

Planting Oilseed Radish as a Cover Crop in Wisconsin

Mike Ballweg-UW-Extension, Matt Ruark-UW-Madison Soil Science Department, Richard Proost-NPM

There has been considerable interest in growing oilseed Radish (*Raphanus sativus* L.) as a cover crop in Wisconsin but little data to substantiate claims and address grower questions. Much of the radish cover crop research often cited has been conducted in the Mid-Atlantic region of the United States with different agronomic conditions than what is experienced in the upper – Midwest.

Oilseed radish is a member of the Brassicaceae or Cruciferae plant family, often called the mustard family which includes: broccoli, kale, cauliflower and cabbage. This publication is developed to help growers better understand the limitations and benefits of growing oilseed radish in Wisconsin. Research for this publication summarizes nine site-years of data collected in northeastern and southern Wisconsin, when radish was planted mid-August following winter wheat harvest. The Daikon type oilseed radish was selected for this study because of its large taproot which can grow 2 or more inches in diameter and more than a foot in length with adequate growing degree days and fertility.

Oilseed Radish in Cropping System

Oilseed radish is best utilized in the cropping rotation when planted after short season crops such as winter wheat, snap beans, peas or other vegetable crops. Planting by mid-August is recommended for oilseed radish to produce adequate biomass before the end of the growing season, tolerating freezing temperatures for several days down to 20 degrees F. Planting into September usually does not result in adequate plant development and little return on seed and establishment investment.

Seeding rates and establishment

Oilseed radish seeding rates used in this study were planted at 10 -12 pounds per acre (lbs./acre). Research conducted in Michigan found that seeding rates of 10, 15 and 20 pounds per acre all produced similar amounts of biomass. With adequate moisture, oilseed radish establishes quickly. Lower seeding rates result in larger individual plants producing bigger below ground tubers.

Oilseed Radish can be drilled (either conventionally or no-tilled) to a depth of one-quarter to one-half inch, or broadcast and incorporated with light tillage. Higher seeding rates are generally recommended when broadcast seeding.

While oilseed radish is often established without the addition of supplemental N, it has been found that growth was greatly enhanced with additional nitrogen applied at a rate of 40 - 60 lbs./acre. The N source may come from residual N, manure or purchased N applications.

Radish planted in late summer may be overly competitive when established in combination with other cover crop species. More recently farmers are planting oilseed radish at 1 -3 lbs./A in combination with other crops such as barley, oats, berseem and or crimson clovers. The addition of the clovers creates a biomass with a more favorable C:N ratio resulting in net N mineralization.

Fall growth and N uptake

Analysis of whole plant oilseed radish grown as a cover crop clearly shows that large amounts of soil nitrate may be captured in the plant biomass. This study found that oilseed radish planted after Winter Wheat in mid-August sowed a N uptake of between -- and -- lbs./acre.

Oilseed radish may provide water quality



benefits but this question was beyond the scope of this study. At the end of the radish growing season, radish significantly reduced the nitrate content in the 0 – 12 inch sampling depth in 6 of the 9 site years, and in 4 of 7 site years in the 12 -24 inch sampling depth.

(table 2 from the manuscript)

However, what is not clear is the fate of the nitrates when released from the decomposing biomass organic matter. It would appear that a N replacement credit may be possible based on the amount of N in the whole plant biomass and a favorable C: N ratio for net mineralization. Unfortunately this study reports no N replacement credit for the next season's crop as determined through N response curves. This research supports radish use as a cover crop to trap fall N, with meaningful amounts of N being captured in the plant biomass, but the ultimate fate of the N that is taken up remains unknown.

Graphs of: Fall biomass ... 3 years Rock County, 2 years each Sheboygan and Washington Counties.

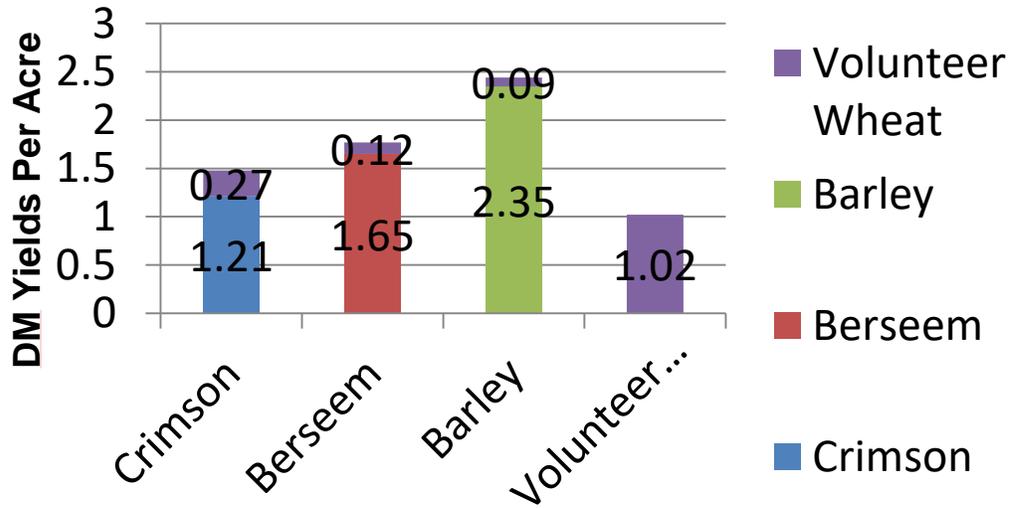
Fall nitrate soil test levels from the same locations.

