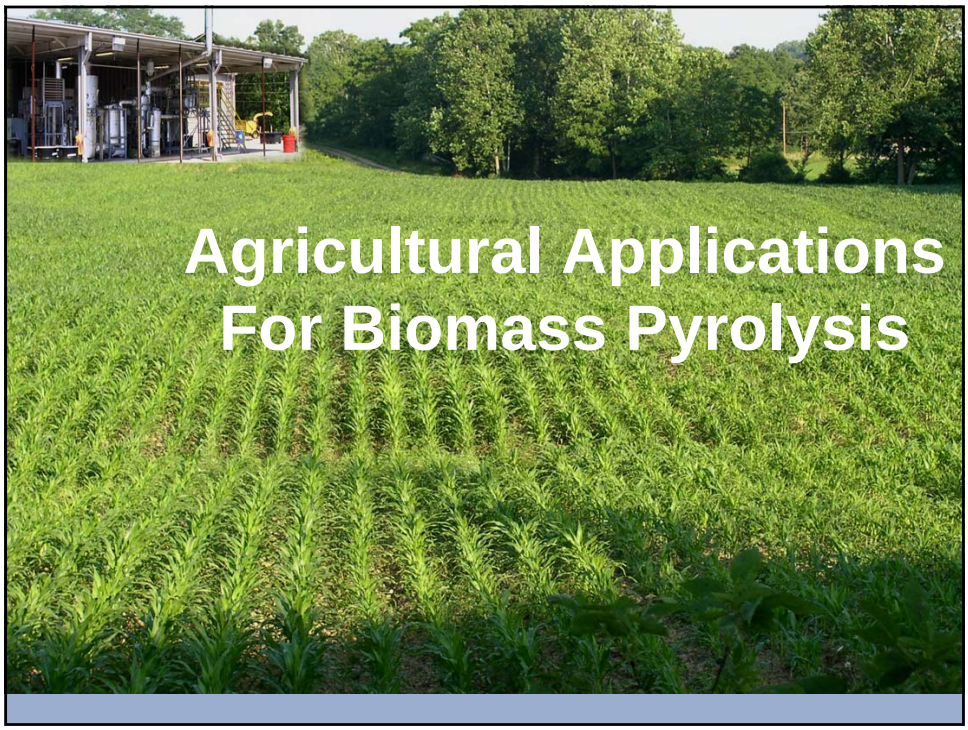
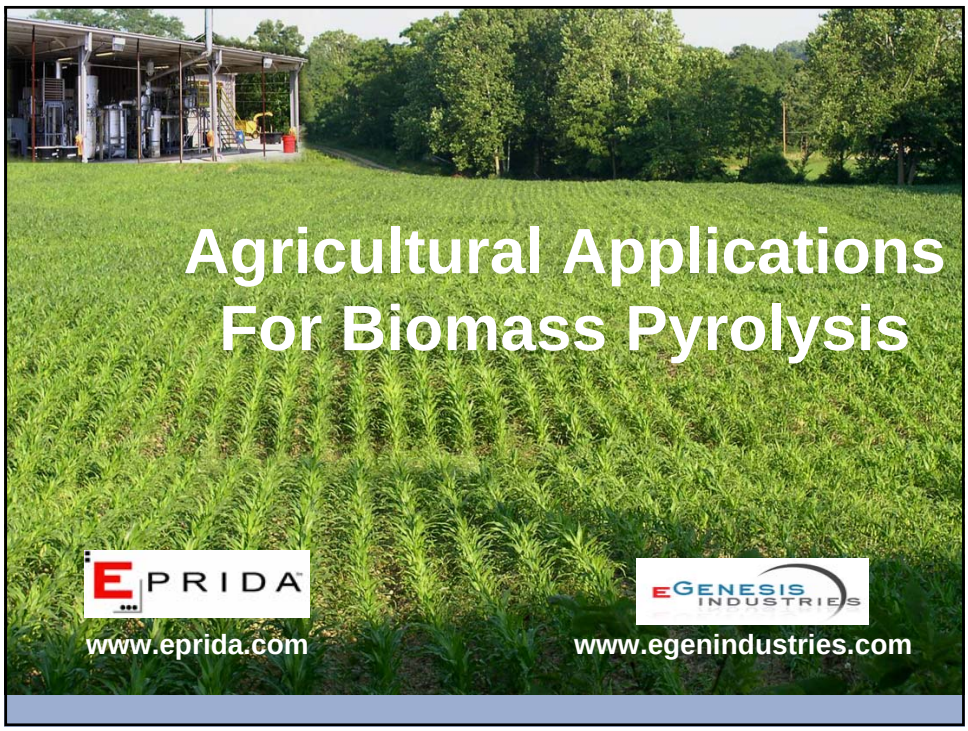
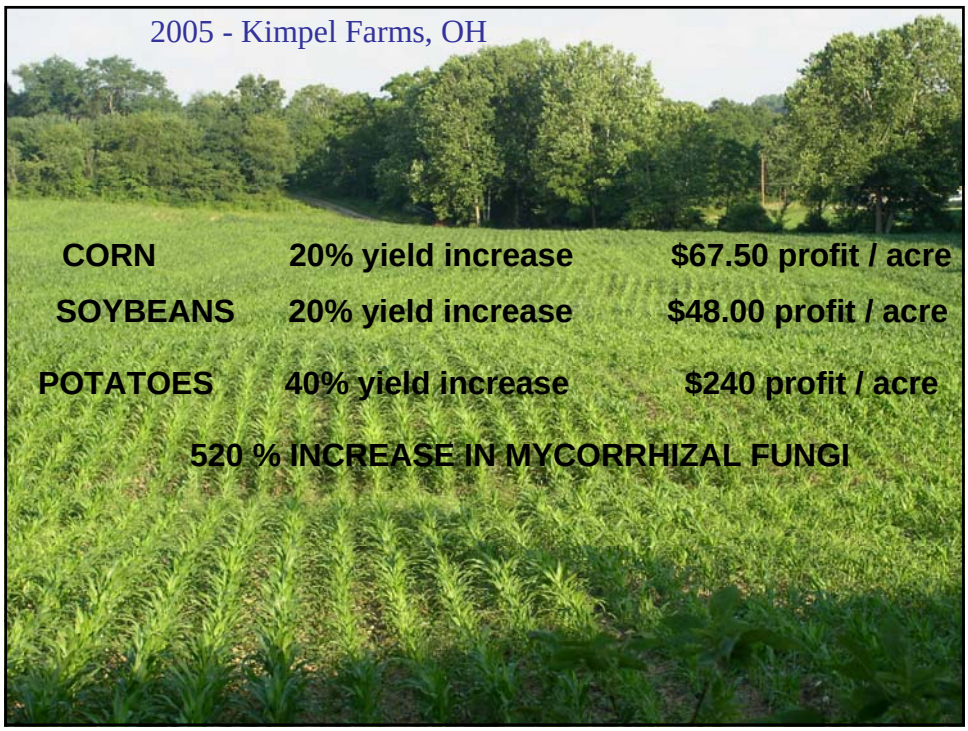

