Southern Cover Crops
2016 CONFERENCE FACT SHEET

Cover Crop N Availability Calculator—Field Demo

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Fig. 1. Corn managed using the Cover Crop N Availability Calculator at the Southern Region Cover Crop Field Day. Photo Roger Winstead

Many farmers use legume cover crops or cover crop mixtures to supply nitrogen for their cash crops; however, they often do not know how much nitrogen (N) might be released or immobilized by these cover crops. Better tools to predict the amount of N released by cover crops will aid organic as well as conventional farmers and should encourage the use of cover crops to preserve and increase soil quality. Scientists at the University of Georgia College of Agricultural and Environmental Sciences have developed the *Cover Crop Nitrogen Availability Calculator* to predict the amount of available N that could be expected from a cover crop. The tool is based on the N subroutine of the Crop Environment Resource Synthesis (CERES-N) model, which is a well-known crop model that simulates crop growth, soil water and temperature, as well as soil N dynamics at the field scale over a growing season. The CERES-N subroutine can successfully predict N mineralized from cover crop residues that are incorporated or left on the soil surface. The Calculator uses analysis of cover crop quality together with cover crop biomass measurements and nearby weather station data for soil temperature and soil moisture to predict the timing and amount of N mineralized. Cover crop quality (total N, carbohydrates, cellulose and lignin) is measured by Near Infrared Spectroscopy (NIRS). Until recently, these data were too costly and time-consuming to obtain routinely. The development of NIRS makes determination of these parameters in the cover crop quick and relatively low-cost.

The Calculator predicts a cumulative amount of available N from the cover crop. This can be positive (N credit) or negative (N debit). The Calculator has been field-tested with summer cover crops (cowpeas and sunnhemp) followed by fall broccoli, heavy rye residue followed by no-till soybeans, white oats followed by cotton, and black-seeded oats/crimson clover followed by organic grain corn in Georgia. These results from the Georgia tests indicate farmers can expect similar yields to their standard N fertilization practices when using the Calculator results to adjust their N fertilization based on the amount of N released from the cover crop.

Field Demonstration

The demonstration used the Cover Crop N Availability Calculator to manage the N fertilizer in plots at the Center for Environmental Farming Systems where the Southern Cover Crop Conference was held. We compared leaf chlorophyll of grain corn at tasseling in the no-cover plot with that from plots with a crimson clover (*Trifolium incarnatum* "AU Robin"), black-seeded oats (*Avena sativa* "Cosaque") or a crimson clover/black-seeded oats mixture. Chlorophyll was used as an index of the N content of the corn, because the field day was held well before harvest. If the Calculator was working as intended, the chlorophyll content should be similar in the no cover crop plots with full N fertilizer and the cover crop plots with N fertilizer modified by the Calculator results.

Cover crops were planted the week of September 28, 2015, which is within the recommended planting dates for the Coastal Plain to maximize biomass. Planting in late September to early October is particularly important for getting a good crimson clover stand. Samples of the cover crop were collected on March 21 and April 5, 2016, biomass was measured, and subsamples were sent to the Agricultural and Environmental Services Laboratories for NIRS analysis. Cover crop biomass changes rapidly in the spring, so biomass nearly doubled between March 21 and April 5th (Fig. 2A and 2B). Because the amount of N in the cover crop is a function of N concentration and biomass, the available N also doubled during this time (Table 1). The Calculator was used to predict available N from the April 5 sampling dates for the different demonstration plots (Table 1). Corn was no-till planted April 19 with a target N fertilizer rate of 120 lbs N/ac.

Fig. 2A. Crimson clover and black-seeded oats cover crop mixture growth on March 21, 2016. Biomass was 3,465 lbs/ac. Photo by Sarah Seehaver

Fig. 2B. Crimson clover and black-seeded oats cover crop mixture growth on April 5, 2016. Biomass was 6,347 lbs/ac. Photo by Sarah Seehaver

The corn in all plots was fertilized at planting with 53 lbs N/ac and typically would receive an additional 67 lbs N/ac at sidedress for 100 bu/ac yield goal (dryland). The Calculator indicated the clover and oats/crimson clover mix would supply enough available N so that sidedress N was not needed (Table 1). Figure 3 shows the Calculator results for crimson clover.

Lab: **10153**
Julia Gaskin/Katie Chatham

Sample ID: **705-Clover**

Average of 5 years

Tuesdays		Nitrogen pounds per acre
Day	Date	Cover Crop
8	04/12/2016	26
22	04/26/2016	60
36	05/10/2016	85
50	05/24/2016	98
64	06/07/2016	106
78	06/21/2016	112
92	07/05/2016	114

The Nitrogen (N) reported above from cover crop decomposition is considered a N credit (if positive) or debit (if negative). The amount of N recommended by a routine soil test may be reduced by the N credit or increased by a debit.

