

ACCOMPLISHMENTS REPORT

Northwest Regional Biomass Research Center

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Research Units Reporting:

Forage Seed and Cereal Research Unit – Corvallis, OR

Northwest Sustainable Agroecosystems Research Unit – Pullman, WA

Physiology and Pathology of Tree Fruits Research Unit – Wenatchee, WA

Biochar produced from gasification of crop residues is useful for rehabilitation of acid mine soils. Water and soils that are adjacent to abandoned mines are typically contaminated with heavy metals. This contamination can move offsite and affect downstream ecosystems. One remediation strategy that has the potential to stabilize soils, stabilize soil, prevent erosion, and reduce surface runoff, involves active revegetation of mine tailings. Though the revegetation of tailings is a promising remediation strategy, heavy metal contamination and acidic soil conditions often limit plant growth and impede revegetation efforts. Biochar is a carbon-rich byproduct of energy production that may have the potential to remediate mine tailings because they decrease soil acidity, immobilize heavy metals, provide plant nutrients, and prevent water runoff. Scientists in Corvallis, OR evaluated the ability of wheat to grow in mine tailings that were amended with biochar. Mine tailings were obtained from either the Formosa or the Almeda mines (Oregon, U.S.A.). The biochar used in this study was produced from two locally abundant feedstocks, Kentucky bluegrass (KB) seed remnants or low value timber from conifers (CW). Both KB and CW biochar amendments promoted plant establishment. Formosa tailings required at least 4% biochar and Almeda soil required at least 2% biochar to promote healthy wheat growth. A complimentary experiment indicated that biochar amendment rates =4% were sufficient to simultaneously neutralize the pH of leachate and reduce concentrations of potentially toxic elements (Zn, Cu, Ni, Al) to levels below concern. These findings support the use of gasified biochar amendments to revegetate acid mine soils. **Citation:** Pillips, C.L., K.M. Trippe, G. Whittaker, S.M. Griffith, M.G. Johnson, and G.M. Banowetz. 2016. Gasified grass and wood biochars facilitate plant establishment in acid mine soils. *J. Environ. Qual.* 45:1013-1030.

As little as 1 ton Brassica seed meal per acre may adequately control of apple replant disease. Symptoms of apple replant disease often appear when trees are replanted in former orchards. Brassica seed meal (SM), commonly available from pressing industrial oilseeds into raw oil for biorefining, can be applied as a soil fumigant for control of apple replant disease. However, cost of the SM treatment is high compared to conventional, non-tarped chemical fumigation. Scientists in Wenatchee, WA applied a Brassica juncea/Sinapis alba (1:1) SM formulation to replant orchard soil at 1, 2 or 3 ton per acre. Regardless of rate, all SM treatments effectively suppressed soil pathogens and increased tree biomass relative to the no-treatment control for all rootstock genotypes. The replant susceptible rootstocks M9 and MM106 showed a

general increase in tree growth at increasing SM rates; however, there was no additional increase in growth when application rate was elevated from 2 ton to 3 ton when used with the replant tolerant rootstocks G41 and G210. After five months growth, rhizosphere microbial communities were similar for the control and 1 ton per acre SM treatment, but the 2 and 3 ton per acre rate possessed communities that were similar to each other but distinct from the control. A reduced SM application rate when employed with the appropriate apple rootstock genotype may provide sufficient replant disease control and thus would likely accelerate commercial adoption of this technology. **Citation:** Wang, L., Mazzola, M. 2015. Integration of apple rootstock genotype with reduced Brassica seed meal application rates for replant disease control. *Phytopathology*. 105:S4.145.

Rotational effects of winter canola on subsequent spring wheat as related to the soil microbial community. Canola production has expanded in the inland Pacific Northwest with the increased demand for biofuel and food-based products. Wheat grown after canola is generally thought to have greater grain yield compared to wheat grown after wheat. ARS scientists and their university colleagues in Pullman, WA investigated differences in the soil microbial communities associated with winter canola and winter wheat. In a 7-year on-farm winter canola rotation study conducted near Reardan, WA, yields of spring wheat following winter canola were reduced compared to yields following winter wheat. β -Glucosidase (BG) activity in winter wheat- the enzyme involved in degradation of cellulose and providing energy for microbes, was significantly greater compared to winter canola in the first year with the effect carrying over to the subsequent spring wheat crop in 3 of 5 crop years. Mycorrhizal fungi were significantly suppressed in winter canola compared to winter wheat in 4 of the 5 crop years demonstrating carry over to the subsequent spring wheat crop. Preliminary data from this work suggest the preceding canola crop may have suppressed mycorrhizal fungi with the subsequent spring wheat crop, which could explain the reduction in spring wheat yields. This study will provide research-based information of the influence brassica crops have on soil microbial health and crop yields to growers, scientists, and industry personnel. **Citation:** Hansen, J., T. Sullivan, B. Schillinger, and A. Kennedy. 2016. Comparison of rhizosphere soil microbial communities for winter canola and winter wheat at paired field sites. In 2016 Field Day Abstracts: Highlights of Research Progress. Dep. Crop and Soil Sciences Tech Report 16-1, Washington State Univ., Available online at <http://css.wsu.edu/biofuels/files/2012/09/Comparison-of-Rhizosphere-Soil-Microbial-Communities-for-Winter-Canola-and-Winter-Wheat-at-Paired-Field-Sites.pdf>