602 Dude, Where's my Nitrogen?

#RealisticRegenAg | Nitrogen is a challenging nutrient to rely on. In wet climates, it can easily leach deep into the soil. If tile drains are present, it can even run off into ditches and water bodies. In dry climates, nitrogen usually cannot be lost to depth, but it can become tied up in residue and may not be released until well after the crop needs it. For this month's regenerative agriculture news, I have selected articles that specifically address finding and retaining nitrogen in place.

Welcome to the sixth season of Plants Dig Soil, a podcast about #RealisticRegenAg. I'm your host, Scott Gillespie, and I'm an agronomist from the western Canadian prairies specializing in climate-smart agriculture. I discuss scientifically proven practices that benefit the planet and, just as importantly, farmers' economic sustainability. Be sure to visit my website, www.plantsdigsoil.com, for resources and information about the services I that I offer for farmers and agribusiness.

Articles mentioned:
https://www.covercropstrategies.com/articles/3025-podcast-can-we-count-the-nitrogen-credits-of-cover-crops-for-the-following-cash-crop
https://fieldcropnews.com/2023/06/when-do-cover-crops-with-and-without-manure-applied-release-nitrogen-that-can-be-used-for-my-corn-crop/
https://acsess.onlinelibrary.wiley.com/doi/10.1002/crso.20334

Transcript is available:
https://www.plantsdigsoil.com/podcast/dude-wheres-my-nitrogen

Realistic Regen Ag Channel (WhatsApp):
https://whatsapp.com/channel/0029VaBofw37NoZxtgHSRl3S

My consulting packages:
https://www.plantsdigsoil.com/pricing/#consulting

Speaking, Teaching, & Workshop Design:
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My funding service offerings:
https://www.plantsdigsoil.com/pricing/#paperwork
SCAP overview: https://youtu.be/0icitHJR2lk
SCAP program details https://www.alberta.ca/sustainable-cap.aspx

My course: Profitable From the Start: Cover Crops for the Prairies:
https://plantsdigsoil.thinkific.com/courses/cover-crops-prairies

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Let's begin with a podcast episode on Cover Crop Strategies with Dr. Marisol Berti from North Dakota State University. Her work focuses on determining when nitrogen is available from cover crops. Although North Dakota is warmer than Alberta, it still experiences cold spring temperatures. When it's cold and there is residue on the surface, nitrogen becomes locked up. Some nitrogen might be released through frost killing. The problem with this is that if the ground is frozen this nitrogen is at risk of being carried away from the field by water flow.

Dr. Berti discovered that fall rye and winter camelia, both winter-surviving plants, decreased corn yield. It's possible that they didn't release nitrogen in time, or they used too much water, or it could be a combination of both factors. Fall rye, also known as cereal rye in the United States, can be successful in high rainfall areas with mild winters like Indiana, Ohio, and Pennsylvania. It can make spring planting easier by reducing moisture. Additionally, it retains a significant amount of nitrogen that might otherwise be lost through deep percolation. In warm and wet climates, the residues break down, releasing nitrogen in time for the corn crop. However, in colder climates with less moisture, fall rye can be detrimental.

Dr. Berti's advice is to conduct rate trials for nitrogen every time you plant, as it is difficult to predict accurately. With modern equipment, setting up test strips in advance can be done in the office prior to seeding, or the operator can override and create a few strips. Conducting tests with lower and higher rates allows you to observe and be prepared to add more if necessary.

This may sound simple, but it is challenging to implement. For most crops, there is a narrow window of opportunity to correct nitrogen deficiencies, and the symptoms often don't appear in time. In cereal crops such as wheat, barley, or oats, 70% of nitrogen uptake occurs when the plants are only 6-12" tall. If there is a 10-20% nitrogen shortage, it may not become apparent until this stage or later. Shortly after this stage, stem elongation occurs, and the head is already formed, with the maximum yield determined by the number of potential grain kernels.

I have seen countless trials over the years that demonstrate the inefficiency of split applications in cereals in the Prairies. While they may work for corn and other longer-season crops like potatoes, cereals grow too rapidly, leaving insufficient time for split applications to be practical in most cases.

As mentioned earlier, cover crops can be effective in wetter climates, such as the states south of the Great Lakes. North of Lake Erie in southern Ontario, Canada, where I grew up, research is being conducted on the same question explored by Dr. Berti in North Dakota: how do we determine when nitrogen will become available? They have examined adding nitrogen to cover crops or incorporating manure application into cover crop systems, but clear rules have yet to be established.

Some guidelines they have found indicate that the more mature the cover crop, the later nitrogen can be expected. This makes sense since crops with hard stems are more resistant to breakdown. If they have flowered and are setting seed, more nitrogen is tied up. Allowing them to reach mature seed poses another problem: not only is the nitrogen tied up in the seed, but a massive seed bank of volunteer cover crops can quickly turn into weeds.

The concept behind adding nitrogen is to lower the C:N ratio. When carbon levels are high, microbes rapidly deplete the available nitrogen, which not only reduces soil nitrogen but can also lead to the breakdown of stable organic matter that we want to preserve. By adding urea fertilizer or manure to the cover crop, it can promote more crop growth and leave behind excess nitrogen to sustain the breakdown process.

The authors have an excellent chart that shows the difference between cover crop species and nitrogen interactions. Red clover gives the best nitrogen release right in time for corn. This has been known by farmers for centuries and it was taught to me twenty-five years ago while attending the University of Guelph. However, establishing red clover can be challenging. The ideal scenario is frost seeding it in winter wheat by spreading the seeds on frozen ground around spring thaw. If conditions are just right, the freeze/thaw cycle pulls the seeds into the ground. Red clover grows under the wheat canopy and experiences rapid growth after harvest. Unfortunately, these ideal conditions are seldom met.

Radish provides a quick release of nitrogen, but it occurs too early for the corn crop. Spring cereals planted in the fall and terminated in winter provide slightly better results. Cereal rye, or fall rye, that survives the winter takes nitrogen from the system and gives some in late summer, but too late for the corn. Remember that you can't just take the chart at face value. These are average curves, but nothing ever works out on average. Unfortunately, right now there just isn't a reliable way to know when the nitrogen will be there for you.

I'm going to finish with an article that is in the latest edition of Crops & Soils, a magazine for Certified Crop Advisors. I get it for free, but it is behind a paywall so unfortunately, you'd need to pay to access. I'll still give a summary of the work.

In the Pacific Northwest of the United States a common practice is to grow winter wheat and then leave a fallow period for a year without a crop to build up soil water and nitrogen. This does work, but only about 30% of the water that falls as rain ends up going through the plant. When it evaporates it can bring up salts. Additionally, when the microbes don't have plants putting sugars into the soil, they tend to break down the stabile organic matter.

Here's the big idea: Why not run some of that water through a plant? As long as you don't use more than is normally lost to evaporation you are ahead. The microbes are fed and, if you use a legume, it can

add some nitrogen into the system. The researchers added a winter pea crop to the rotation that was terminated after flowering and before pods formed. In the first few years there was some gain to the winter wheat, but not a lot. However, over the years the yield increased. After 10 years they can now attain the same yield of winter wheat at half the nitrogen rate.

The takeaway from this for me is that it is worth putting the effort into cover crops. They will pay in the long term. The great challenge is: How do we make them pay in the short term? Or in the very least, not cost us money to use them?

Thanks for listening. The links to all these articles will be in the description. While you're looking there don't forget to check out the links to my services, the Realistic Regen Ag community on WhatsApp, and details on the book I'm in the process of getting published. Talk to you again next episode.