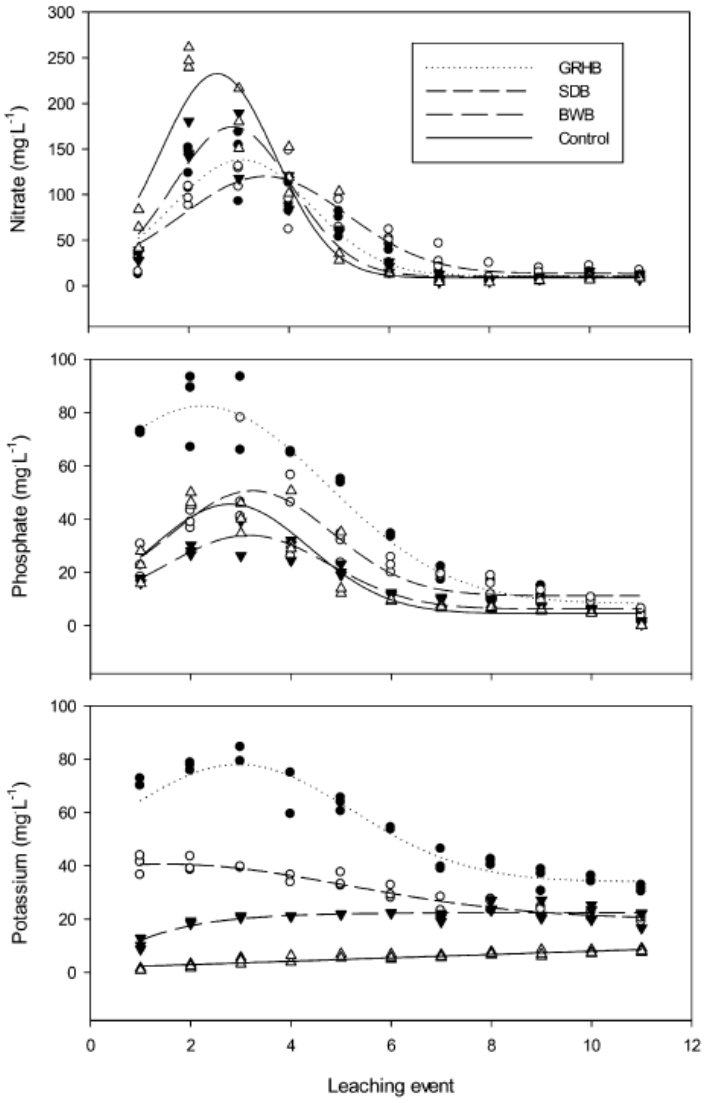
Effect of Biochar Type on Macronutrient Retention and Release from Soilless Substrate

Biochar is the charred organic matter that remains after pyrolysis of biomass or manure. The influence of biochars on soilless substrates used in greenhouse and nursery containers has not been studied adequately. previous studies indicates benefits in soilless substrates including additions of some nutrients, reduction in leaching of nitrates and phosphates, beneficial shifts in microbial populations, and improved physical properties. The objective of this research was to determine the influence of three different biochar types on nitrate, phosphate, and potassium retention and leaching in a typical greenhouse soilless substrate.

A commercial substrate composed of 85 sphagnum peatmoss : 15 perlite (v:v) was amended with 10% by volume of three different biochar types including: gasified rice hull biochar (GRHB), sawdust biochar (SDB), and a bark and wood biochar (BWB). The non-amended control substrate, along with the amended substrates were each packed into three columns. Columns were drenched with 200 mL of a 100 mg·L^{-1} nitrate nutrient solution and leached with 60 mL of water. Collection of leachate was done 11 times over the course of 16 days to determine the impact of biochar on nutrient retention and leaching.

Nitrate release curves were exponential and peaked lower, at later leaching events, and had higher residual nitrate release over time with each biochar amendment (Figure 1). The impact of biochar amendment on phosphate retention and release was more variable. The GRHB was a net source of phosphate, providing more phosphate to the system than the fertilizer application and hence obscuring any retention and release effect it might have. Potassium release varied by amendment type within each experiment, but within each amendment type was relatively consistent. All biochar types were a source of potassium, with GRHB providing more than SDB, but both providing far more potassium than the fertilizer event. The BWB amendment resulted in more leached potassium than the control substrate, but relatively little compared with GRHB and SDB amendments.

Figure 1. Nitrate, phosphate, and potassium leaching from 85:15 sphagnum peat:perlite substrates amended with GRHB, SDB, BWB, or a non-amended control.



	GRHB		SDB		BWB	
Sieve size (mm)	Percent sample	SD	Percent sample	SD	Percent sample	SD
<0.106	25.8	1.3	28.8	0.7	0.5	0.1
0.106	20.2	0.9	17.0	0.5	4.1	0.3
0.18	13.9	0.1	11.5	0.2	30.2	1.4
0.25	15.5	0.3	12.8	0.2	42.3	0.1
0.35	12.1	0.5	11.1	0.4	17.9	1.2
0.5	9.5	1.0	9.0	0.4	4.6	0.6
0.71	1.9	0.3	3.8	0.2	0.3	0.1
1	0.5	0.1	2.2	0.2	0.0	0.0
1.4	0.5	0.1	2.0	0.1	0.0	0.0
2	0.1	0.1	1.2	0.1	0.0	0.0
2.8	0.0	0.0	0.4	0.2	0.0	0.0
4	0.0	0.0	0.0	0.0	0.0	0.0
6.3	0.0	0.0	0.1	0.1	0.0	0.0

Table 1. Particle size distribution of gasified rice hull biochar (GRHB), sawdust biochar (SDB), and bark and wood biochar (BWB) before amendment in a greenhouse substrate (n =

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