Rice Straw to Biochar

Case Description

Agri-residue management became a major agricultural as well as societal challenge across the north-western agrarian states with whole Indian Gigantic Region facing the consequences like hazardous levels of air pollutants due to the intensive paddy straw burning in months of October-November. The quantum of problem is such that there is a need of multiple solutions both in-situ and ex-situ working at scale. This presents an opportunity to scale solutions which not only reduces burning issue presently at hand but also improves long term agricultural sustainability. Biochar is one such product which can be applied back to the field to improve the soil quality and reduce dependence on chemical fertilisers.

Biochar is a carbon rich material made by thermal decomposition of waste biomass at elevated temperatures in an inert atmosphere. The use of biochar has been accepted across the world as a sustainable approach to improve soil quality and remove heavy-metal pollutants from the soil. Biochar contains organic matter and nutrients, its addition increased soil pH, electric conductivity (EC), organic carbon (C), total nitrogen (TN), available phosphorus (P), and the cation-exchange capacity (CEC) of soil which improves soil quality by reducing toxicity, improve transport and fate of various heavy metals in the soil due to improved soil absorption capacity.

The process of making biochar also leads to emission which necessitates constant process optimisation for minimal emissions. Takachar developed and patented the design of small-scale, low-cost, portable equipment based on novel thermo-chemical process to convert waste biomass into biochar (used as solid fuel, fertilizer, and other specialty chemicals). This reactor reduces overall emissions by up to 95% as compared to open burning. The reactor is designed to work in mobile mode converting waste paddy residue to biochar from one farm to another. This system is more profitable as it reduces the logistics cost of hauling loose, wet, and bulky biomass. Biochar stores carbon in the soil for hundreds to thousands of years and thus, the level of greenhouse gases like CO_2 and CH_4 can be reduced significantly from the atmosphere. This solution is profitable to make economic use of these biomass, while reducing carbon emissions and air pollution.

Details of Business Model

One version of model is already deployed in Kenya and currently pilot plant of Takachar is being deployed in field in Rohtak, Haryana, where biochar is produced from the paddy residue. Trial for the application of biochar in paddy crop is under way with almost 40 farmers in two geographies Rohtak and Fatehabad to assess the impact of biochar application on productivity and soil quality.

Details of deployed reactor which is a follows:

- Reactor Capacity: 100 kg biomass/hour
- Bio-Char conversion ratio: 1:0.4
- Power Requirement: 400 W (currently being met by solar panels)

Impacts

- Biochar stimulates soil fertility and improves soil quality by increasing soil pH, the ability to retain moisture, attracting more useful fungi and other microbes, improving the ability of cation exchange, and preserving the nutrients in the soil.
- Biochar increases the availability of C, N, Ca, Mg, K, and P to plants as it absorbs and slowly releases fertilizers. It also adsorbs pesticides, nutrients, and minerals in the soil, preventing the movement of these chemicals into surface water or groundwater and the subsequent degradation of these water from agricultural activity.
- Biochar remains stable in the soil achieving long term carbon sequestration.
- Eliminates more than 95% of smoke compared to open biomass burning.
- Increases the net income of rural communities by 40% by creating a market for crop residues.

Innovation

- This model is developed to work in mobile mode where the reactor can be attached to tractor and work from field-to-field converting residual straw to biochar which can be utilized as soil conditioner.
- The technology is highly replicable with 8-10 reactors per village converting paddy straw across the village into biochar.

About Pioneer

Website: https://www.takachar.com/

Email: vidyut@takachar.com

Geography

Dhaman Village, Rohtak, Haryana, Punjab