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Engineering Intervention for Resolving Crop Residue Burning Issues

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Abstract—*Crop residues are the parts of plants left in the field after the crops have been harvested and thrashed. Crop residues are good sources of plant nutrients, are the primary source of organic material added to the soil, and are important components for the stability of agricultural ecosystems. Crop residue is not a waste but rather a tremendous natural resource. About 25% of nitrogen (N) and phosphorus (P), 50% of sulphur (S), and 75% of potassium (K) uptake by cereal crops are retained in crop residues, making them valuable nutrient sources (Cannell, 2003). Leaving crop residue on the soil surface year around, before and after planting provides soil surface protection at critical times to protect the soil against wind and water erosion. Reducing tillage operations improves soil surface properties, including improved soil aggregation accounting for increased infiltration and percolation; less compaction due to less usage of field implements; and more biological activity due to an increase in organic matter. Adding soil surface cover increases water infiltration, reducing soil drying and maintains more moisture for crop utilization.*

The burning of paddy and wheat fields causes a huge loss of precious nutrients and pollutes the environment. The heat generated by burning paddy straw kills useful microbes in the soil, leading to poor soil health and loss of fertility. The authorities should enact a law prohibiting the burning of crop residue as there is no specific law thus far. Stringent punishment and heavy penalty for violators and disconnection of electricity supply to the tube wells of the farmers who burn their own fields after the crop would help curb this practice.

Complete retention of crop residues at the soil surface by using zero or reduced tillage systems. Successive crops can be sown using zero-tillage after straw is left on the soil surface. In areas where there is high demand for animal feed, controlled grazing may be permitted or a percentage of the crop residues are removed from the field for feed or silage. An adequate amount of residue must be left on the field to provide soil surface protection. The crop residues can be gainfully utilized for livestock feed, composting, power generation, bio-fuel production and mushroom cultivation besides several other uses like thatching, mat-making and toy making. Conversion of ligno-cellulosic biomass into alcohol is of immense importance as ethanol can either be blended with gasoline as a fuel extender and octane-enhancing agent or used as a neat fuel in internal combustion engines. Theoretical estimates of ethanol production from different feedstock (corn grain, rice straw, wheat straw, bagasse and saw dust) vary from 382 to 471 ton of dry matter. Bio-oil can be

produced from crop residues by the process of fast pyrolysis, which requires temperature of biomass to be raised to 400-500 ^{0}C within a few seconds, resulting in a remarkable change in the thermal disintegration process (Ritcher, 2004). The crop residues can be used in the gasifiers for 'producer gas' generation. One ton of biomass can produce 300 kWh of electricity (Choudhary et al,. 2003). The gasification technology can be successfully employed for utilization of crop residues in the form of pellets and briquettes. The generated 'producer gas' is cleaned using bio-filters and used in specially designed gas engines for electricity generation. Biochar is a high carbon material produced through slow pyrolysis (heating in the absence of oxygen) of biomass. It is a fine-grained charcoal and can potentially play a major role in the long-term storage of carbon in soil, i.e., C sequestration and GHG mitigation (Schils et al., 2005). The process of bio-methanation utilizes crop residues in a non-destructive way to extract high quality fuel gas and produce manure to be recycled in soil. Biomass such as rice straw can be converted into biogas, a mixture of carbon dioxide and methane, which can be used as fuel.

Keywords: Gasification, Biochar, Bagasse, Biomass, Crop residue.

References

Choudhary S.K and Lovely D.R., Electricity Generation Cells, Biotechnol, 21, 1229-1232 (2003).

Cannell, M.G. R. (2003). Carbon sequestration and biomass energy offset: theoretical potential and achievable capacities globally in Europe and the UK. Biomass and Bioenergy, 24, 97-116.

Ritcher, B. (2004). Using ethanol as an energy source. Science, 305-340.

Schils, R. L. M., Verhagen, A., Aarts, H. F. M., Sebek, L. B. J., (2005). A farm level approach to define successful mitigation strategies for GHG emissions from ruminant livestock system. Nutrient Cycling in Agro-ecosystems, 71, 163-175.

US-EPA (2006). Global Anthropogenic Non-CO2, Greenhouse Gas Emissions: 1990-2020. United States Environment Protection Agency.