Restoring Arbuscular Mycorrhizal Fungi in Agroecosystems: Oats (Avena sativa) Shows Promise as a Cover Crop

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What’s a Cover Crop?

- **Legume**
  - Clovers
  - Peas
  - Vetches

- **Grass**
  - Ryegrass
  - Sudangrass
  - Oats
  - Winter rye

- **Brassica**
  - Turnip
  - Radish
  - Rapeseed
  - Mustard
Why Cover Crops?

Free Energy, Carbon, Nitrogen

Better infiltration
More storage
Less water erosion

Less wind erosion
Promoting Arbuscular Mycorrhizal Fungi with Cover Crops
Arbuscular Mycorrhizal Fungi (AMF)

• Form **obligate** relationships with >80% plants
  – Most crops, excepting the *Brassicas*

Source: Dr. Wendy Taheri, USDA-ARS
AMF nearly eliminated in Ag Soils

- Tillage
- Seasonal Fallow
- Annual Fallow
- Monocropping, simple rotations
- Inorganic fertilizer application
- Fungicide application
- Soil Compaction

![AMF Spores/50 cc soil](chart.png)
AMF Benefits for Agriculture

- Low #s can stress plant
  - Improve production
- Acquire P, Cu, Zn, other nutrients
  - Reduce fertilizer
- Increase Tolerance
  - Disease
    - Reduce pesticides
  - Drought, salinity
- Improve soil structure
  - Reduce erosion
Soil Propagules: White Lake, SD (Fall, 2009)

Soybean - Small Grains/CC - Corn

AMF Propagules/100 g Soil

- None
- Clover
- Oats_Pea
- pea_Timothy
- Canola
- Radish_Pea

* BD
% Colonization of Corn Following Cover Crops (2010, 2011)

Soybean - Small Grains/CC - Corn

% Root Colonization

Average all cover crop treatments
AMF Diversity

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Cropped Field

Prairie
Capturing AMF Diversity with Cover Crops

Classified with validated reference database (Krüger et al., 2012)
79.5% of all the sequences were Rhizophagus-a. Diversispora and Funneliformis each had about 4%; combined they made up 88.0% of the sequences (n=83).
85.4% of the sequences were in the four largest OTUs, Acaulospora, Funneliformis-a, Rhizophagus-a and Claroideoglomus-a (n=82).
NATURAL RE-ESTABLISHMENT OF VESICULAR-ARBUSCULAR MYCORRHIZAE FOLLOWING STRIPMINE RECLAMATION IN WYOMING

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Vesicular–Arbuscular Mycorrhizae in Taconite Tailings. I. Incidence and Spread of Endogonaceous Fungi Following Reclamation

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