	5	42.62

\* straw with 10 per cent moisture

\*\* based on fertilizer prices of \$0.99/lb N; \$1.10/lb P<sub>2</sub>O<sub>5</sub>; \$0.42/lb K<sub>2</sub>O; and \$0.24/lb S.

**Table 5. Average nutrient contents in chaff\***

<b>Crop chaff</b>	<b>lb N/ton</b>	<b>lb P<sub>2</sub>O<sub>5</sub>/ton</b>	<b>lb K<sub>2</sub>O/ton</b>	<b>lb S/ton</b>	<b>Total \$/ton**</b>
Wheat	18	4.6	24	3.6	33.82
Barley	20	6	36	3.6	42.38
Oats	20	4.6	36	4	40.94
Peas	34	10.6	24	5	56.50

\* chaff with 10 per cent moisture and not excessive weed seed

\*\* based on fertilizer prices of \$0.99/lb N; \$1.10/lb P<sub>2</sub>O<sub>5</sub>; \$0.42/lb K<sub>2</sub>O; and \$0.24/lb S.