Improving Agricultural Water Sustainability and Resilience Using Agricultural-Waste-Derived Soil Amendments

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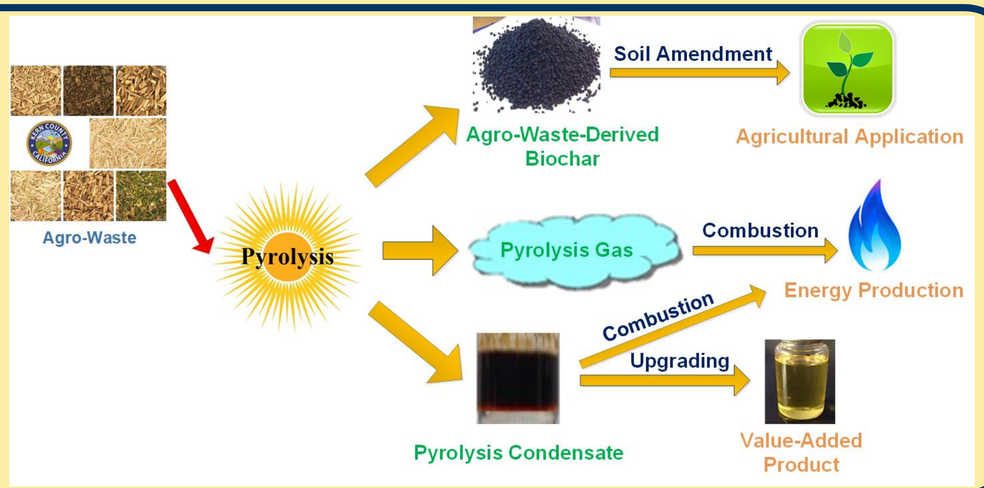
Research Background

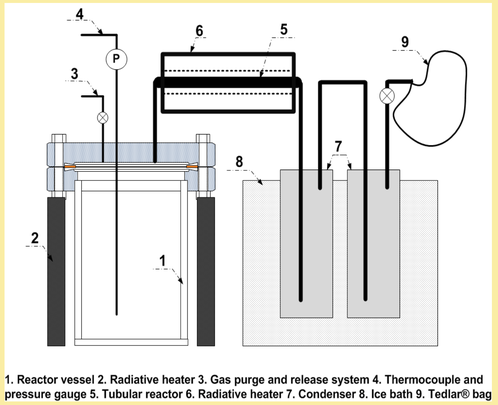
Pyrolysis is a commercialized thermochemical technology for energy and resource recovery that converts carbonaceous materials to biochar, bio-oil, and pyrolysis gas (py-gas). Bio-oil and py-gas can be burned to provide the energy required by the process itself. Biochar is widely recognized as a good soil amendment to enhance retention of moisture and nutrients due to its porous structure. In order to increase the soil water retention capacity and improve the soil microbial communities during the drought season in California, using soil amendments such as biochar is a proved method to promote resilience to climate-related impacts such as heat waves.

In this study, the major types of agricultural waste generated in California were first converted to biochar via pyrolysis. Then the beneficial effects and the plant growth-promoting properties of agricultural-waste-derived biochar were evaluated systematically. Beneficial effects on the soil were scored through measurement of pH, moisture retention and microbial activity. The plant growth-promoting properties were scored by measurement of the root and shoot biomass (fresh and dry weight), the root-to-shoot ratio and the photosynthetic capacity of plants grown in amended versus non-amended soil.

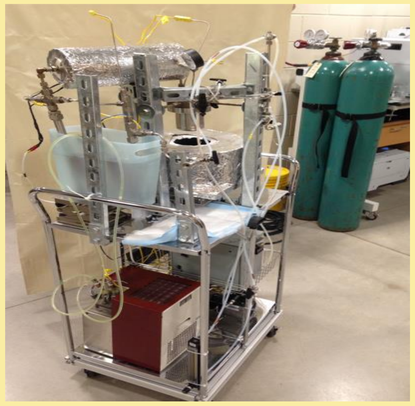
Pyrolysis of Agricultural Wastes



Experimental setup



1. Reactor vessel 2. Radiative heater 3. Gas purge and release system 4. Thermocouple and pressure gauge 5. Tubular reactor 6. Radiative heater 7. Condenser 8. Ice bath 9. Tedlar® bag

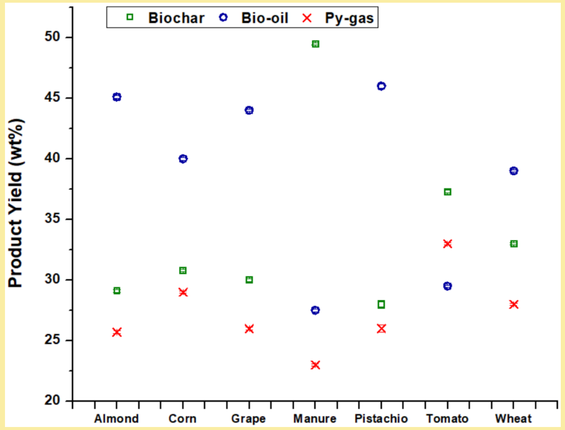


Preliminary Results

Agro-Wastes in Kern County

Agro-Waste-Derived Biochar

Pyrolysis Product Yields



Comparison between w/ and w/o Biochar

Acknowledgements

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