Risks and rewards: Cover crops before organic dry beans

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Introduction

- Dry edible beans are planted in late May or early June, providing a window of time to incorporate cover crops into the rotation
- Cover crops have the potential to increase nutrient availability to subsequent dry beans through scavenging and/or N fixation
- Weed infestations may be influenced by cover crops

Objectives

- Determine the effect of cover crops on organic dry bean production with regard to:
  - Nitrogen availability
  - Weed infestations
  - Dry bean populations and yield

Materials & Methods

- Cover crops planted prior to dry beans (Figures 1 and 2):
  - Medium red clover 'Marathon' (11 kg/ha)
  - Oilseed radish 'Groundhog' (12 kg/ha)
  - Rye 'Wheeler' (100-125 kg/ha)
  - No cover

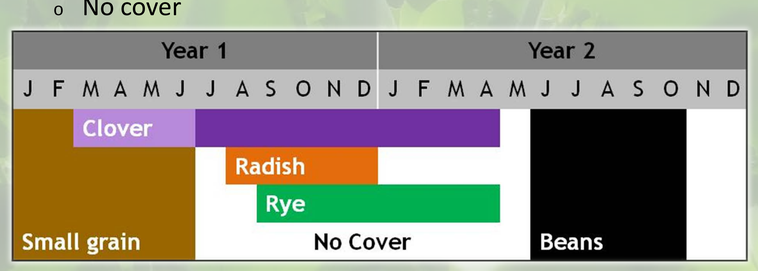

Figure 1. Cropping sequence to study the impact of cover crops on dry beans.

- Locations (RCBD at each, 2011 & 2012, 4 site-years total):
  - MSU Agronomy Farm (East Lansing, MI)
  - Kellogg Biological Station (Hickory Corners, MI)
- Cover crop + pre-season weed biomass was collected at peak production (i.e. late-fall for oilseed radish, prior to spring incorporation with a chisel plow for the other cover crop treatments and weeds) (Figure 2)
- Nitrogen measurements:
  - Soil samples (Planting, V2, R1, R5 and Harvest)
  - Ion exchange resin strips (changed every 2 weeks)
  - Spad meter readings (V2, R1, and R5)
- Weed measurements:
  - Within-row weed density and dry aboveground biomass (V2 and R1)
- Dry bean measurements:
  - Populations
  - Yield
  - Grain nitrogen content at harvest

Figure 2. Cover crops studied (left to right) medium red clover, oilseed radish, cereal rye, and no cover.

Nitrogen Results

NITRATE

- Peak nitrate availability occurred at V2 in all site-years
- Nitrate levels were highest in plots following frost seeded clover (biomass >7,000 kg/ha) compared with no cover at planting, V2, R1, and R5 in 2 of 3 site-years (Figure 3)
- Rye reduced nitrate availability compared with the no cover at V2 both years in East Lansing (Figure 3)

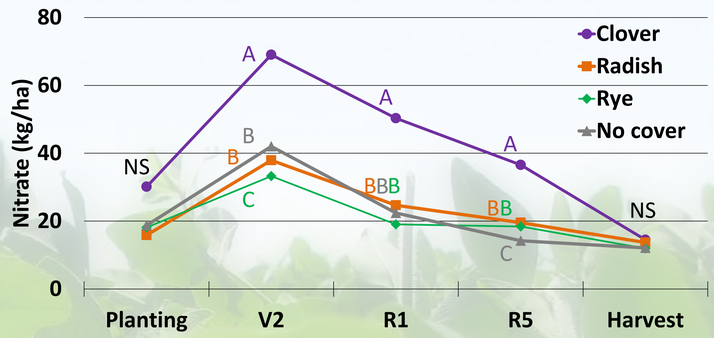

Figure 3. Available nitrate, from soil samples at East Lansing (2012)

AMMONIUM

- Peak ammonium availability occurred at dry bean planting (Figure 4)
- Ammonium levels were highest in plots following frost seeded clover at bean planting (14 kg/ha) and V2 (7 kg/ha)

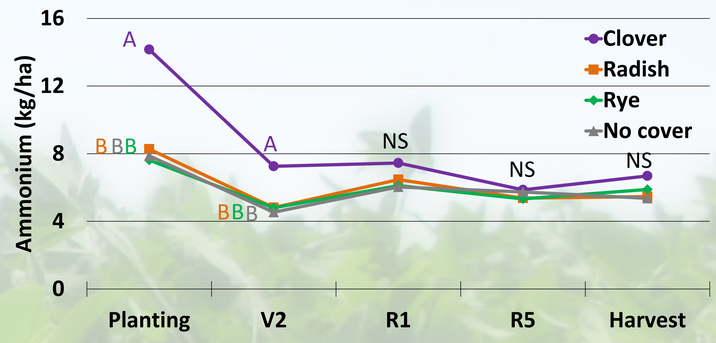

Figure 4. Available ammonium, from soil samples at East Lansing (2012) and Hickory Corner (2011 and 2012)

- Trends in nitrate and ammonium availability were similar among the various measurement techniques; data from the ion exchange resin strips being the most variable

Weed Results

- Oilseed radish and rye did not affect weed biomass or density compared with the no cover treatment
- Dry beans following clover had higher weed densities and biomass at 3 of 8 sampling times
- Greater weed pressure following frost seeded clover may be related to increased weed seed inputs during the fall prior to dry bean planting and/or increased nitrogen availability early in the season

Figure 3. Common lambsquarters was clearly visible in bean plots planted following clover at East Lansing in 2012

Dry Bean Results

- Dry bean populations were highest following a rye or oilseed radish cover crop compared with the clover and no cover treatments
- Dry bean yields were highest following a oilseed radish cover crop (though not different from no cover) and lowest following a rye cover crop (Figure 4)
- Grain nitrogen content was 19% higher when beans were planted following clover (40 µg N/ mg grain) compared with the other treatments (average 34 µg N/ mg grain)

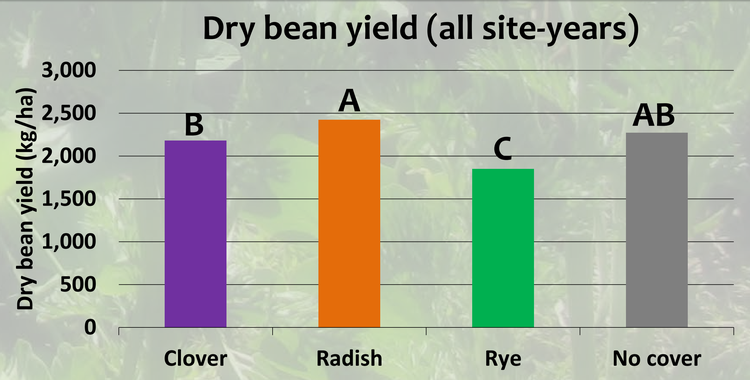

Figure 4. Dry bean yield averaged across both years and locations

Risks

- Clover and rye can be problematic to kill with tillage in the spring if conditions are wet
- Clover and rye can be detrimental to dry bean production:
  - ***Clover***- Excess nitrate & ammonium → Increased weed infestations
  - ***Rye***- Reduced nitrate availability→ Reduced yields

Rewards

- Oilseed radish was not detrimental to the dry beans and therefore benefits outside those measured in this study may be realized (e.g. reduced compaction)
- Beans following clover showed an increase in the nitrogen content of the seed, translating into increased protein, though there was not an increase in yield