Agricultural Applications
For Biomass Pyrolysis


Agricultural Applications
For Biomass Pyrolysis
EPRIDA
www.eprida.com
EGENESIS INDUSTRIES
www.egenindustries.com

Biomass Pyrolysis

……. **the thermo-chemical decomposition of organic materials by heating in the absence of oxygen**,

Controlled pyrolysis is a Clean Development Mechanism (CDM) for avoidance of methane production from biomass decay.



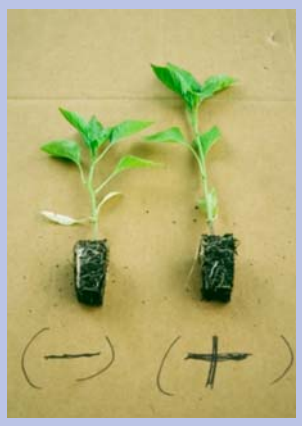
VirginiaTech
Invent the Future

Effects of inoculated carbon on Crop Yield of Irish Potato, Sweet Corn, Tomato and Bell Pepper

2006-2007

- achieved a 10% increase in Sweet Corn yield (2006-07)
- 30 lb./acre savings in nitrogen for Irish Potatoes (2006)
- 22% increase in Tomato yield (2007)

2 CUPS OF INOCULATED CARBON
IN 100 CUPS OF POTTING SOIL



Research results

Increased yields with biochar
Lehmann and Rondon 2006, Steiner et al 2007, Plant and Soil

Increased retention of fertilized nitrogen = fertilization efficiency
Lehmann et al 2003, and Steiner et al 2008

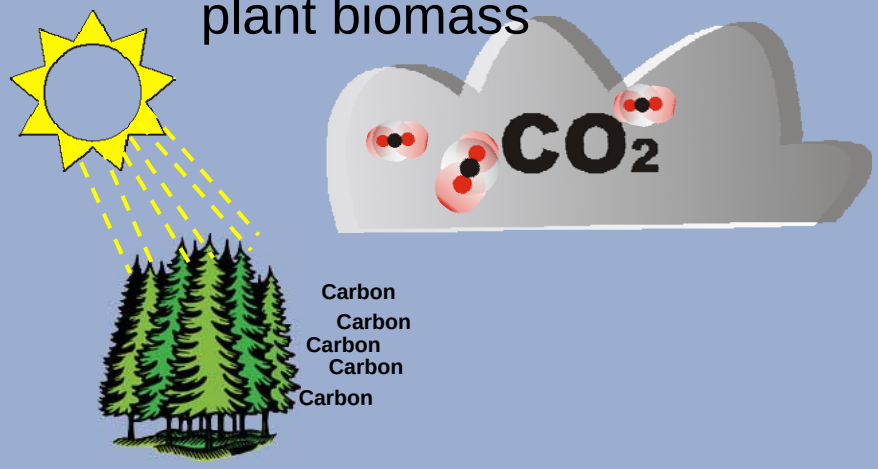
Reduced GHG emissions (CH_4 and N_2O) from soil
Marco A. Rondón, Juan A. Ramirez, Johannes Lehmann, USDA Symposium on C sequestration. Baltimore, March 24, 2005