Example for credit:

Recommended N = 150 lbs/Ac
Cover Crop N = 50 lbs/Ac
Recommended after credit: 150 - 50 = 100 lb N/Ac

Example for debit:

Recommended N = 150 lbs/Ac
Cover Crop N = -50 lbs/Ac
Recommended after debit: 150 + 50 = 200 lb N/Ac

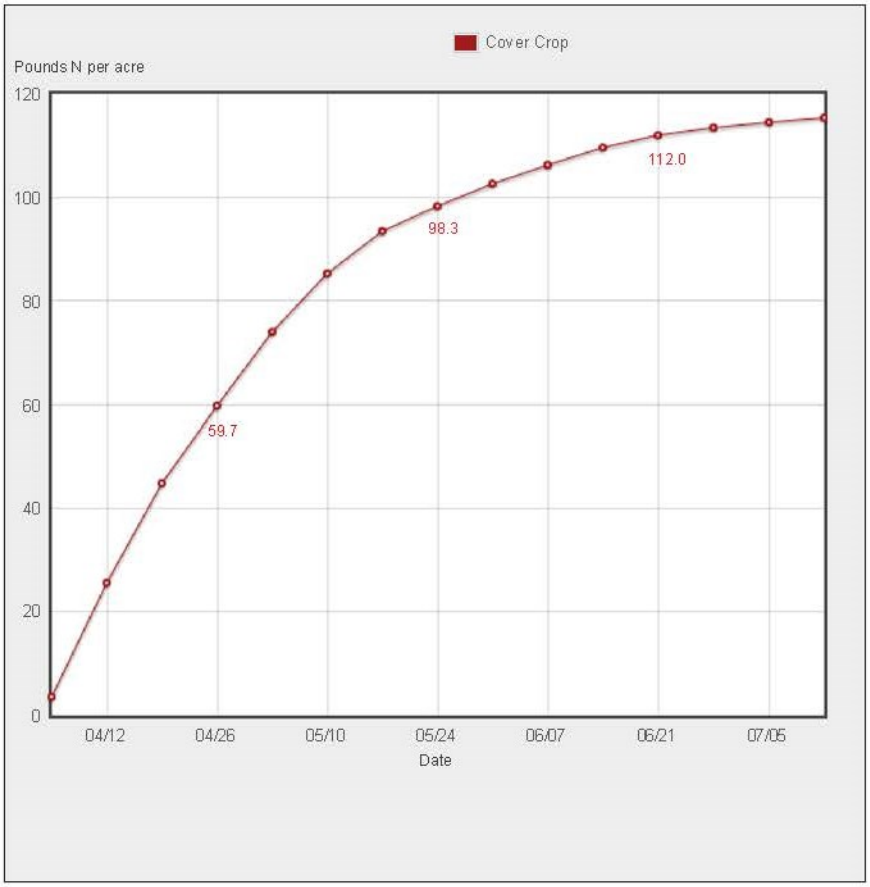

Fig. 3. Results of the Cover Crop Nitrogen Availability Calculator for the crimson clover cover crop at the Southern Cover Crop Conference field demonstration site.

TABLE 1. A summary of key information for the field demonstration at the Southern Cover Crop Conference.

Cover Crop	Seeding Rate (lbs/ac)	Predicted Available N (lbs/ac)	N Fertilizer Application (lbs/ac)		Corn Leaf-Chlorophyll (SPAD units)	Relative Chlorophyll in Corn Leaves
			Planting	Sidedress		
None	0	0	53	67	52.0	
Crimson clover	20	114	53	0	53.3	1.03
Black-seeded oats	100	17	53	67	51.6	0.99
Crimson clover/ black-seeded oats	12/60	90	53	0	50.4	0.97

Chlorophyll was measured on June 19 (Table 1). The relative chlorophyll (cover crop treatment/no cover crop treatment) was similar in the demonstration plots indicating the Calculator-based N management was effective in supplying enough N to this point in corn development.

The Calculator has potential to help farmers better manage their N fertilizer in conjunction with cover crops. There is a University of Georgia Extension bulletin available on how to take a representative cover crop biomass sample and subsample for NIRS analysis:

Cover Crop Biomass Sampling (C1077) - http://extension.uga.edu/publications/detail.cfm?number=C1077

Predicting Nitrogen Release from Cover Crops: The Cover Crop Nitrogen Availability Calculator is a new bulletin on the Calculator and will be available soon at: http://extension.uga.edu/publications/

Sample submission forms can be found at: http://aesl.ces.uga.edu/forms/. Users from outside of Georgia may need to supply data on soil temperature and moisture.

Fig. 4. Corn from the demonstration plots at the Southern Cover Crop Conference. Photo Roger Winstead

Acknowledgements

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