



Nitrogen Credits from Red Clover as Cover Crop between Small Grains and Corn

Introduction

Red clover interseeded into or with a small grain crop can be an excellent source of nitrogen (N) for corn in organic and conventional cropping systems. This fact sheet provides guidance on growing red clover for N credits in small grain before corn in rotations.

Seeding Window, Rate and Method

The typical seeding window for red clover in New York (NY) is February 1 through June 15th. Early seedings usually result in stronger stands. Recommended seeding rate is 7-9 lbs/acre. Clover is well suited to frost-seeding in early spring conditions when cold nights cause the soil to “honeycomb” providing crevices that cradle the small seeds that are covered as the soil settles with warmer daytime temperatures. For winter grains, clover seed can be sown by a spin-type broadcast applicator. Drilling will potentially damage the winter grain. In spring grains, either spin on the clover seed before or after drilling the grain, or by using the grass seed box on the drill if one is available.

Fertility and Crop Management

While tolerant of pH below 6.0, the optimal pH for clover is 6.2, similar to forage grasses, corn and many small grains. If the pH of the soil is less than 6.0, liming is recommended for the greatest production of clover biomass. Use soil test results to determine P and K needs of the clover. It is recommended to mow the clover stand at 4-5 inches height in early to late August to reduce weed seed production. Exact timing depends on the weed species present.

Biomass Accumulation and Composition

Initial studies in NY suggest the total above ground biomass of spring-seeded clover companion cropped with a small grain accumulated by late fall or the next spring ranges from 1.5 to 2.5 tons DM/acre. This biomass typically has about 2.5-3.5% N, representing a total above ground N pool of

75-175 lbs N/acre. The biomass typically has a C:N ratio between 10 and 20, rendering clover biomass readily decomposable by soil microbes, releasing N to the soil solution for uptake by corn or other crops that follow within the same growing season.



Figure 1: Red clover interseeded into or with a small grain crop can supply N to the corn the following spring.

When and How to Terminate?

Limited field studies suggest that (1) killing clover just prior to seeding of corn will result in greater N supply than fall-killing of the clover; and (2) the total N supply by the clover can be enhanced somewhat by fall mowing (Figure 2).

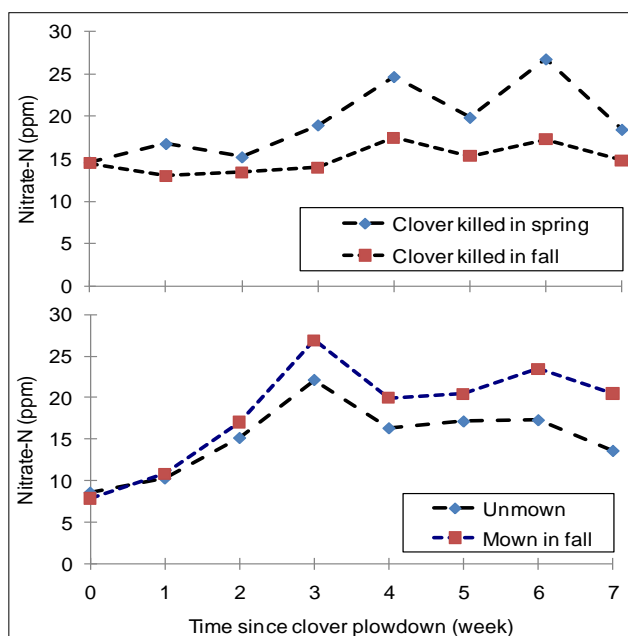


Figure 2: Impact of spring versus fall kill (top) and mowing of a fall stand (mid September, 2009), on nitrate release.

Clover should be killed with herbicide or mowed before plowing it under. Otherwise it may regrow and compete with the corn.

Nitrogen Credits

In studies reported in the literature, the 1st year N fertilizer replacement value (NFRV) of clover for corn can be large. When clover was interseeded into a small grain (oats, wheat, etc.) the year before corn, the NFRV was 70 lbs N/acre in studies conducted in Ontario, 135-140 lbs N/acre in Pennsylvania, 85-100 lbs N/acre in Wisconsin, and 90-120 lbs N/acre in Michigan and New York. The N release from spring-killed clover tends to coincide with the time of greatest N need of corn. This is illustrated by soil nitrate levels after clover plowdown shown in Figure 4.

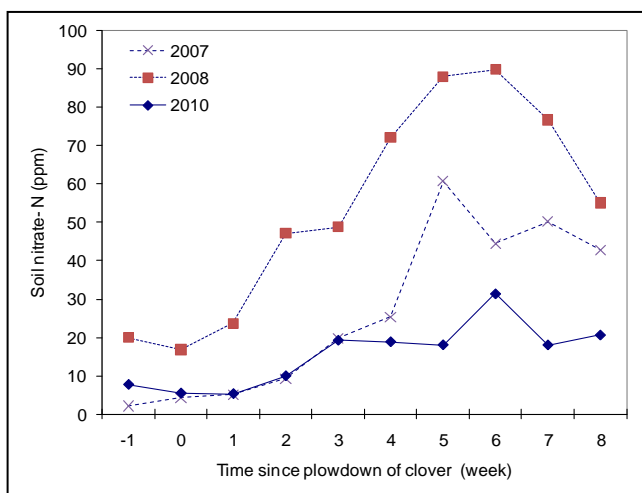


Figure 4: Nitrate levels (0-8 inch depth) after clover turnover. The nitrate peaks show year to year differences but yield comparison with plots that received extra N fertilizer showed the clover alone supplied sufficient N, even in 2010 which had the lowest soil nitrate levels in the 3-year study. Total above ground N pools were 90, 168 and 110 lbs N/acre in 2007, 2008 and 2010, respectively.



Figure 5: Clover interseeded into a small grain supplied all the nitrogen needed for 25 ton/acre corn silage in 2008.

In Summary

A good quality one-year clover stand can deliver a large amount of N to the corn crop following clover in the rotation. To quantify N needs for corn after a one-year clover stand in the rotation, determine N guidelines for corn after corn (agronomy fact sheet 35) and subtract 70-120 lbs N/acre from the recommended N rate.

Cornell University

Nitrogen fertilizer replacement value of red clover interseeded into a small grain for the following year corn crop

“Red clover N credits”

The optimum economic N rate for corn after clover, interseeded into a small grain, can be lowered by 70-120 lbs N/acre. This adjustment should be applied only for the first year of corn following the clover.

Additional Resources

- “Managing Cover Crops Profitably”. 3rd Edition. Handbook Series Book 9. Published by the Sustainable Agriculture Network, Beltsville, MD. <http://www.sare.org/publications/covercrops/covercrops.pdf>.
- 2011 Cornell Guide for Integrated Field Crops Management. Electronically accessible at: <http://ipmguidelines.org/Fieldcrops/>.
- Agronomy Fact Sheet 43: Nitrogen benefits of winter cover crops. Electronically accessible at: <http://nmsp.cals.cornell.edu/guidelines/factsheets.html>.

Disclaimer

This fact sheet reflects the current (and past) authors’ best effort to interpret a complex body of scientific research, and to translate this into practical management options. Following the guidance provided in this fact sheet does not assure compliance with any applicable law, rule, regulation or standard, or the achievement of particular discharge levels from agricultural land.

For more information



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Nutrient Management Spear Program
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