Reduced acidity
Topoliantz et al 2005, Steiner et al 2007

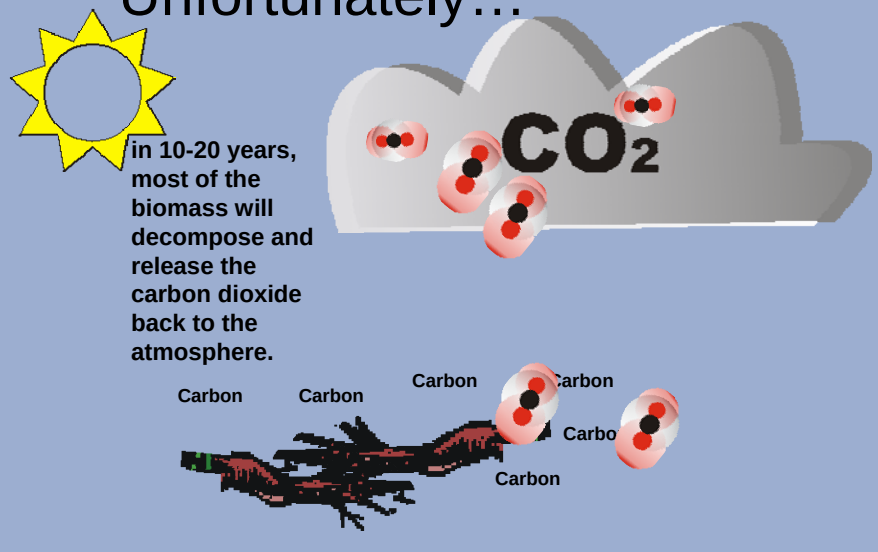
Increased mineral nutrition (mainly K)
Steiner et al 2007

Increased colonization rates by mycorrhizal fungi
Warnock et al. 2007, Plant and Soil

