

Growing ryegrass in soil samples can be a useful measure of soil nitrogen availability

What is this research about?

Switching from conventional farmland to organic farmland typically takes 36 months, during which soil fertility must be managed without chemical fertilizers. Although several nutrients are necessary for plant growth, nitrogen (in a form plants can use) is especially important and often lacking in agricultural soils.

There are several ways to increase soil nitrogen. First, farmers can alternate “forage” plants with cash crops (for example, potatoes or wheat), typically for one or two years out of every four. Forage plants are often legumes, which can make their own nitrogen using bacteria on their roots. There are also organic fertilizers, such as composted animal manure and ground up legumes, which can be added to the fields.

Whichever method they choose, it is important that farmers accurately measure and monitor the amount of nitrogen in the soil. Nitrogen exists in several forms, not all of which plants can use, so a good measure will only consider the nitrogen that is available to plants.

What you need to know:

Several different farming systems can be used to successfully transition conventional farmland to organic farmland. Measuring the nitrogen uptake of ryegrass grown on sample soil can provide a reliable and accurate estimate of nitrogen availability over the entire growing season.

How can you use this research?

Organic farmers can use this research to choose more effective farming systems during the transition from conventional to organic farming.

Soil scientists can use this research to better measure the amount of plant-available nitrogen in soil.

Keywords:

Farming system, organic farming, soil nitrogen, forage, crop rotation, animal manure, legume.

What did the researchers find?

Total soil nitrogen at the end of the transition period was not affected by the farming system used. Overall, the six treatments increased total soil nitrogen by 23% over three years. No difference in mineral soil nitrogen was found between the farming systems when using the potassium chloride test. The nitrogen content in ryegrass, however, was much lower in the 2-year legume-based system than in the other systems. The ryegrass content test produced the most reasonable estimate of available nitrogen over the growing season, while the leaching method overestimated. Potassium chloride extraction only measured available nitrogen at a single point in time.

Based on the ryegrass test results, all 6 farming systems provided the soil with enough useable nitrogen for an organic potato crop to be grown at the end of the 36 month transition period.

What did the researchers do?

Six different sample plots were created on long-term pasture and followed for four years. The fertilizer used was either legume-based (alfalfa meal) or manure-based (composted beef manure), and forage (red clover and timothy grass) was planted either zero, one, or two times in the two middle years. Soil samples were taken from each plot before the experiment and after harvest each fall.

Different forms of nitrogen were measured using several different soil sample tests including: removal with potassium chloride, leaching of heated soil, and measuring nitrogen content in ryegrass grown on soil samples.

About the University of Guelph researcher:

Ralph Martin is a Professor and the Loblaw Chair in Sustainable Food Production in the Department of Plant Agriculture, at the University of Guelph. Email: rcmartin@uoguelph.ca.

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