# Carbon and Nitrogen Content of Winter Cover Crop Dry Matter

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AGRONOMY AND HORTICULTURE
*Institute of Agriculture and Natural Resources*

USDA United States Department of Agriculture | National Institute of Food and Agriculture

MISSOURI S&T

## Step 1: Biomass Preparation

Sampled Above-Ground Biomass

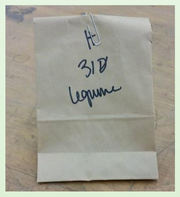

Dried and Weighed

## Step 2: Grinding

Grinder

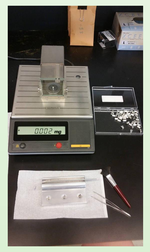
Finely Ground Sample

Bagged Sample




## Step 3: Packing

Microgram Scale



Sample Tray

## Step 4: Analysis

Elemental Combustion System


SAS
PROC GLIMMIX
version 9.3

## Introduction

- Only half of costly nitrogen (N) fertilizer is taken up by the crops (Tonitto et al., 2006). Cover crops (CC) can be a cheaper alternative to N fertilizer.
- Microorganisms prefer carbon to nitrogen ratio (C:N) of 24:1 (USDA, 2011) so CC residue ranging from 20:1 to 30:1 optimize N availability for subsequent crops while ensuring soil protection (Creamer et al., 1997).
- High C:N ratio CC (>30:1):
  - Slow residual breakdown which gives lots of soil protection
  - Immobilize N which can leave N deficit for subsequent crops
  - Prevent N leaching
- Low C:N ratio CC (<20:1) :
  - High N content, microorganisms break down biomass quickly
  - N is left for subsequent crops

**Research Question: Does species and CC planting date affect C:N ratio, %N, and total N in the aboveground biomass of CC?**

- Four locations studied but only the Mead, NE location shown
- Three CC: winter rye, legumes (hairy vetch and winter pea), and a cocktail mix (rye, vetch, pea, red clover, collard, forage radish, black oats)
- Two planting dates: broadcast seeds September 3 - 9 into corn and soybean stands, and drilled seeds October 14
- Above-ground CC biomass sampling: April 15 - 25
- Total N in kg/ha = %N x dry matter (DM) in kg/ha

## Discussion

Legumes are grown as N suppliers because some of the N in their biomass is from fixation, a net N gain for agroecosystems. Legumes had the highest %N but supplied very little total N because their DM production was very low. Rye residue, on the other hand, contained a much higher amount of total N because of its high DM production. Rye CC took up soil N left by the previous crops, possibly preventing N leaching.

Cover crop C:N ratio increases with the plants' age, and was highest for early planted rye. However, it was within the optimum range for C:N ratio, so N immobilization is unlikely to occur.

This study shows that in order to ensure N supply, CC dry matter must be high. To avoid N immobilization, CC should be terminated before their C:N ratio is greater than 24:1. Future studies should also take into account below-ground biomass to assess total N produced by CC.

## Results

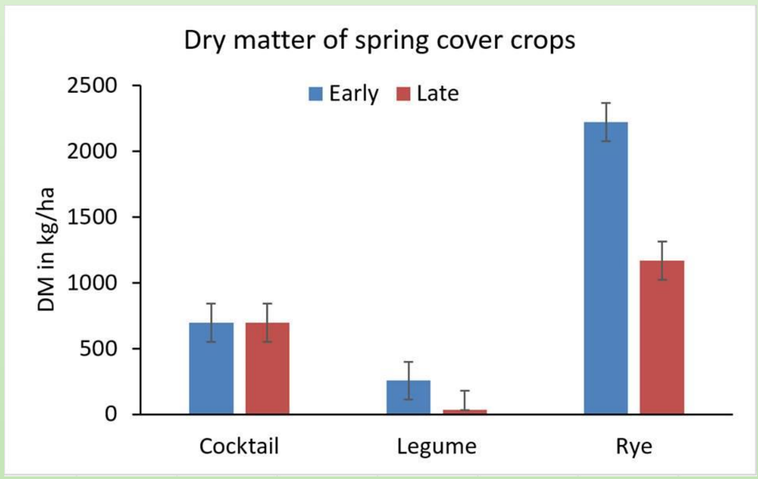



Figure 1: DM was influenced by the interaction between species and planting date. Early-planted rye and legume was more productive with rye at 2220 kg/ha and legume much lower at 256 kg/ha.