Carbon *can* be sequestered in plant biomass

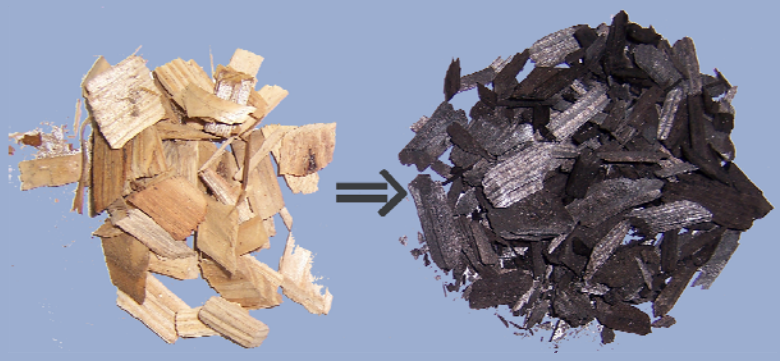


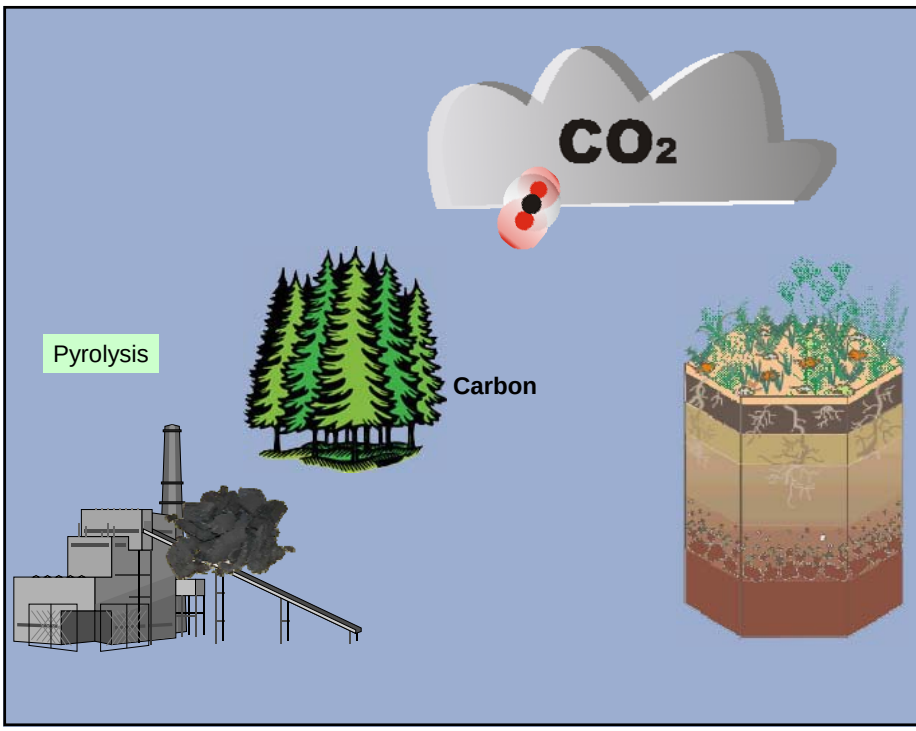
Unfortunately…

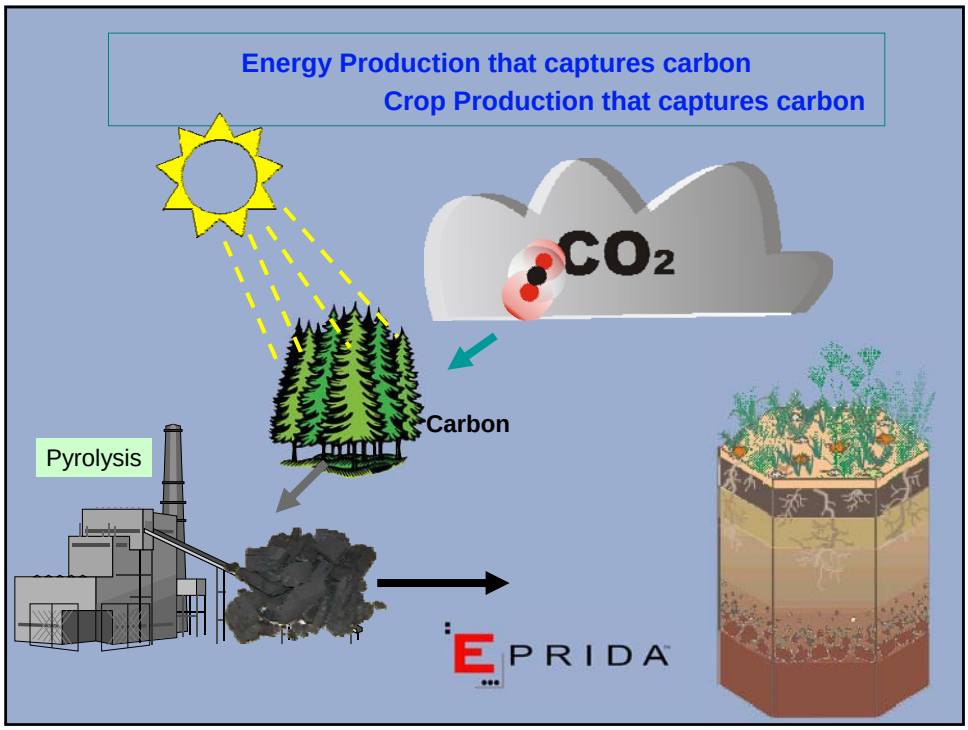


However, if the biomass is converted to **charcoal**, it is extremely stable

Buried in the soil, it can have a 1/2 life of 1000 years.







Burning of biomass,

at best sequesters only 3% of the initial carbon

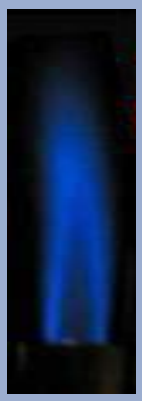
GASIFICATION → carbon neutral
FOSSIL FUELS → carbon positive

