Using Bicultures to Improve Soil Conservation and Phosphorus Cycling in Oilseed Radish Cover Crops

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Introduction

- The use of *Raphanas sativas* (oilseed radish, OSR) as a cover crop has been increasing in the production systems of the Corn Belt
- OSR contains a large taproot that can biologically till the soil and store large amounts of nutrients such as phosphorus (P) in its tissue
- OSR winter-kills and decomposes rapidly in the spring
- Rapid decomposition of OSR in the spring may result in surface losses of available P before a subsequent crop is present to recover it, and can leave the field susceptible to runoff and erosion
- Planting OSR simultaneously (biculture) with a crop containing a higher C:N ratio such as *Avena sativa* (oats) or *Secale cereale* (cereal rye) may allow for slower decomposition in the spring and improve the ability of the cover crop to maintain soil and available P until the establishment of a subsequent crop

Objectives

- To compare treatments consisting of OSR (Cisco Seeds Groundhog Radish®), OSR + oats, OSR + cereal rye, and no cover crop to determine if OSR bicultures improve OSR's ability to conserve soil and cycle P back to subsequent crops
- To measure P in soil, plant tissue, and runoff over time to determine where it accumulates as a result of the cover crop and when it's available to a subsequent crop

Materials & Methods

- Plots were established in Toronto silt loam (Udollic Epiaqualfs) at the Purdue Diagnostic Training Center in West Lafayette, IN
- Treatments were replicated three times with 4.3 x 9.1 m plots arranged in a randomized complete block design
- Cover crops were planted into soybean residue on August 28, 2012 with a no-till drill at 19 cm row spacings using the following rates: 13 kg ha^{-1} OSR (alone), 7 kg OSR + 31 kg oats ha^{-1}, and 7 kg OSR + 36 kg cereal rye ha^{-1}
- Corn was no-till planted following cover crops on May 4, 2012 at 76 cm spacings with 392 kg ha^{-1} of 10-34-0
- Soil samples were obtained in August (background), November (fall), March (spring), and June (V6) from 2 row positions and 3 soil depths (Figure 1) and analyzed for water soluble and Mehlich-3 phosphorus

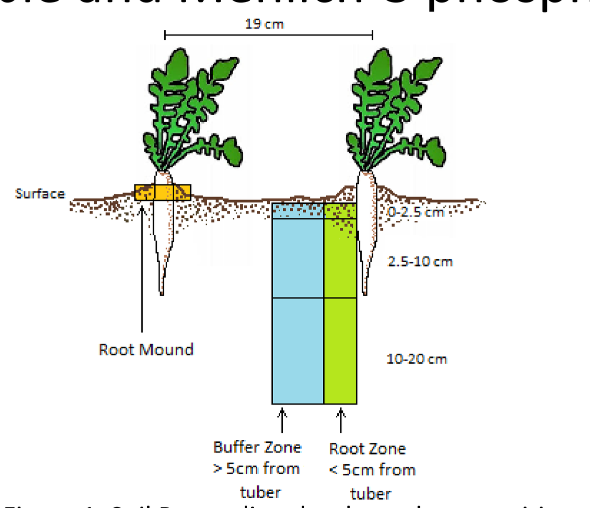


Figure 1. Soil P sampling depths and row positions

- Samples of cover crops (fall and spring, from 0.25 m^2 frames) and the subsequent corn crop (V6 and tasseling, leaf samples) were collected to observe cover crop biomass accumulation and P uptake by corn


