



Effects of Flashed Carbonized[©] Macadamia Nutshell Charcoal on Plant Growth and Soil Chemical Properties

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Terra Preta (Amazonian Dark Earths): Highly Fertile Anthropogenic Soils



Picture source: <http://www.gerhardbechtold.com/TP/gbtp.php>



Photo source: University of Bayreuth

Terra Preta Soil



Photo source: University of Bayreuth

Typical Upland
Amazonian Soil

Effect of Charcoal on Plant Growth



Photo source: <http://tinselwing.wordpress.com/tag/terra-preta/>

Charcoal Additions

No Charcoal Additions



Objective:

To demonstrate the effectiveness of charcoal additions on plant growth in two Hawaiian soils

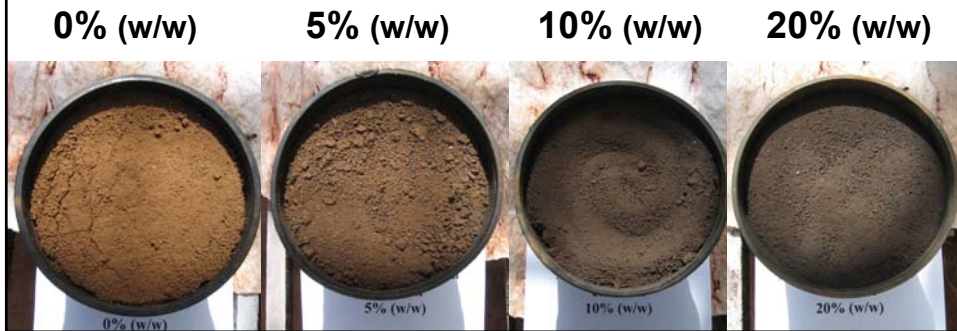


Flash
Carbonized[®]
Charcoal

Hawaii Natural
Energy Institute

Materials and Methods

- Cultivated fertile, volcanic ash soil (Waimea Series)
- Flash Carbonized © macadamia nutshell charcoal
- Lettuce
- 4 treatments, 3 replicates