Dedicating land to biofuels increases carbon emissions

- **Corn-based ethanol doubles greenhouse gas emissions over 30 years**

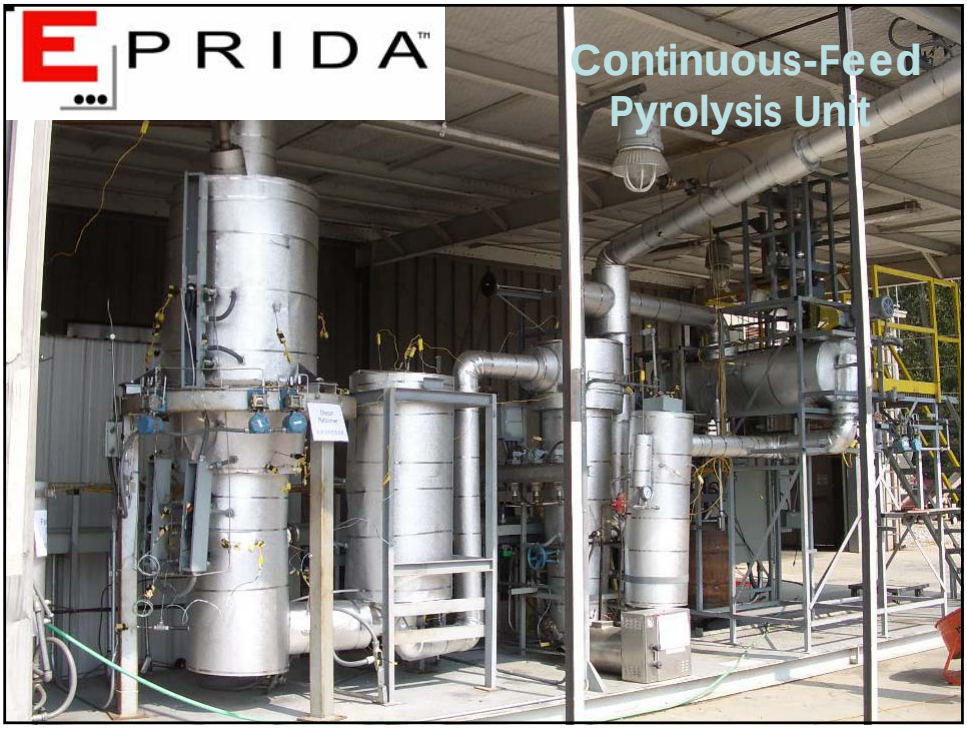
Searchinger et al. 2008, Science

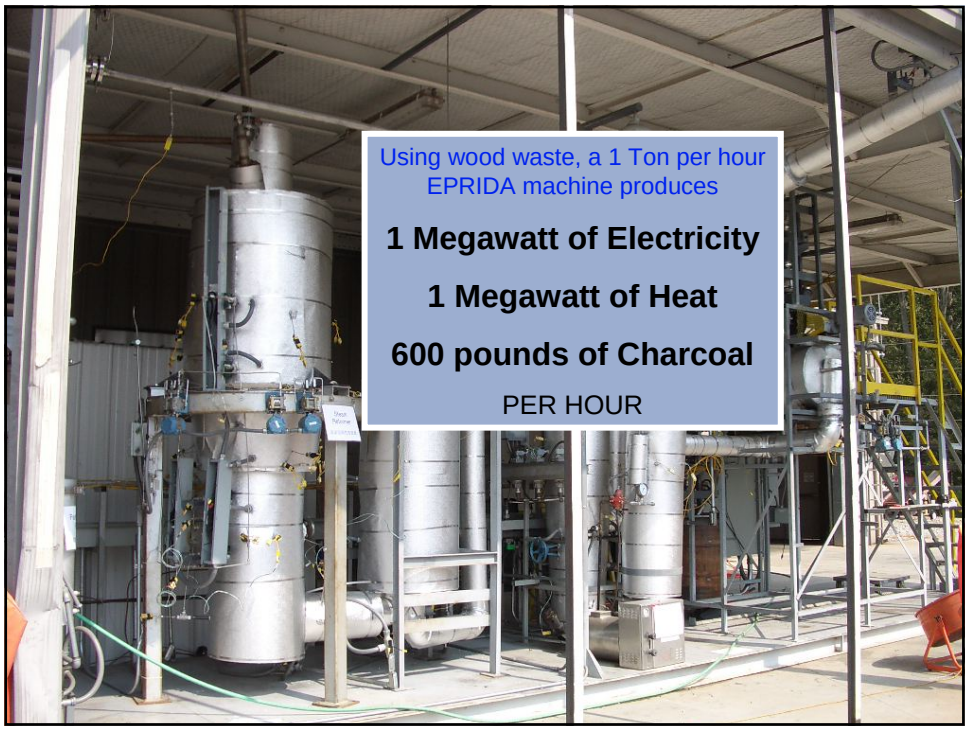
EPRIDA™ **PYROLYSIS**

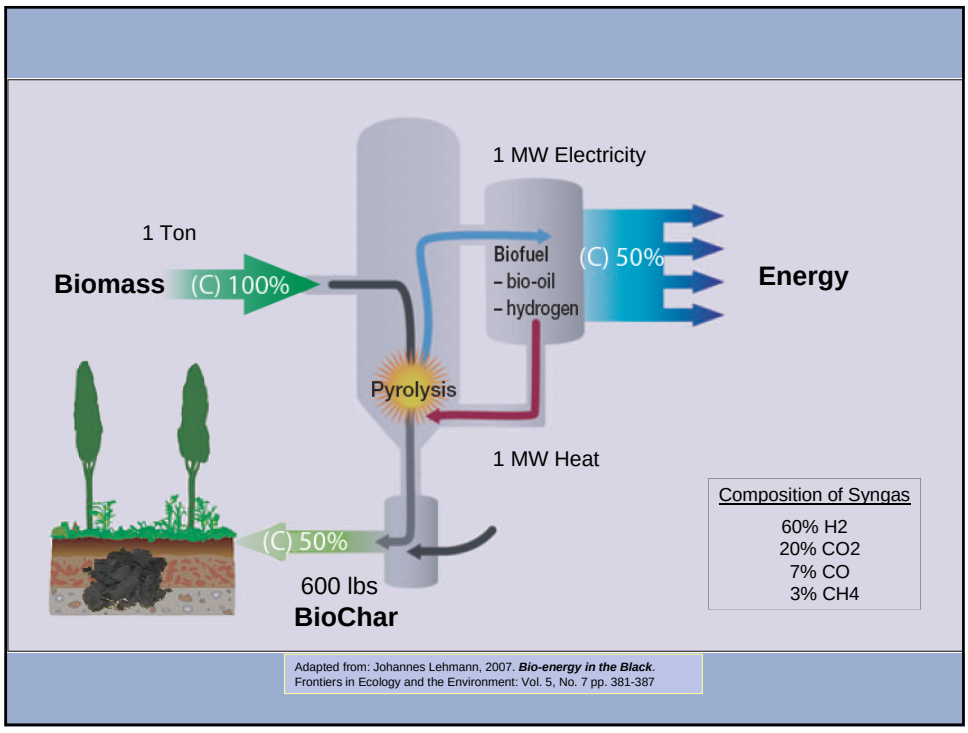


- Sequesters up to 50% of the initial carbon (C) input and returns it to the soil.
- The initial loss of C is used for energy production to offset fuel use.
- Can use agricultural residues but DOES NOT require new crops to be grown to fuel the process

EPRIDA™

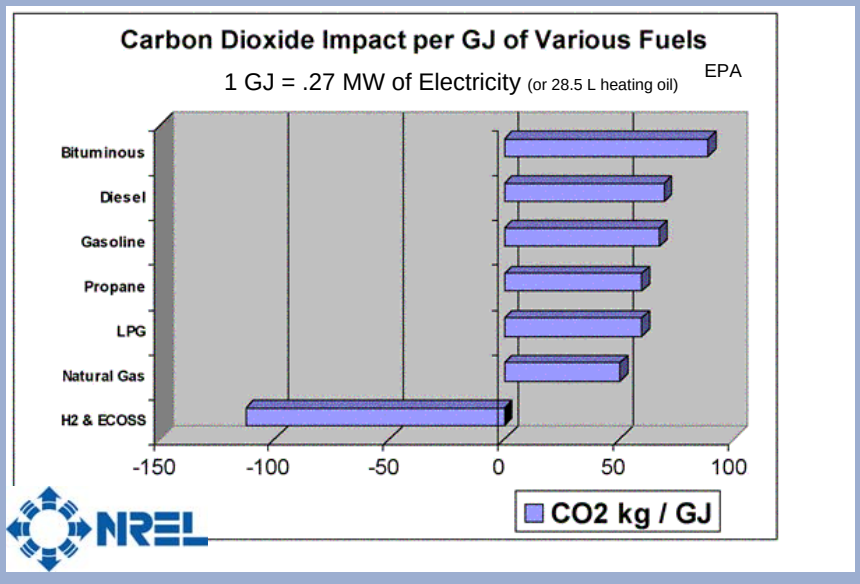



Using wood waste, a 1 Ton per hour EPRIDA machine produces
1 Megawatt of Electricity
1 Megawatt of Heat
600 pounds of Charcoal
PER HOUR


1 MW Electricity
1 Ton
Biomass
(C) 100%
Biofuel
– bio-oil
– hydrogen
(C) 50%
Energy
Pyrolysis
1 MW Heat
(C) 50%
600 lbs
BioChar
Composition of Syngas
60% H2
20% CO2
7% CO
3% CH4
Adapted from: Johannes Lehmann, 2007. Bio-energy in the Black.
Frontiers in Ecology and the Environment: Vol. 5, No. 7 pp. 381-387

CO-PRODUCTS

1. Bio-oils
2. Direct Use - Combustion - Heat / Electric power
3. Syngas - Hydrogen (for Fuel Cells) - Ammonia (for Fertilizer)
4. Synthetic Liquid Fuels
5. Non-Energy products
6. Soil Amendments
7. Carbon Sequestration



For every 1GJ of hydrogen produced and used
112 kg carbon dioxide is utilized and stored in the soil

A Wide Variety of Biomass Can Be Converted Into Biochar

Some Examples:

