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

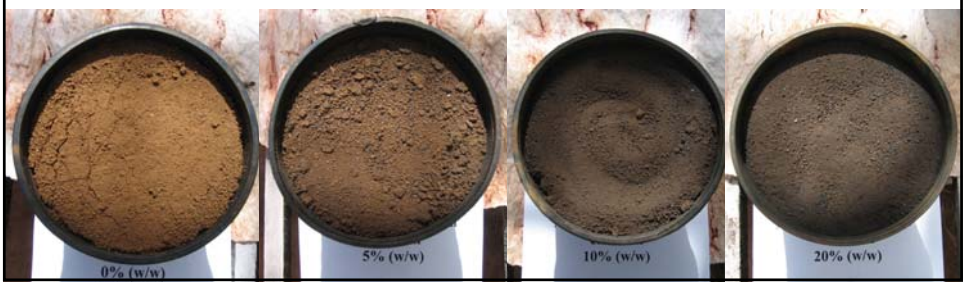
Flash Carbonized© Charcoal

Hawaii Natural Energy Institute

Materials and Methods

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

0% (w/w) **5% (w/w)** **10% (w/w)** **20% (w/w)**

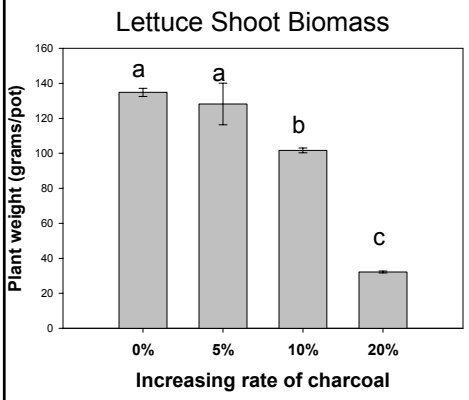


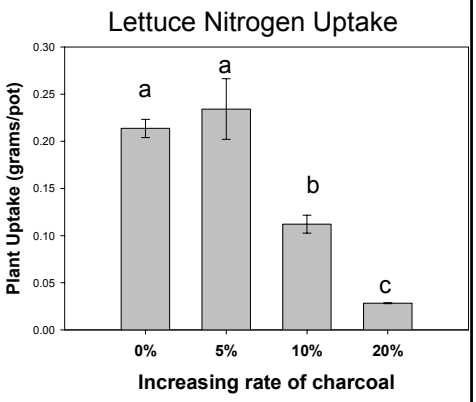
Results

- With no charcoal additions

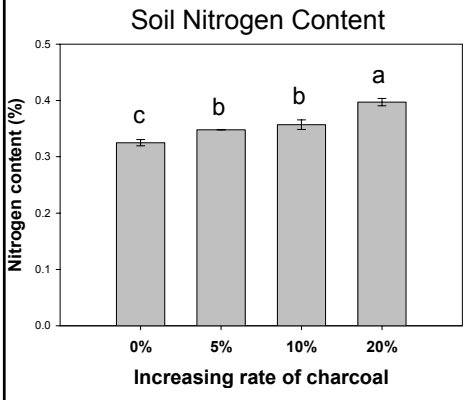
- With 20% (w/w) charcoal addition

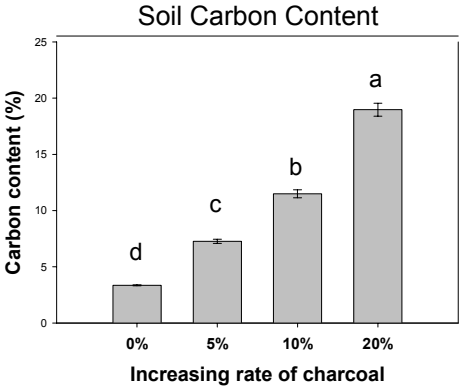
Plant Effects



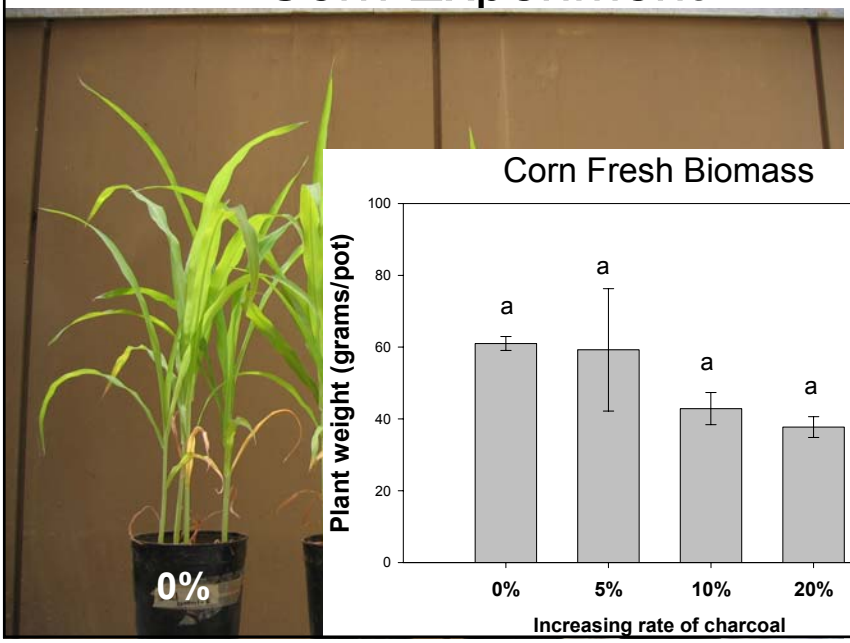


