# Cycling Nutrients On-Farm with Integrated Chickens and Cover Crops

## Lessons From a Season of Farmer-led Research

**By Sarah Larsen**

Shiying Lu is passionate about incorporating livestock into her vegetable rotation at Brilliant Meadows, a 48-acre farm within the rolling hills of the Niagara Escarpment. Since 2022, she's grown on this land with her partner, Jason, and her family to produce pasture-raised meats and organically grown Chinese diaspora vegetables.

From the start, Shiying had a three year garden rotation—two years of vegetables with one year cover crops—and soon wanted to incorporate livestock. In her second season, she worked in cooperation with the County of Wellington's Experimental Acres program to explore the effects of grazing meat chickens on the cover crop.

"Through that experience I was able to observe that the chickens did better on cover crop than pasture. They seemed to consume more forage and better finishing weights with the same amount of feed consumed," reflects Shiying. "I felt that this was a practice that I would continue with in my garden rotation, but I was also curious to learn more about the effects of the chickens on the soil in the garden."

"I decided to apply to EFAO's research program," she continues, "and I remember asking questions in my proposal like, 'How much fertility are the chickens adding? Is it staying in the soil/being taken up by the cover crops? Should I be worried about leaching out of the soil?'" While there are many academic papers on nutrient cycling that provide information and insight into these questions, Shiying wanted to demonstrate the concepts and find the answers for her farm and her system.

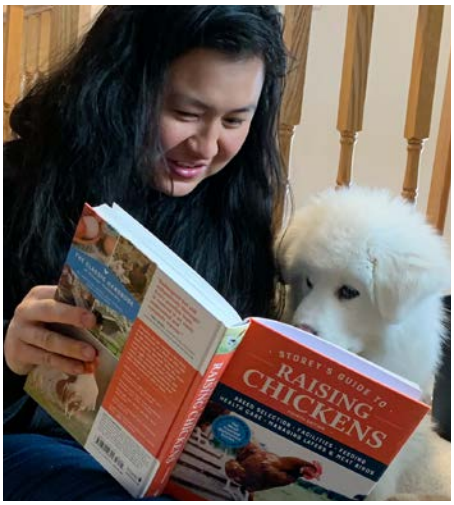


To dig a little deeper on feedbacks between cover crops, grazing meat chickens and soil, Shiying and I designed a farmer-led research trial. As a framework to explore these feedbacks, we developed a sampling scheme based on Jesse Way and Meghan Brandenburg's farmer-research projects on plant available nitrogen from cover crops.

"In the garden space that had been dedicated to a rotation year of cover crops in 2024," explains Shiying, "I seeded cover crops on May 12th with a mix of 50% of a blend that was mostly oats and peas and 50% of a blend from Speare Seeds of oats, forage peas, crimson clover, fragiblaster radish, sorghum sudangrass, sunflowers and phacelia."

"I then divided the area into four lanes. Each lane had enough room for seven moves of 150 meat chickens in our one 13' x 16' Cackellac," she says. "I also fit in one extra day at the beginning and end of their time on pasture, for a total of 30 daily moves on the cover cropped field—just enough time for our grow-out period."

Because she is curious about the effect of chicken manure on nutrient cycles in the soil, Shiying decided to standardize manure deposition by moving chickens based on feed consumption. "This meant I moved chickens more frequently as








they got bigger and ate more," says Shiying. This suggestion from Shiying for standardization is a great example of the type of research improvement that puts the 'farmer-led' in research and keeps it focused on practical results.

Throughout the grow-out period, Shiying took cover crop biomass samples before the chickens entered a lane (akin to taking a biomass sample at cover crop "termination") and soil nitrate measurements before and after chickens entered each lane. Above ground, she observed that the carbon-to-nitrogen ratio (C:N) and percent nitrogen (%N) in cover crop biomass changed noticeably over the season. As the cover crop aged, its C:N ratio increased while tissue nitrogen content declined.

While this trend is what we expected, it is important because it indicates a reduced availability of plant-accessible nitrogen as the crop matures. The same concept applies to cover crop termination and nitrogen benefits for subsequent cash crops.

For Shiying, these results remind her that "timing cover crop grazing is important when it comes to forage quality for the chickens."

A main motivation of Shiying's was to measure the nitrogen impact of the chickens, so she could have a better sense of how they might affect nutrient cycling. "We want their manure in the system," she explains, "but don't want to overload the system with nitrogen to the point that it leaches."

Below ground, soil nitrate levels were consistent across the site before the chickens entered a grazing lane. After chickens exited a lane, however, soil nitrates nearly doubled in grazed areas compared to non-grazed zones. This confirms that chicken manure contributed an increase in nitrogen to the system. Interestingly, we saw that nitrate levels remained below 10 ppm, which suggests a relatively low leaching risk, at least at the time of sampling.

Because leaching could still be a risk as the manure decomposes, Shiying reseeded with cover crops on September 9th, and resampled for soil nitrate ten weeks later in early November before freeze-up. Before re-seeding, soil nitrate levels ranged from 1-19 ppm, depending on the time since the chickens exited the lane. After re-seeding, soil nitrate was back down to 4 ppm across all lanes.

Reflecting on the trial, Shiying was pleased to see that "soil nitrate levels right after the chickens left were around the same, which means that moving the chickens based on their feed consumption worked well to distribute fertility more evenly across the garden!'

"This trial also drove home the importance of post-grazing reseeding to capture any extra nitrogen added by the chickens and keep it on in the soil," she concludes. "Looking in a detailed way at soil nitrate also makes me think that overwintering cover crops may be a better fit to provide early forage for chickens while protecting soil over the winter."

When I asked Shiying about the garden areas she grazed in 2023, she was happy to report that these areas performed exceptionally well. "Crops such as Asian greens, corn, squash, cucumbers, bitter melon, tomatoes, sweet potatoes, peppers, eggplants and potatoes thrived," observed Shiying. "I also saw strong fertility, reduced weed pressure, and notably low pest levels, including minimal Colorado potato beetle activity. Whether these benefits were direct results of the integrated system or coincidental, we are pleased with this system so far."

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To read more about this study, including a full analysis of the data, look for Shiying's research reports this fall! ■

*Sarah Larsen is EFAO's Research and Small Grains Program Director. She holds a PhD in Soil Ecology. Through her work with EFAO, she supports farmer-researchers across Ontario to design and implement farmer-led research projects that not only satisfy their curiosities about how on-farm practices impact both the soil and the bottom line, but that help to provide evidence-based results on which to make decisions. Sarah lives on a farm near Aylmer, Ontario with her husband and daughter, where they tend 50 acres of diversified perennials and a menagerie of grazers, and build ponds and wetlands.*