Peanut Hull Biochar

Pine Chip Biochar

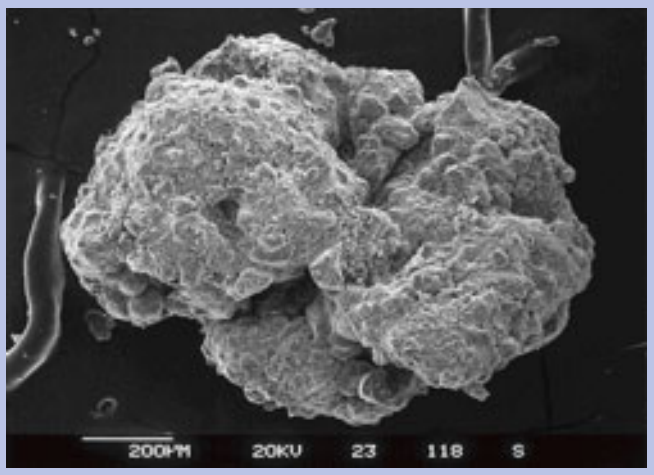
Bamboo Biochar

Corn Stover Biochar

BIOCHAR GRANULES

The Value of BIOCHAR

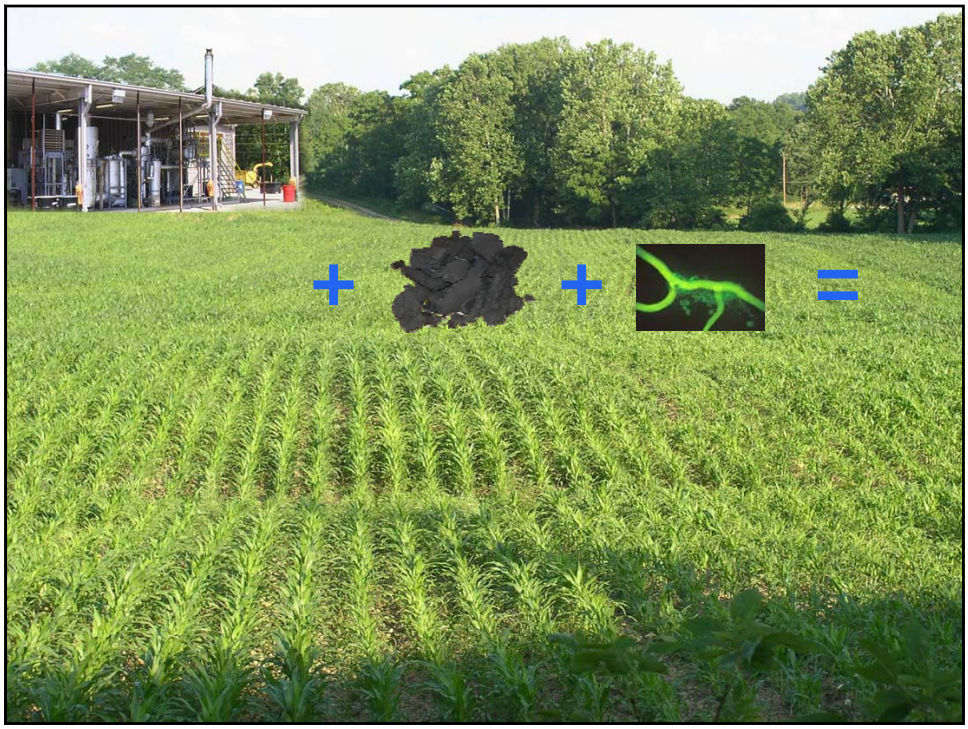
- High Stability
- Increases soil fertility
- Increases nutrient retention, water holding capacity, structural stability, cation exchange capacity
- Increases beneficial soil microorganisms
- Reduces nutrient run off, absorbs ammonia
- Absorbs pesticides & soil toxins
- Acts a carbon sink for atmospheric CO2

