Measuring N in Cover Crops

Western SARE

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Situation and Objective

In many farming systems cover crops have the potential to produce enough nitrogen (N) for crop production and enough dry matter to increase soil organic matter. Optimizing the potential of these on-farm resources will increase the efficiency and competitiveness of farms that also rely on purchased N and dry matter sources.

Nitrogen contributions from cover crops vary widely. Farmers in the Pacific Northwest currently disregard N contributions of cover crops or use very rough rule of thumb estimates. Growers need an efficient and reliable method to estimate cover crop N when determining fertilizer rates. The extension literature includes descriptions of various on-farm estimation methods, but these methods have not previously been compared.

Our team included five farmers who determined our project objectives, chose cover crop species and hosted the trials. We compared practical on-farm techniques for estimating cover crop N with a standard research method.

Methods

- All collaborators met to review proposed testing methods, select cover crops and plan on-farm trials. Paired farms were seeded with the same cover crop treatments.
- Cover crop total N was measured using the standard laboratory method and each on-farm method under evaluation.
- Results using each method were compared with results from the standard laboratory method using regression analysis.
- Plant-available N (PAN) was estimated using an

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Professional + Producer Grant

Title: Estimating Nitrogen from Cover Crops

Project Number: FW06-301

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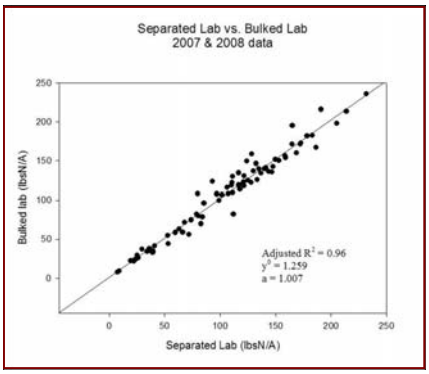
Amount Funded: $19,325

A 20" tall cereal rye, common vetch and field pea stand providing an estimated 155 lbs total N and 50 lbs plant-available N.



Comparison of separated species and bulk species lab methods for estimating cover crop total N.

Measuring N in Cover Crops

OSU mineralization model (http://small-farms.oregonstate.edu/organic-fertilizer-calculator) and PAN estimates from the most promising on-farm method were compared with PAN estimates from the standard laboratory method using regression analysis.

Cover crops and testing methods:

The cover crops used for comparing the sampling methods included: crimson clover (all farms); cereal rye, common vetch and Austrian field peas (2 farms); Walken oats, common vetch and Austrian field peas (2 farms); Walken oata and common vetch (2 farms); Walken oats and crimson clover (2 farms); cereal rye and Austrian field peas; cereal rye (1 farm) and common vetch (1 farm).

We compared all on-farm methods to results from above-ground cover crop samples that were separated by species and analyzed in the laboratory for total C and N (separated species lab method). On-farm methods from the extension literature included:

- Bulk lab method: single lab analysis of above-ground samples of all species not separated
- Fresh weight method: fresh weight of each species is multiplied by a factor for average N content
- Dry weight method: dry weight of each species is multiplied by a factor for average N content
- Canopy method: canopy height and density are used to estimate the cover crop N

Results

Regression analysis showed that the bulked species lab method gave very similar results to the separated species lab method (figure on first page). Further analysis using an OSU mineralization model showed that PAN estimates were also very similar between the bulked species and separated species lab methods. The bulked species method saves growers a lot of sampling time while still providing a good estimate of N content.

Nick Andrews demonstrates cover crop sampling at a project field day.

Average N content values used in the fresh weight method were adjusted with our data, and values used in the dry weight method were developed from our data. Comparisons between the fresh weight method and separated species method were strong (Adjusted R2 = 0.906, y0 = -0.086, slope = 0.993). Results using the dry weight method were also similar (Adjusted R2 = 0.932, y0 = -2.011, slope = 1.137). However, both of these methods required farmers to separate cover crop species, and participating farmers felt this was impractical during the spring for the dry weight method. Results from the canopy method were different from the separated species lab method (Adjusted R2 = 0.592, y0 = 61.963, slope = 0.905).

Impacts and Benefits

The bulked species lab method has proved to be an efficient and reliable technique for estimating total N and PAN contributions from cover crops. The fresh weight and dry weight methods are useful if labs are unavailable, but they require separating individual cover crop species.

This work helps growers realize the benefits of cover crops. Organic farmers currently spend approximately $4.00 per pound for PAN from fertilizers allowed for use on organic farms. Assuming a cover crop provides 50 lbs PAN, cover crop PAN can be estimated to cost approximately $0.80 per pound. We have been able to demonstrate a practical method for estimating cover crop N content that could save growers up to $160/acre on fertilizer costs.

An understanding of the financial benefits of cover crops can help farmers justify the management time and effort that effective cover cropping requires. Improved cover cropping practices and increased use of cover crops will also increase organic matter content in agricultural soils and reduce erosion. In some cases, pest management and crop pollination may also be improved by enhanced use of cover crops.

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