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Alteration of biochar characteristics through Post Production Treatments

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The application of pure, untreated biochar to temperate soils does not lead to substantial increase in soil fertility and plant growth. Moreover, the application of 10 tonnes or more of biochar per hectare is not economically viable on most farms. To be more efficient in improving soil fertility, increasing SOM and ecosystem services, new methods of using biochar in farm settings need to be developed.
To improve the effect of biochar on plant growth, biochar can be enhanced by (1) adding nutrients, (2) inoculating it with beneficial microorganisms, (3) improving its surface reactivity and thus its sorption dynamic, (4) increasing its porous volume, and/or (5) fostering the creation of biochar-mineral-organic complexes. These supplementary biochar enhancements can be achieved through different methods of feedstock blending and biochar post-production treatment which can be classified according to the resulting surface alteration of biochar:
1. Addition of nutrients, MOs, minerals in liquid solution which get soaked into the biochar pores without or with only slight surface alteration, resulting in enriched biochar.
2. Physico-chemical activation (treatment with acids, vapours, toasting with minerals . . .) resulting in alteration of the surface, pore volume and functional groups.
3. Bio-chemical activation through the interaction of biochar with organic compounds, minerals, nutrients and microorganisms in a biological very active environment, resulting in the complexation of biochar, minerals and organic compounds.
Whereas physico-chemical activation is a highly technical process and has to be done by professional biochar producers, bio-chemical activation and enrichment can be done very efficiently by the farmer himself. On-farm enrichment and activation of biochar help to close the organic nutrient cycles of the farm, improving agronomic system efficiency and thus becoming economically viable. Adding biochar to highly labile organic matter like manure, sludge or compost improves decomposition and complexation, and helps to stabilize their nutrients and carbon. The combination of biochar and lacto-acid-bacteria in silage, feed, bedding and liquid manure treatment decreases methane and ammonia emissions, increases the feed-energy balance, and boosts animal health. On every step of this cascading use of biochar in animal husbandry, the biochar becomes more oxidized, more activated and more enriched with nutrients. When finally applied to the soil, biochar acts as carrier for nutrients and thus works to improve soil fertility.

Much more research is needed in the field of biochar post-treatment and into each of the different possible farm uses. Nevertheless, sufficient serious research has already been done and published, enabling us to judge the importance of post-treating biochar to improve its agronomic performance and value.