Results

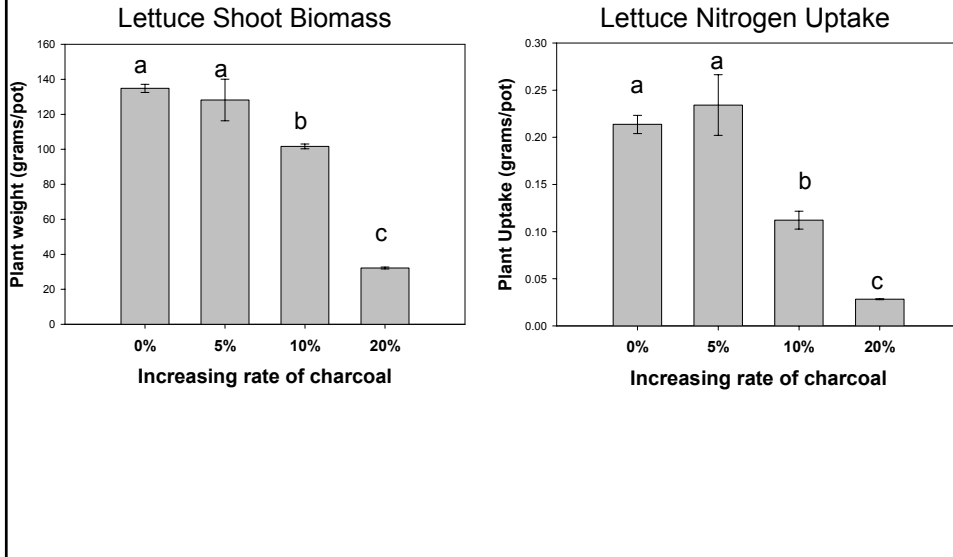


- With no charcoal additions

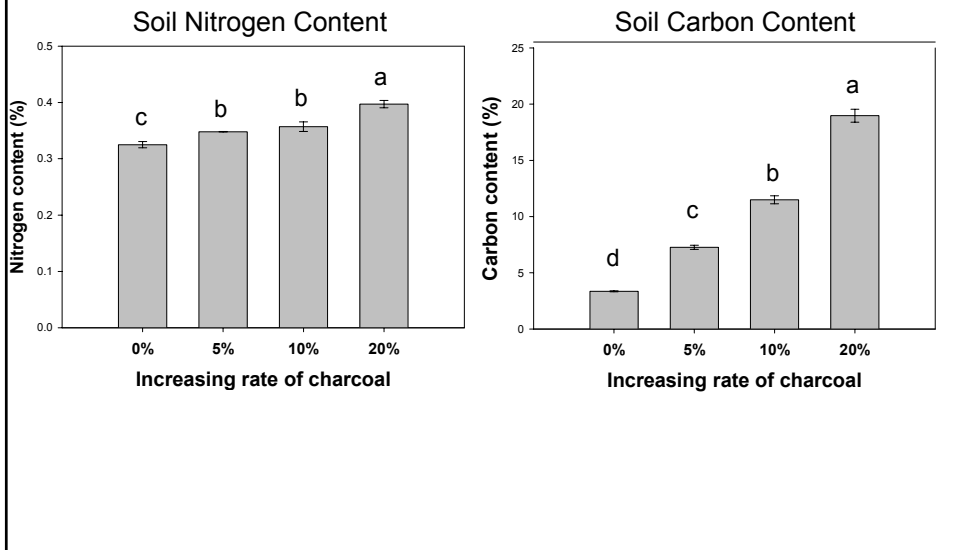


- With 20% (w/w) charcoal addition

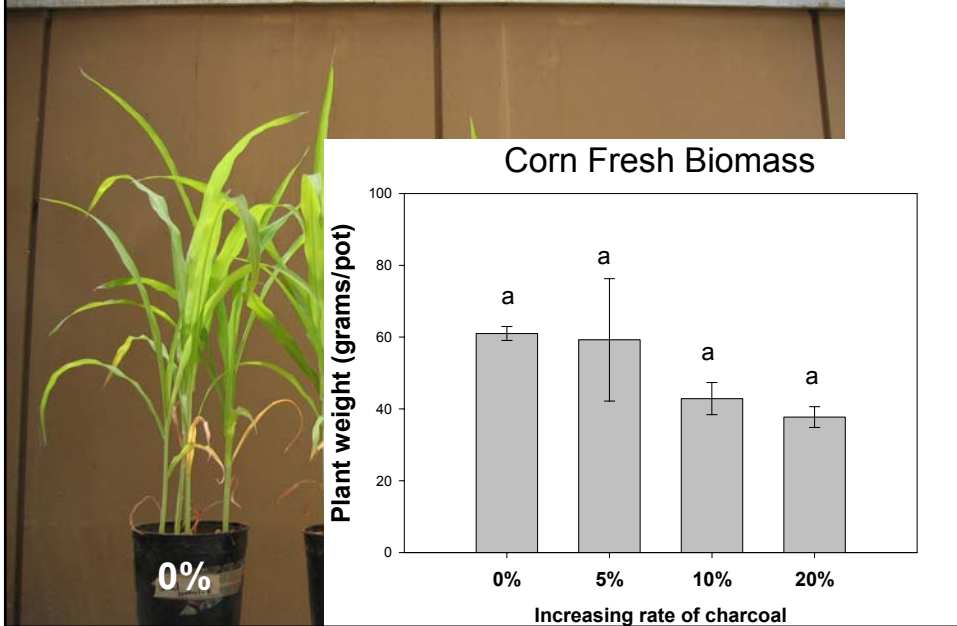
Plant Effects



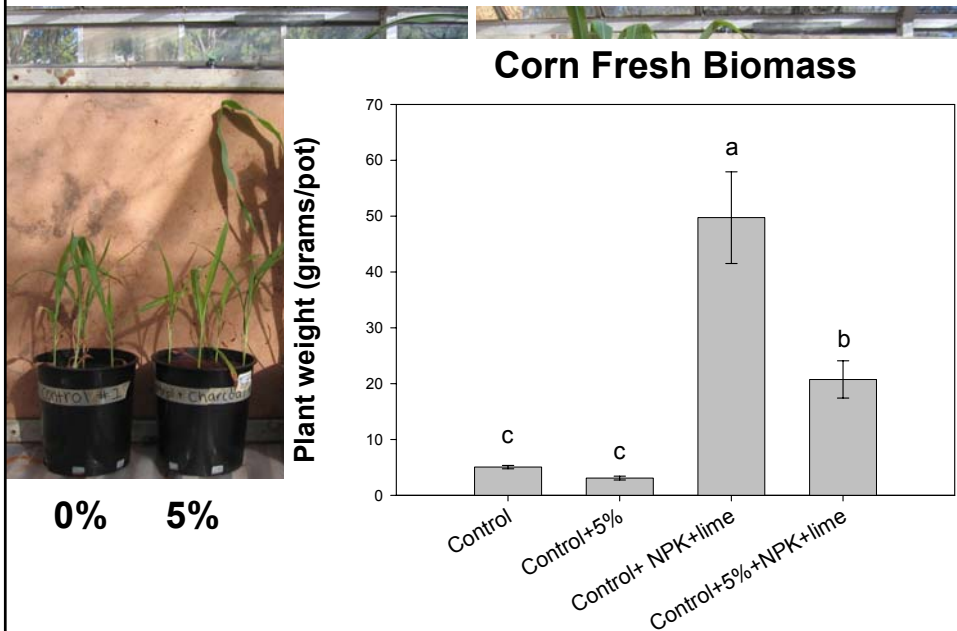
Soil Effects



Corn Experiment



Charcoal Effect in an Infertile Soil



Preliminary Conclusion:

Charcoal used in the experiment caused a negative effect on plant growth

But why?

