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Abstract.

Biochar is a co-product of the bioenergy pyrolysis process during which biomass is pyrolized in low-oxygen to zero-oxygen environments resulting in carbon-rich, recalcitrant charred organic matter. Many studies have shown biochar amendments to suboptimal field soils increase soil function by enhancing chemical and physical soil properties contributing to soil fertility. Our research aims to address a presently novel area of biochar research. The amount of current biochar knowledge that is applicable within the context of native plant container nursery seedling production is sparse. One material showing promise as a replacement for peat and perlite is biochar.

We conducted a greenhouse study to examine the effects of biochar on the growth of 4 western Montana native plant species: deerhorn clarkia (*Clarkia pulchella* Pursh.), common blanket flower (*Gaillardia aristata* Pursh.), ponderosa pine (*Pinus ponderosa* Doug.), and Idaho fescue (*Festuca idahoensis* Elmer). All four species were propagated from seed with biochar amending and displacing the standard soilless nursery media (3:1:1 ratio of peat, perlite and vermiculite) at rates of 0%, 15%, 30%, and 45% (percent volume composition). Species were divided into short and long season crops and grown for either 12 weeks (*Clarkia* and *Festuca*) or 26 weeks (*Gaillardia* and *Pinus*). We investigated effects on plant growth by quantifying biomass (total, root and shoot), final growth (height, leaf count or bunch diameter), root:shoot, final foliar nutrient concentrations (N, P, and K) and chemical substrate properties, pH and EC. The goal of the study was to better inform nursery practitioners of the potential for biochar application in nursery media for native plant propagation.

For *Clarkia pulchella*, biochar treatments yielded no significant effects on plant growth or chemical substrate response variables. For *Festuca idahoensis*, significant treatment effects were found for the following response variables: log mean root biomass, log mean total biomass and mean bunch diameter. Specifically, the control treatment group yielded grasses with significantly greater root biomass than all of the other biochar treatment groups. Also, the control treatment yielded bunchgrasses with significantly greater final total biomass than the 15% and 30% biochar treatments. With regard to mean bunch diameter, the control treatment produced seedlings with significantly greater mean bunch diameters than the 30% and 45% treatment groups. For *Gaillardia aristata*, statistical analysis found significant treatment effects for the chemical substrate pH variable. Specifically, the control treatment had significantly higher media pH than the 30% and 45% biochar treatment groups. For *Pinus ponderosa*, the 30% biochar treatment group produced seedlings that were significantly taller than all of the other biochar treatment groups. The control treatment also produced final media pH that was significantly greater than the 45% treatment group.

Biochar utilization stands to markedly alter plant propagation in soilless growing substrates, and potential exists to alter standard nursery practice from its current state to a more

sustainable operation. Our study findings indicate replacing non-sustainable growing substrate components with biochar is possible, particularly with Rocky Mountain native plant species such as *Clarkia pulchella* and *Pinus ponderosa*. Biochar amendments to standard growing substrates may even prove beneficial when propagating *Pinus ponderosa* seedlings in container nurseries. Comparable to many biochar studies, effects on plant growth and chemical substrate properties are biochar, species and substrate specific. Additional and replicate studies are warranted to fully assess biochar's potential utility in native plant nurseries.