Prairie Love Song Farm, Linwood, Kansas

Making Biochar

in a 55-gallon TLUD

October 2012

In October 2012, I proposed a "Cool-Food" initiative to test a new marketplace label to identify foods grown and marketed by methods that sequester carbon, rather that spewing more carbon into Earth's atmosphere and adding to our already catastrophic climate change. Implementing this requires producing several tons of biochar this winter to spread on a few acres of cropland next spring. I need to upgrade my biochar-making equipment, and then train people to operate this equipment, and make the char.

So, on Friday, October 26, four new friends joined me at Prairie Love Song Farm near Linwood, Kansas to fabricate a new and better 55-gallon burn barrel, and we made two test batches of wood chip biochar. Three had serious interest to develop a business making and selling char.

Making Biochar with a TLUD
get-dirty how-to workshop
9am Saturday, Dec. 1
1pm Sunday. Dec. 9
6pm Monday, Dec. 10
9am Saturday, Dec. 15

The new TLUD barrel burner is an improvement over the crude, rough-cut barrel Brad Rush and I made at 4 Oaks Farm in the winter. Most upgrades were to improve air flow up through the burn barrel, and up the chimney. These were successful, and this new equipment performed significantly better, evidenced by faster, hotter burns, and the gas flare contained inside the chimney.

55-gallon Barrel Burner
with weathered fiberglass insulation

The new barrel has a removable lid, making it easier and faster to load and unload. The one-piece barrel we used at 4 Oaks Farm was loaded through an 8-inch chimney hole in the top, and emptied through the same hole. The lid is permanently attached to the first length of chimney, making it secure against strong winds, safer to remove, with tighter air seal at the lid-chimney junction.

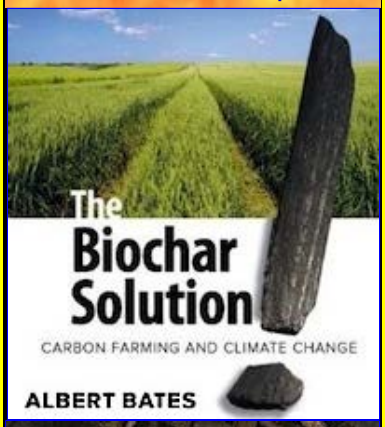
VIDEO: **TLUD 55-gallon Barrel Burner**
with 1-inch ceramic fiber insulation

Instead of three large air intake holes in the burn barrel bottom, over four dozen half-inch holes were drilled. This assures multiple small streams and wider spread of air flow up through the wood chip biomass. This air spread should yield more even, symmetrical burns, and reduce tendency of fire to rush rapidly down one side of the barrel, leaving other feedstock incompletely burned.

1st generation
TLUD
4 Oaks Farm
Topeka, KS
Feb-March 2012

Similarly, at the base of the chimney, a series of half-inch holes were drilled in a staggered row. Hot smoke and gases shoot straight up the chimney. The old chimney had only four large cutouts to add air to super-hot pyrolysis gases, and this resulted in inadequate

BIOCHAR: the story, the source, the miracle, the promise



mixing of air and gases, to cause incomplete combustion of gases in the chimney.

The new chimney has smaller holes spread evenly around. Thus, this more even distribution of air all around the chimney assures more thorough mixing of air with gases, thus more complete combustion inside the chimney.

Air Intakes in Chimney
smaller holes, wider distribution

While this staggered row of air intakes improves the gas flare, further improvements will be installed. One is to tighten the space between holes to make them closer, thus further increase air volume injected.

Another is to add a slotted metal plate "damper" to cause gases to swirl as they go up the chimney, rather than shoot up in a straight line. Forcing gas and air into a vortex flow will increase their more thorough mixing, and thus assure rapid, complete combustion.

Air Intakes in Barrel Bottom
smaller holes, wider distribution

Another approach to create a "swirl chamber" for optimum air-gas mixing is to insert a change in chimney width. A short section of 6-inch stovepipe would then connect the barrel lid to the 8-inch stovepipe, encouraging a venturi effect at the junction.

A third length of stovepipe was added to create a taller chimney and increase the updraft to pull air up through the packed biomass. The difference between two and three stovepipes was very evident, and resulted in a nearly perfect smokeless burn with steady, strong updraft. The gas flare blazing up the chimney was nearly all within the chimney, and few flames were visible above the top.

We didn't have time or tools Friday to wrap the new burner in the 1-inch ceramic fiber insulation. So we continued using the semi-circular wire cages of fiberglass Brad Rush had fashioned in March. Although the fiberglass is partially melted and badly weathered, it reduces heat radiation, and thus increase internal burn temperature. Insulation also creates a comfortable, safe work environment.

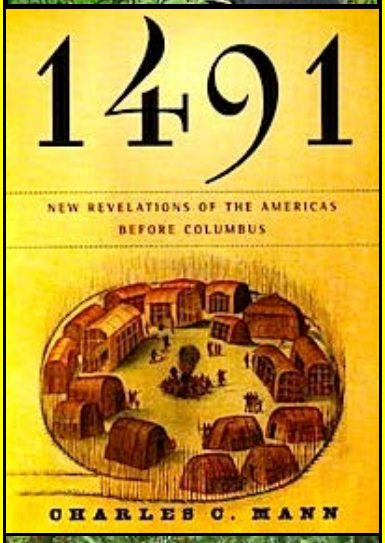
Two Burn Barrels

The next Friday, Nov. 2, with help from Tim, Tiffany and Steve, I wrapped the barrel in 1-inch thick ceramic fiber insulation, which withstands temperatures over 2300 degrees without degrading. This space age thermal material traps even more heat in the barrel to achieve even higher burn temperatures. This should permit 500 degree C burning, to assure thorough removal of tars and resins from the char and chimney.

Ceramic fiber also blocks heat better, keeping external surfaces cooler, focusing heat inside. Even with a red-hot barrel, a bare hand can be comfortably placed on 1-inch ceramic fiber insulation. Insulation will also be added to the barrel lid and the first length of chimney to further contain heat in the burner.

With two burn barrels, work efficiency will improve, since while one barrel is burning, the other can be loaded and lit. My goal is to have six, perhaps eight, burn barrels that are loaded and fired in rapid succession, one after the other. Thus, in a single day, over 100 gallons of char can be producedÑover two full barrels.

Another upgrade is to mount the burn barrel on a stand made from a cut-off barrel end, instead of a few bricks. This allows the burn barrel to be locked firmly, safely securely in place. More important, this allows air intake under the barrel to be



more closely controlled. Regulating air flow is about this only way to control a burnÑin particular to slow it dowm, or even snuff it out.

Barrel Burner Loaded
ready for ignition

Learn to burn carbon-negative
Learn to live in the 21st Century
Co-create a carbon accountable culture