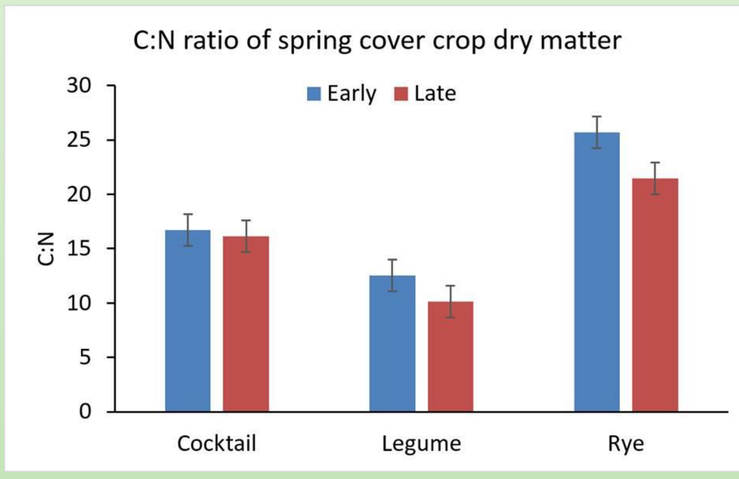



Figure 2: Cover crop C:N ratio differed by species and planting date. It was highest for the early planted rye at 25:1 and lowest for the late-planted legumes at 10:1.

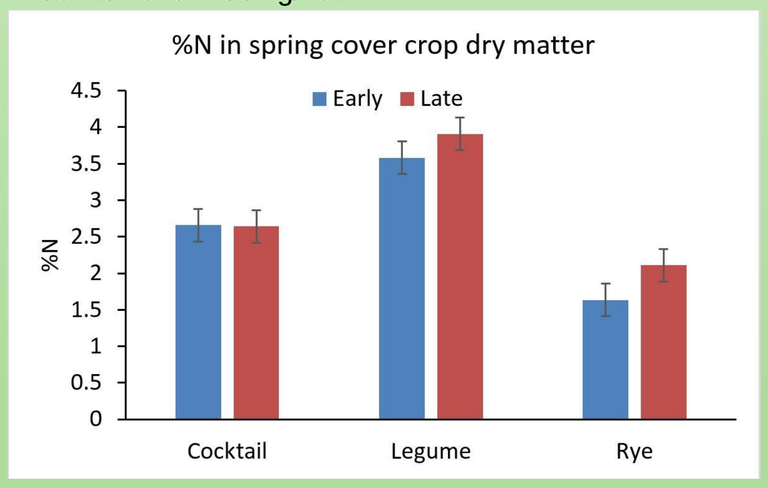



Figure 3: The %N in spring cover crop dry matter was influenced by species but not by planting date. Legume %N was highest at 3.6%N, cocktail 2.7%N and rye 1.6%N.

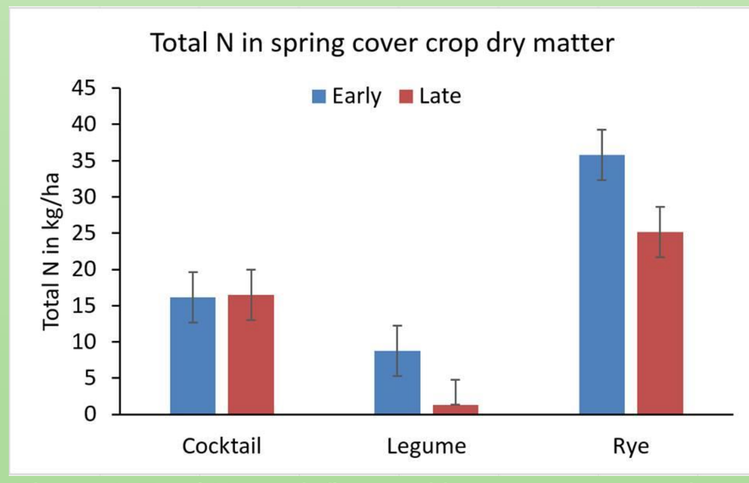



Figure 4: Total N was influenced by cover crop species and planting date. Total N was highest for rye (36 kg/ha in early planting) and lowest for the legume.

## Acknowledgements

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## References

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