# Building Soil Carbon Via Biomass Pyrolysis

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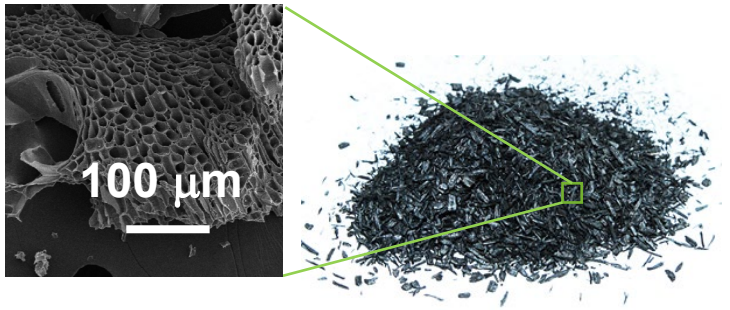
# Biochar: Faster and more efficient than building soil organic matter

## *Slow vs fast pyrolysis*

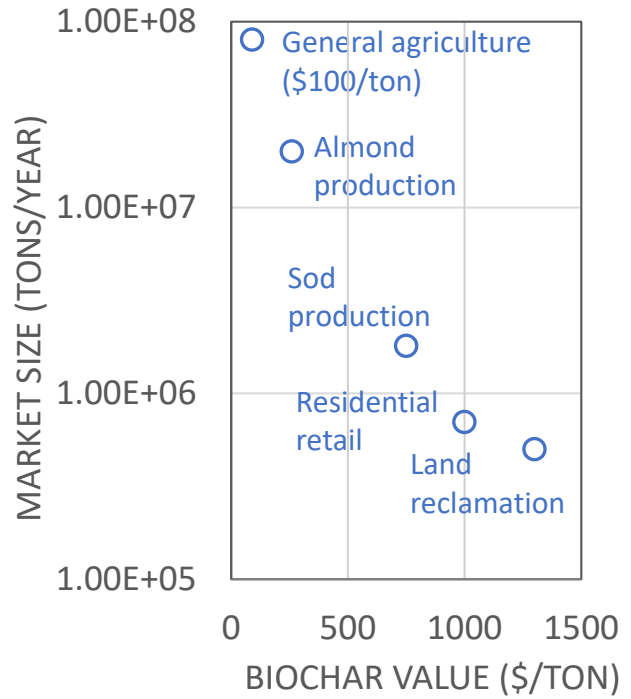
*Slow pyrolysis*
- Lower capital costs
- Higher yields of biochar (20-40 wt%) vs fast pyrolysis (10-20 wt%)

*Fast pyrolysis*
- Higher throughputs
- Higher value co-products improve economics




*Is biochar really the same thing as "soil carbon?"*
- Biochar exhibits many of the same benefits to soil fertility as soil organic matter
- Biochar already makes up part of the natural complement of soil carbon, produced by forest and prairie fires

*Biochar value depends upon market size*




Adapted from Laird and Mba Wright

# Concept for Fast Pyrolysis Biorefinery

Lignocellulosic Biomass

Pyrolysis Reactor

Product Recovery

**Unrefined Sugars from Polysaccharide**

**Phenolic Oil from Lignin**

**Unrefined Acetate from Hemicellulose**

**Biochar**

| | | | | |
|---|---|---|---|---|
| **First Generation Products** | Ethanol  | Bio-asphalt and marine fuel  | In-plant thermal energy  | Soil enrichment & sequestration of carbon  |
| **Potential Future Products** | -Pharmaceuticals<br>-Polymers<br>-Alcohol-to-jet fuel | -Renewable diesel<br>-Octane enhancers<br>-Biobased chemicals  | -Acetone<br>-Acetic Acid<br>-Bio-cement  | -Slow release fertilizer<br>-Activated carbon  |

# First Demonstration Project

- Partners: Stine Seed Company, Frontline Bioenergy and Iowa State University
- Technology: ISU *autothermal pyrolysis* technology incorporated into modular system
- Approach: Pilot scale research to guide design of 50 ton per day demonstration plant using corn stover as major biomass feedstock

Autothermal pyrolysis pilot plant (15-20 kg/h) supported design of demonstration plant

Autothermal pyrolysis demonstration plant (50 ton per day) near completion in Redfield, IA

Pyrolysis Products

Phenolic oil

Prilled biochar

Pyrolytic sugar (later phase )