AGRONOMY

Estimating Nutrient Availability from a Cover Crop Biomass Report

The largest nutrient impact that a cover crop makes to the following crop is the release of nitrogen. How quickly the cover crop residue decomposes and when the nitrogen in that residue becomes available to the crop depends on some characteristics of the cover crop including species, biomass accumulation, growth stage at termination and the carbon to nitrogen ratio of the residue. It is also influenced by soil moisture, temperature, rainfall and contact with the soil.

A cover crop that is a legume, or mixture that is mostly legumes will capture nitrogen from the atmosphere, adding it to the soil as a nitrogen credit during decomposition. If the cover crop is primarily grass, such as oats or rye grass, or brassicas, such as turnips or radishes, the nitrogen that was in the soil when the cover was planted will be returned to the soil as the cover crop residue decomposes. But in the short term this nitrogen may be unavailable to other crops.

AgSource's cover crop biomass report provides the information you need to understand when and how much nitrogen will be available. By measuring the biomass accumulation, nitrogen content and carbon to nitrogen ratio (C:N ratio) we can judge whether the biomass will provide nitrogen to the following crop right away or if it might become nitrogen deficient during its early growth stages. If the cover crop C:N ratio is low, <15:1, the residue will decompose more easily and release nitrogen to the crop. If the C:N ratio is high, > 20:1, then the micro-organisms decomposing the residue will compete with the crop for the available nitrogen.

Estimating Plant Available Nitrogen

Legume cover crops have a low C:N ratio and they continue to accumulate nitrogen through their vegetative and flowering growth stages. Grasses accumulate N in the early vegetative stage but once they enter reproductive growth stages, along with stem elongation, the C:N ratio increases rapidly. The table below shows simple calculations to use to estimate the plant available nitrogen (PAN) that can be anticipated in the first 4 weeks after cover crop termination (short term), and how much will be available over the growing season. Multiply the total nitrogen, expressed in lbs/acre, times the appropriate factor as shown.

Table 1. Estimating Plant Available Nitrogen from Cover Crop Biomass

C:N	Short term PAN, lbs/ac	Seasonal PAN, lbs/ac
>22:1	(N, lbs/ac) * -0.5	(N, lbs/ac) * 0.3
22:1 – 20:1	(N, lbs/ac) * -0.1	(N, lbs/ac) * 0.4
20:1 – 15:1	(N, lbs/ac) * 0.25	(N, lbs/ac) * 0.5
15:1 – 12:1	(N, lbs/ac) * 0.5	(N, lbs/ac) * 0.5
<12:1	(N, lbs/ac) * 0.6	(N, lbs/ac) * 0.6

If the short-term PAN is estimated to be negative or near zero it is being 'immobilized' during the decomposition process. In this case a starter fertilizer application of 30 – 40 lbs of nitrogen is necessary to overcome the projected deficiency.

Estimating Phosphorus and Potassium Availability

The other major nutrients that cover crops contribute to the following crop are phosphorus and potassium. The phosphorus that is part of the plant residue is released in the decomposition process like the nitrogen is released. In the short term if the decomposition is slow because of low nitrogen the release of phosphorus will also be slow. In the cropping season up to one half of the phosphorus content will become available to the crop. See the estimation table below.

Table 2. Estimating Phosphorus Availability from Cover Crop Biomass

C:N	Seasonal P_2O_5
>20:1	(P_2O_5, lbs/ac) * 0.3
<20:1	(P_2O_5, lbs/ac) * 0.5

Potassium is less dependent on decomposition of the plant residue because it can be leached from the stalks and stems of the cover crop biomass. Therefore, most of the potassium can be credited to the following crop as illustrated in the table below.

Table 3. Estimating Potassium Availability from Cover Crop Biomass

C:N	Seasonal K_2O
>20:1	(K_2O, lbs/ac) * 0.6
<20:1	(K_2O, lbs/ac) * 0.8

All the nutrients discussed, as well as the minor and micronutrient content of the biomass will be released as it decomposes. During the first four weeks this decomposition and release is the most rapid. Also some of the carbon in the residue will become part of the organic matter in the soil which will have long term positive implications for nutrient and moisture availability.