Cover Crops Suppress Weeds and Volunteer Cereal Grains

Oilseed radish germinate and emerge quickly after planting to create a competitive environment against emerging weeds and volunteer small grains. Other cover crops are also found to reduce weed and volunteer small grains competition.

This is data collected from the clover plot in 2016 in Sheboygan County.

Cover Crops Suppress Wheat & Weeds



Photos from Rock County – Oilseed Radish planted following Winter Wheat



November 3, 2011



April 4, 2012

Spring decomposition and residual soil nitrogen levels

The C: N ratio of radish whole plant biomass ranged from 10.1 to 19.3 with the above ground biomass ranging from 9.02 to 16.0 and the below ground biomass ranging from 11.7 to 25.1. This data was averaged from across all site locations in 2012 and 2013. These C: N ratios would suggest a N net mineralization rather than a N net immobilization during the radish decomposition however this favorable C:N ration did not provide a N replacement credit. Despite a favorable C: N ratio radish decomposition in Spring did not create a flush of nitrate N that might have been expected considering the significant amount of N taken up the previous fall.



May 8th, 2013, Sheboygan Co June 13, 2013 Washington Co

Graphs of PPNT and PSNT by year and by location.

Data from in season nitrates soil tests from the Zero N plots would be very useful here.

This will provide insight to N mineralization from radish biomass. I see there is ammonium data as well. Matt how useful is that? Should this be included somehow?

I think the graphs will help address these questions.

a. Flush of N in the spring or is there less because of N uptake in fall?

b. Does it mess with PPNT or PSNT values?

Does oilseed radish provide an N credit when corn follows radish?

Results show that while oilseed radish N uptake can be quite substantial, no N fertilizer replacement value was determined. The effect of radish on in-season plant available N (PAN) content differed across growing seasons, with radish both increasing and decreasing PAN. Across the nine site-years of the study, radish had no effect on corn yield in five site-years and had a slight negative effect on corn yield in two site-years. In the remaining two site-years, radish led to increased corn yields at greater N rates, suggesting there is the potential for radish to increase the yield potential of corn, but greater amounts of N would be needed to achieve them.

Graph the corn yields and N rate response ...There is a lot of data and I think the cleanness was to present is by location and year.

Can Oilseed Radish provide “Bio-tillage” Benefits?

There are claims that growing oilseed radish will provide “bio-tillage” as large taproots are thought to disturb soils in the plow layer and deeper. Oilseed radish taproots decompose quickly in the spring, leaving holes of various sizes throughout the field.

“While research on the ability of radish to alleviate deep compaction is inconclusive, experience suggests a positive impact on surface characteristics, especially in no-till. The ability of radish to suppress volunteer wheat and winter annual weeds through competition and allelopathy is well documented and frequently a burndown herbicide is unnecessary following a good stand of oilseed radish. Residue decomposition during the winter season allows the surface to dry faster, enabling easier no-till planting including better planter-slot closure” says Jim Stute, Research Director, Michael Fields Agricultural Institute.



Kevin Shelley, UW - NPM Regional Specialist comments, “Oilseed radish is a fast growing edible root vegetable capable of producing a girthy taproot that can extend several feet deep if planted in July or August. Daikon radishes selected as cover or forage crops are often touted to alleviate soil compaction by “bio-drilling” down through compacted layers within the crop root zone. Observations suggest, however, radish root growth can be restricted by compaction zones. Radish roots often follow the path of least resistance, finding an older root or earthworm channel (bio-pore), to navigate downward. This may, or may not, offer soil health benefits unique to radish (or other brassica) root growth. Observations also suggest the girthy growth of radishes can have a loosening effect at the soil surface which can cause conditions susceptible to gully erosion”.

Not sure if we what to use quotes in the pub, but they capture well the discussion around bio-tillage.

It is recommended to plant radish in combination with other cover crops, such as oats, barley, and winter cereal rye. Including legumes such as Berseem and/or Crimson Clovers will provide a more favorable C: N ratio helping to provide for net mineralization of N.

Use Caution when planting radish on highly erodible soils



Figure 2. Corn planted into wheat and oilseed radish residue.



Figure 3. Soil loosened by oilseed radish washed out in former radish rows

Photos by Johnson and Stute

Does Radish Provide a Bio-Tillage Benefit when Compared to No-till

In both Rock and in Washington (2013 and 2014) counties graph comparison of radish vs. no-radish. Comparison of corn yields, plant populations. We have penetrometer data and temperature data from Rock County.

Sheboygan County it is tillage vs. no-tillage radish? Same comparisons ...corn yields plant populations and penetrometer data and temperature data.

Are there Bio-fumigant Benefits of Radish that Suppress Nematode Populations?

I've read through the thesis on potential bio-fumigant benefit. I would suggest that we not include any discussion in this pub about suppressing nematode populations. Following is a concluding quote from Megan's thesis the topic.

“The fields used in these experiments were not infested with SCN, as exemplified by the SCN counts. With these results, it is impossible to detect any difference radish might have had on SCN populations. All of the samples collected at all of the sites in both years were well below the damage threshold for RL nematodes as well. Since one of the best nematode management practices is prevention of population increase, utilizing fields with low nematode populations was still helpful, especially prior to planting a crop favorable as a food source such as corn”.

References

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