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CHAB Camp: Hands-on Development of "Combined Heat And Biochar" Devices

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Introduction

Society has hundreds of reasonably priced devices that use wood and other biomass as fuel, deliver useable heat, and generate ash. It is proposed that a selection of devices be developed to similarly consume biomass and provide useable heat, while also creating a solid charcoal residue to be used as biochar.

Distributed biochar production by CHAB (Combined Heat And Biochar) devices in affluent and impoverished societies worldwide can make an important contribution to the diverse biochar objectives. Distributed small-scale biochar production is an integral component for spawning the biochar industry, affording individuals in both affluent and impoverished societies the opportunity to interact with biochar on a personal level. This interaction derived from the use of CHAB devices will create an understanding of and appreciation for biochar otherwise unavailable to industry and society.

A weeklong hands-on workshop (not a children's camp) to study and develop CHAB devices was held at the New England Small Farm Institute (NESFI), Belchertown, in western Massachusetts from August 9th-13th, 2010. The two co-authors were the principal organizers of this event. The three criteria for the CHAB devices developed and tested were that they must:

1) generate wood gas, the product of the thermal treatment of biomass, and utilize it in a productive manner,

2) provide for the recovery of biochar, and

3) produce acceptably low emissions for untreated discharge at the intended application or via flues to the outside environment.

Activities and Discussion

The goal of the CHAB Camp was to establish a core set of knowledge about wood gas (pyrolytic gases) generation and utilization, build awareness of the range of CHAB devices and explore their configurations with hands-on tasks and usage. Examples of CHAB devices include cookstoves that use the TLUD (Top-lit Updraft) technology, where biomass is converted to biochar and the wood gas is combusted to provide heat for cooking. Another CHAB configuration is the retort, where biomass is heated in the complete absence of air to create biochar and wood gas, and the wood gas is subsequently combusted for useable heat. An Adam Retort was operated during the camp week. Suitable heat applications for CHAB devices include greenhouse heaters, home furnaces, saunas, and combination cooking/water heaters. Cooking and heat recovery for residential space heat and hot water are the most likely heat applications. Although mentioned and discussed, large and expensive industrial applications for biochar production were beyond the scope of CHAB Camp activities.

In a series of morning study groups, the fundamentals of biomass pyrolysis, biochar characterization, carbonization conditions (those that promote higher performing biochars) and heat capture and transfer were reviewed. Afternoons and evenings were devoted to the design, fabrication and testing of existing and prototype CHAB devices.

Because of their prominence as cookstoves that can be operated for the simultaneous production of a quality biochar and cooking heat, the Top-Lit UpDraft (TLUD) pyrolytic gasifiers received considerable attention. The participation of Dr. Thomas B. Reed (innovator of TLUDs in 1985) provided an extremely valuable resource in both morning lectures and afternoon development sessions. The sequentially separated two stages (pyrolysis and char-gasification) of TLUD devices permit the biochar removal when the pyrolysis front reaches the bottom of the fuel stack and before excessive char-gasification occurs.

CHAB performances, both in terms of heat recovery and biochar properties, were measured and evaluated. The highlights of the actual units developed and their performance are reported for the first time at the IBI

Conference in Brazil, including a short video segment.

Conclusions

CHAB Camp is occurring when this expanded abstract is submitted. Fifteen people (including chemical engineers, international development practitioners, graphic designer, MBA candidate, masonry stove builder, and organic farmers) are attending, with larger numbers at the two demonstration events on Tuesday evening and Friday. Many participants are active “Stovers” (advocates and developers of improved cookstoves for Developing Societies) who shared experiences and collaborated to create stove solutions. This aspect is similar to “Stove Camp” held each summer in Oregon, USA, except that the only stoves being discussed at CHAB Camp are the ones that can produce biochar, namely TLUDs and retorts. Two persons who attended both camps this year noted the high value of both events.

The networking aspect of CHAB should not be overlooked. As people come together across disciplines, ideas are created and discoveries made through reframing arguments and explanations for a new and different set of ears and eyes. Relationships are forged that have far reaching value, as new initiatives are born and ideas hatched.

It is anticipated that CHAB Camp will become an annual event, allowing continued evolution of simple, inexpensive and accessible CHAB devices. Persons interested in organizing CHAB Camps in other locations are encouraged to contact the authors.

Reference Link for Further Info

The New England Small Farm Insititute (NESFI) is the central contact point for CHAB Camp information: www.smallfarm.org