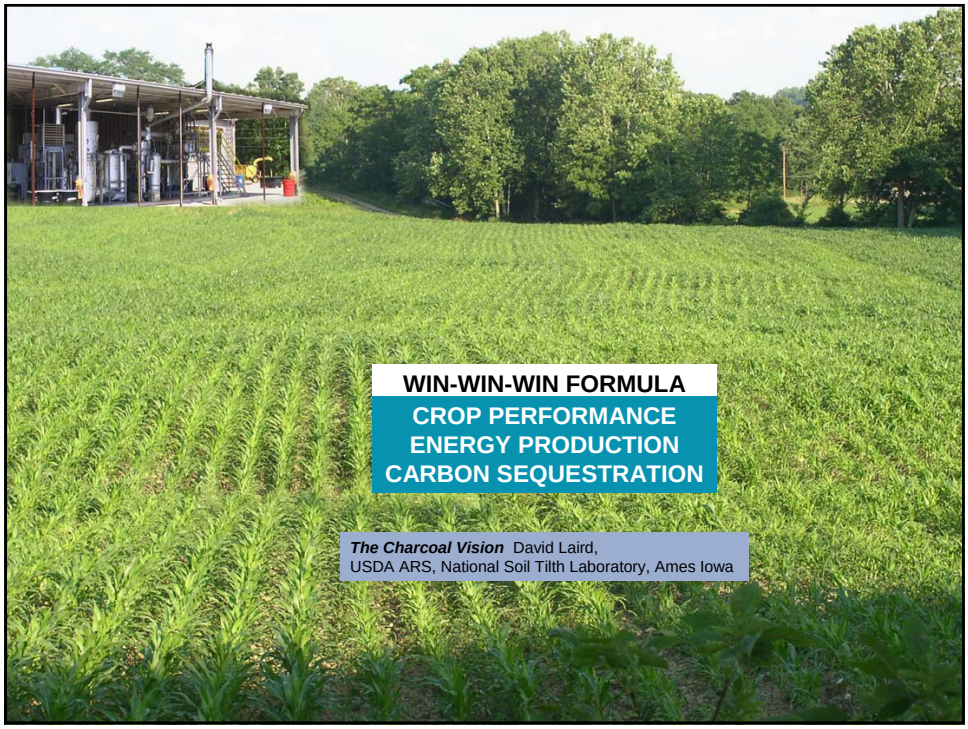


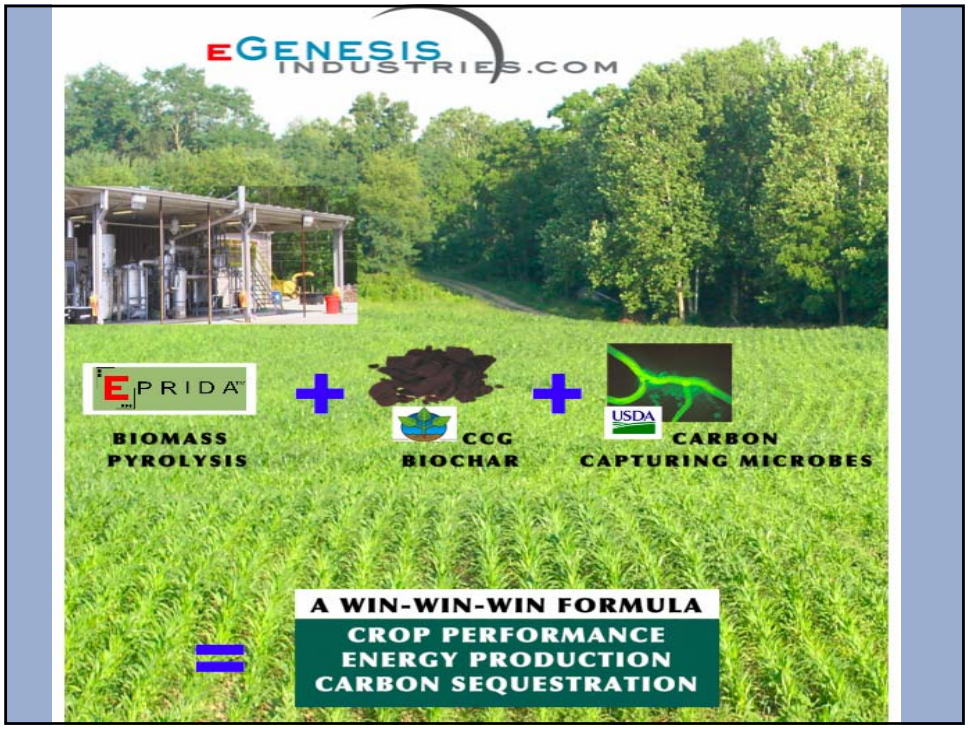
An electron micrograph of soil aggregate, held together by carbon.
Photo: Alex McBratney Professor of Soil Science at the University of Sydney

Source: "Glomalin: Hiding Place for a Third of the World's Stored Carbon"(2002, Kristine Nichols USDA ARS)

Along with Eprida, USDA ARS scientists Don Reicosky and Kristine Nichols have also shown that bio-char has the potential to improve soil carbon sequestration by four-fold through increased macro-aggregate formation and glomalin production (Day, Reicosky, Nichols 2005).




WIN-WIN-WIN FORMULA
CROP PERFORMANCE
ENERGY PRODUCTION
CARBON SEQUESTRATION
The Charcoal Vision David Laird,
USDA ARS, National Soil Tilth Laboratory, Ames Iowa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INDUSTRIES.COM
EPRIDA
BIOMASS
PYROLYSIS
CCG
BIOCHAR
USDA
CARBON
CAPTURING MICROBES
A WIN-WIN-WIN FORMULA
CROP PERFORMANCE
ENERGY PRODUCTION
CARBON SEQUESTRATION