- Crop?
- Soil??
- Charcoal???

• **Volatile Matter (VM) content**: a measure of the susceptibility of charcoal to further decompose and form carbon when heated

Charcoal Behavior Upon Wetting

Water Repellency



22.5% VM Content

Water Absorption



6.3% VM Content

Hypothesis:

The volatile matter content of charcoal affects its value as a soil amendment

Uneven Infiltration



Soil with High VM Charcoal

Uniform Infiltration



Soil with Low VM Charcoal

Materials and Methods

- More degraded tropical soil (Leilehua Series)
- High (22.5%) and low (6.3%) volatile matter content charcoal
- Corn
- 5 treatments, 3 replicates
 - control
 - control + 10% (w/w) high volatile matter charcoal
 - control + 10% (w/w) low volatile matter charcoal
 - control + lime + NPK
 - control + 10% (w/w) low volatile matter charcoal + lime + NPK



0% (w/w)

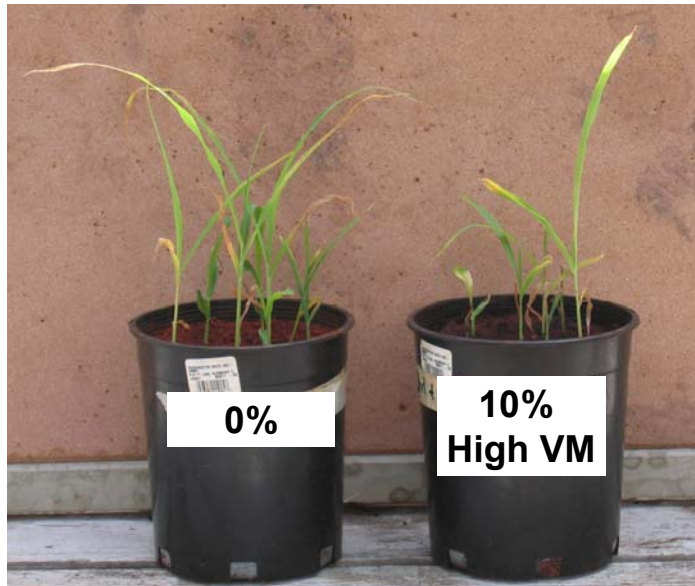


10% High VM

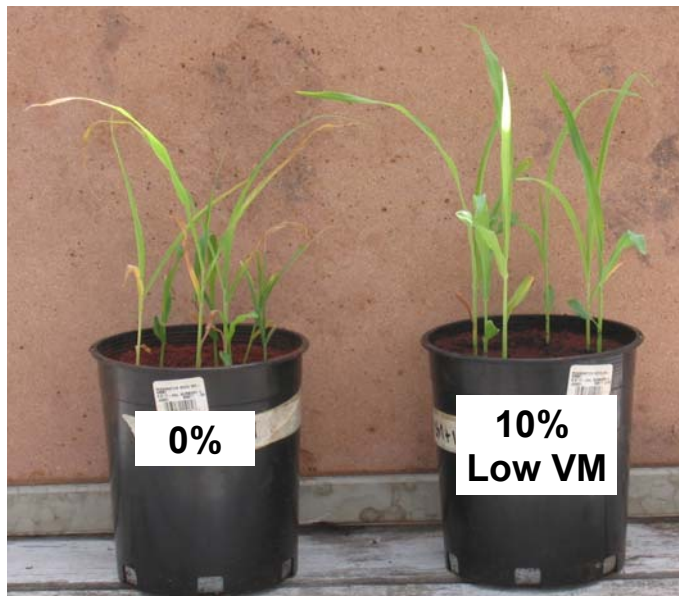


10% Low VM

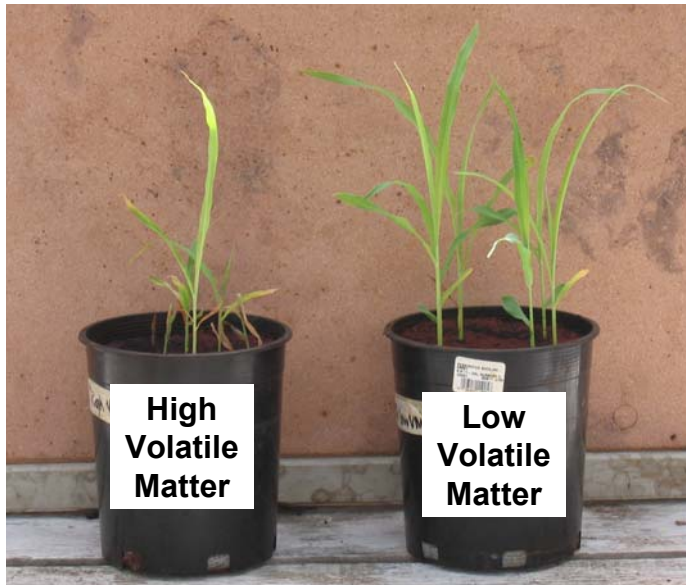
Effect of High Volatile Matter (22.5%) Charcoal on Plant Growth



