

BIODRILLING BY FORAGE RADISHES – *Research Update*

Background: The physical and chemical changes that occur as a result of forage radish roots growing in non-till pasture were investigated. Typically forage radishes, FR, (Raphanus sativus) are sown in mid-to-late summer so that the above ground growth can be grazed by cattle. In the winter radishes are killed by frost and decompose quickly in the spring. In row-crop systems, radish residues will be mixed with compacted soil during tillage eliminating holes. In no-till pasture radish holes would have to be filled in by redistribution of surface materials.

Approach/Methods: Soil quality indicators such as organic matter, bulk density, water content and more were measured to see how the soil is affected by the ephemeral presence of radishes in the pasture. A sandy loam pasture soil was sown with FR in early July, 2012 at a seeding density of 8000 seeds per acre and allowed to grow for 12 weeks. In the late summer of 2012 soil core samples were taken to a depth of 20 cm adjacent to, 10 cm from and 30 cm from the FR root as well as from a control plot with no radish, we also sampled earthworms near the radishes and in the control plot. Both control and forage radish plots were grazed in autumn. In the spring of 2013, each paddock was again sampled for organic matter, soil density, active/labile carbon, dry root weight, earthworm density, water content, soil nitrogen and runoff infiltration rates.

Results:

Fall 2012:

* At the soil surface density was lower adjacent to the root (0.78 g/cm3) than at 30 cm (0.92 g/cm3) from it, but no difference among distances for the 10 - 20 cm depth increment (1.3 g/cm3).
* Similarly, organic matter differed only at the surface between the 0 (11%) and 30 cm (9%) distance.
* There was no significant difference in dry root mass among distances from the root and soil depth.
* Earthworm density was greater near radish roots.

Spring 2013:

* SOM, dry root weight, bulk density and N-NO3 revealed no significant difference amongst treatments.
* Although no significant difference at the .05 level, there seems to be a slight difference with:
	+ Volumetric water content at the 10-20 cm depth (p-value = .172; control = .496 & adjacent to radish = .858)
	+ Active carbon at the 10-20 cm depth (p-value = .13; 10cm from radish = 616mg/kg; control = 872 mg/kg; adjacent to radish = 742 mg/kg; and 30 cm from radish = 801 mg/kg)
	+ N-NH4 at the 10- 20 cm depth (p-value = .13; control = .468; adjacent to radish =.557; 10 cm from radish = .681; 30 cm from radish = .529).
* Earthworm density was greater near radish roots similar to that of the previous fall season.
* The infiltrometer on all tests was unable create runoff due to the high infiltration rate of water into the soil profile and therefore no calculations could be made.

\*Most difference occurred at the 10-20 cm depth, not the surface (0-10cm) in 2013.

Discussion/Future Research:

Comparing the soil quality indicators from 2012 to 2013, it is possible that the increased organic matter at the surface in the fall of 2012 has moved down the soil profile to the 10-20cm depth in the following spring and therefore increasing volumetric water content closer to the FR root as well as lowering the bulk density. This however is inconclusive due to lack of significant evidence. There did seem to be a significant difference in earthworm population suggesting an increase in biological activity independent of other soil quality indicators measured.

Additional studies are required to offer recommendations to farmers of seeding FR as a compaction management technique on VT pastures. The results of this experiment may change with increased sampling or under different management practices. Since no significant differences were found with the varying soil quality indicators, it may be a sign that the current practices of the pasture are working positively. Perhaps with a poorly managed soil, differing results may occur. However,

* Crop rotation/paddock rotation. The paddock was grazed and resulted in no significant differences; what if it was ungrazed for a season?
* Increased sampling (where there was difference, but not significant, could increased sampling provide more power to the results?)
* Difference in seeding density? Soil types(study the use of forage radish on known compacted soil and soils of potential concern(clay soils)? Management practices? Past history?
* Analyze at greater depths. Where minor differences were present, it was only at the 10-20 cm depth and not at the surface. Perhaps, sub 20 cm there could be affects to the soil profile.