Oilseed radish tuber in fall 2011


Oilseed radish treatment during fall 2011

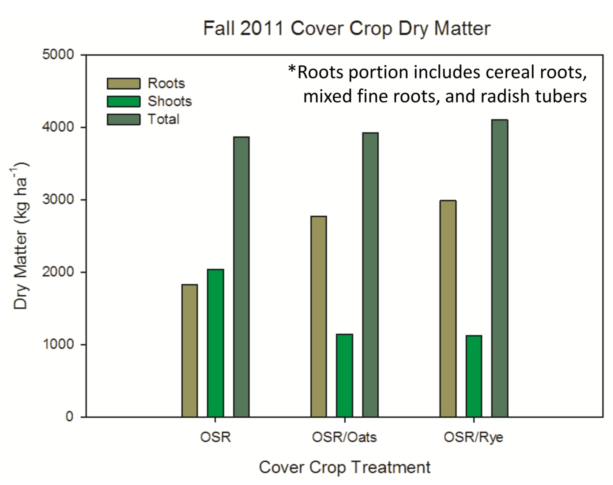

Oilseed radish and cereal rye treatment during spring 2012

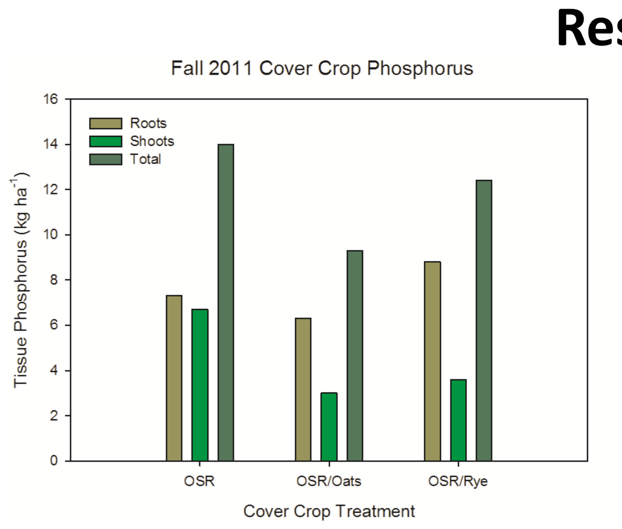

Oilseed radish treatment during spring 2012

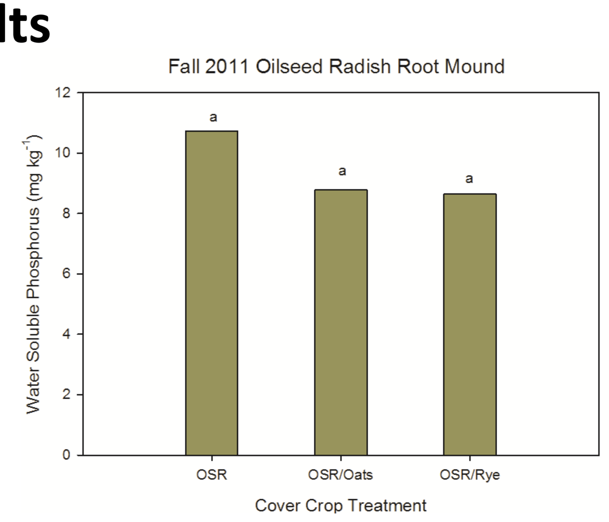

Subsequent corn growing in OSR/Rye residue during spring 2012

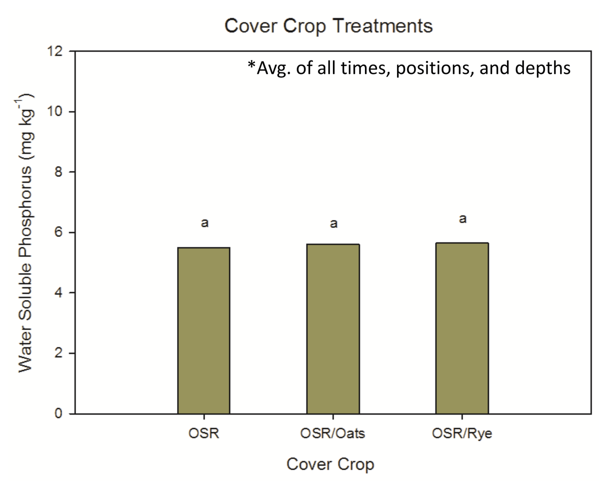

Tasseling corn following OSR/Rye cover crop

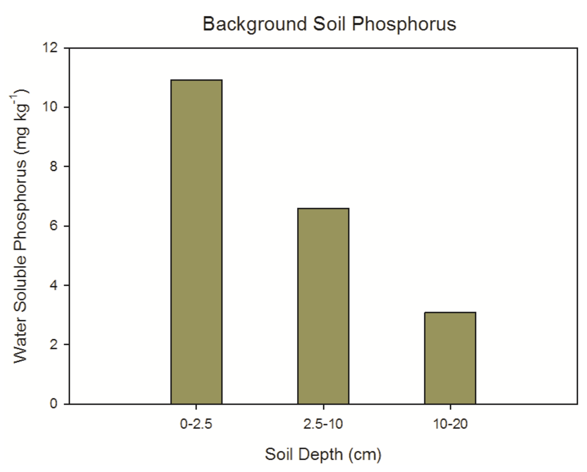
Results

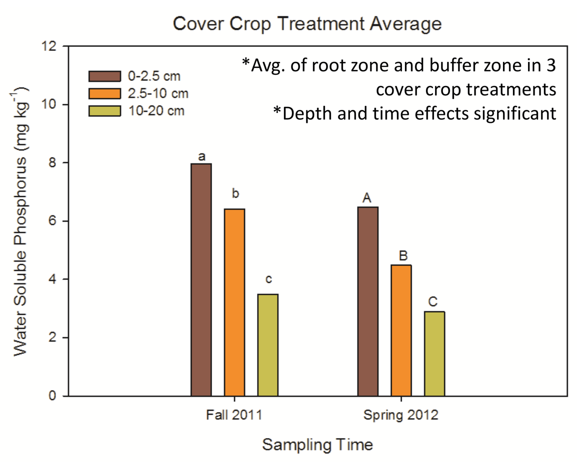


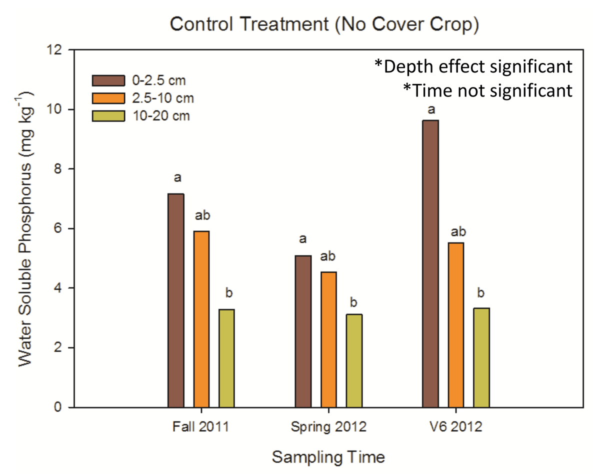


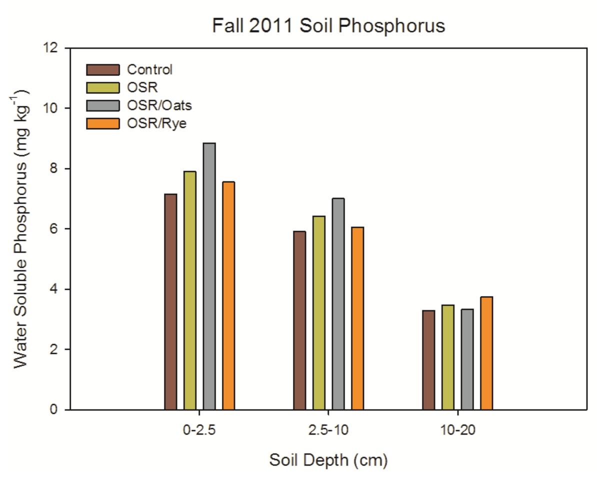


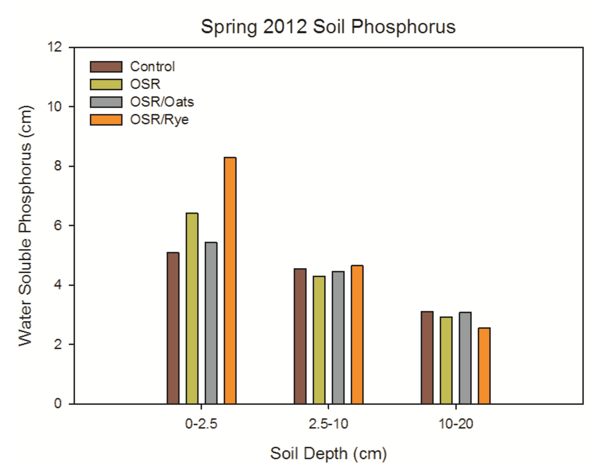


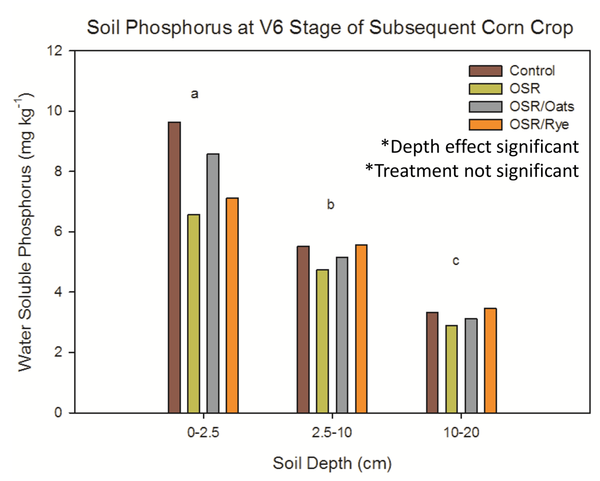












Conclusions

- Water soluble P (WSP) was consistently different with depth, with highest concentrations at the soil surface
- OSR alone contained similar fall cover crop tissue P content in roots and shoots whereas the majority of the P in the bicultures was in the roots
- The mound of soil formed around the crown of the OSR tuber contained high concentrations of WSP, similar to background WSP at the surface
- There was no difference in WSP between OSR alone and the OSR bicultures
- WSP did not change by position related to the OSR tuber
- WSP across the whole field changed significantly from fall to spring when a cover crop was present, but did not change when a cover crop was not present

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