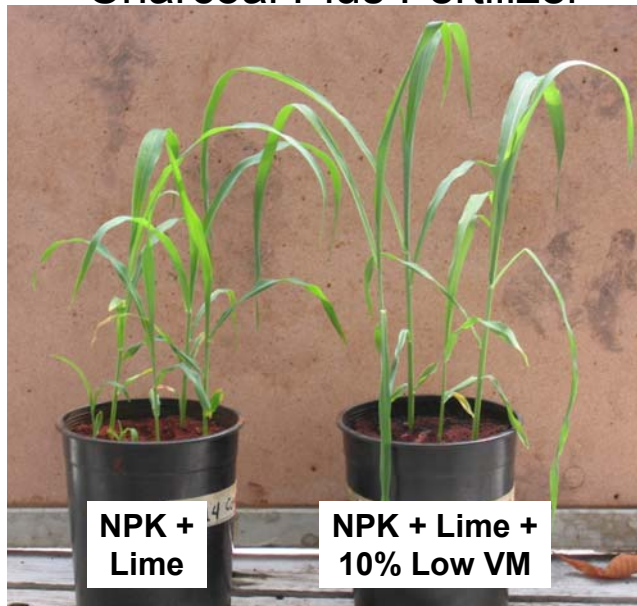
Effect of Low Volatile Matter (6.3%) Charcoal on Plant Growth

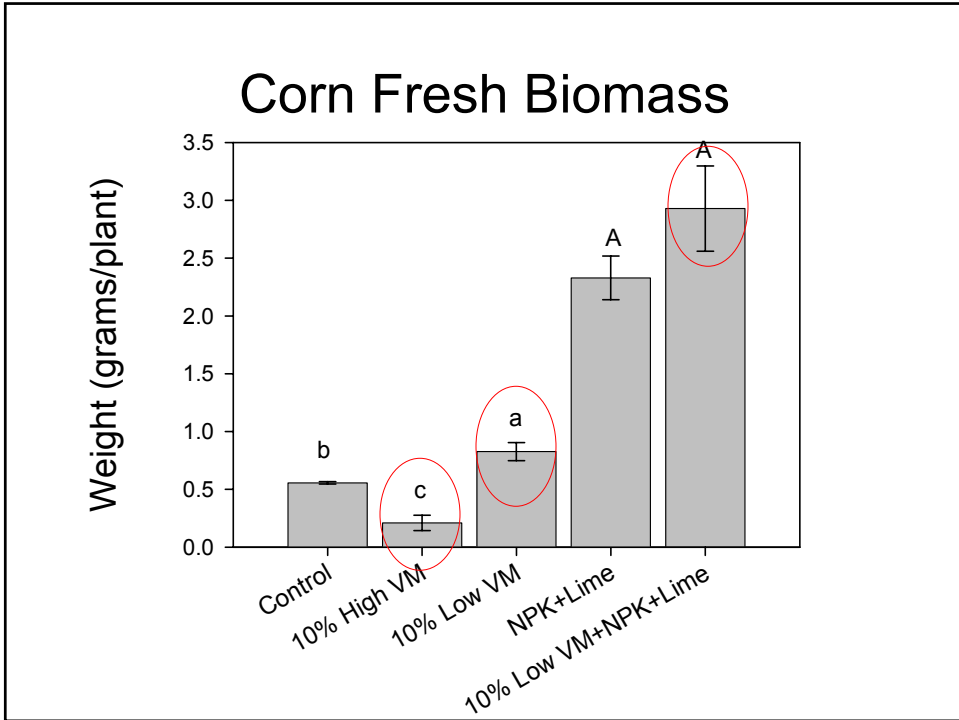


Low Volatile Matter Charcoal (6.3%) versus
High Volatile Matter Charcoal (22.5%)



Combined Effect of Low Volatile Matter
Charcoal Plus Fertilizer





Conclusions

High volatile matter content charcoal has a detrimental effect on plant growth

BUT!

Low volatile matter charcoal may have a beneficial effect on plant growth, especially when combined with fertilizer

What type of charcoal are you adding to your soil?



Volatile Matter: 36.4%

OR



Volatile Matter: < 4.5%

Acknowledgments

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