Soil Effects



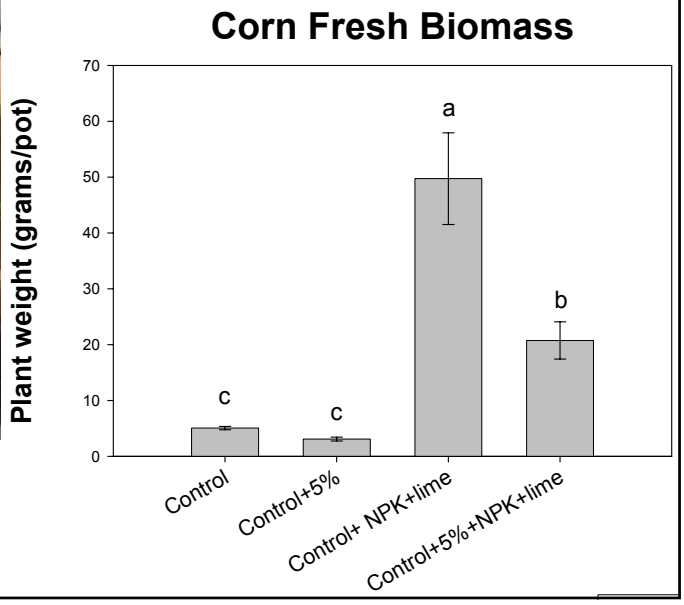


Corn Experiment



Charcoal Effect in an Infertile Soil

0% 5%



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

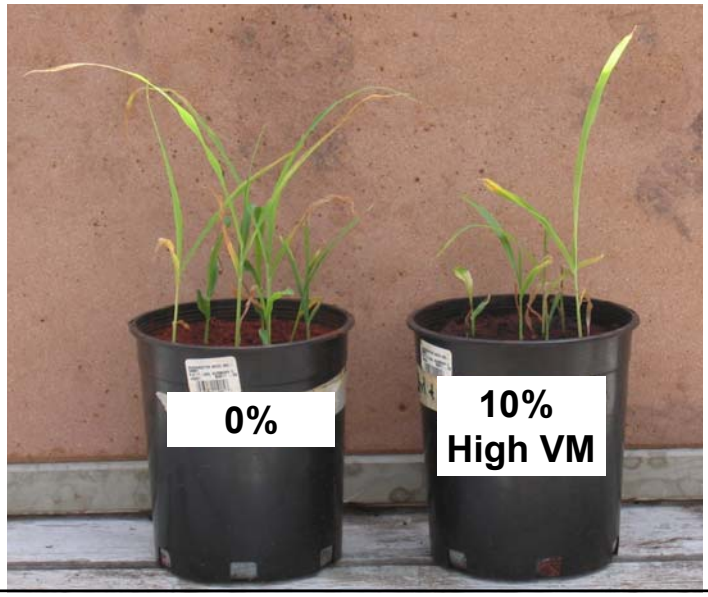
- More degraded tropical soil (Leilehua Series)
- High (22.5%) and low (6.3%) volatile matter content charcoal
- Corn
- 5 treatments, 3 replicates
  - control
  - control + 10% (w/w) high volatile matter charcoal
  - control + 10% (w/w) low volatile matter charcoal
  - control + lime + NPK
  - control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

0% (w/w)

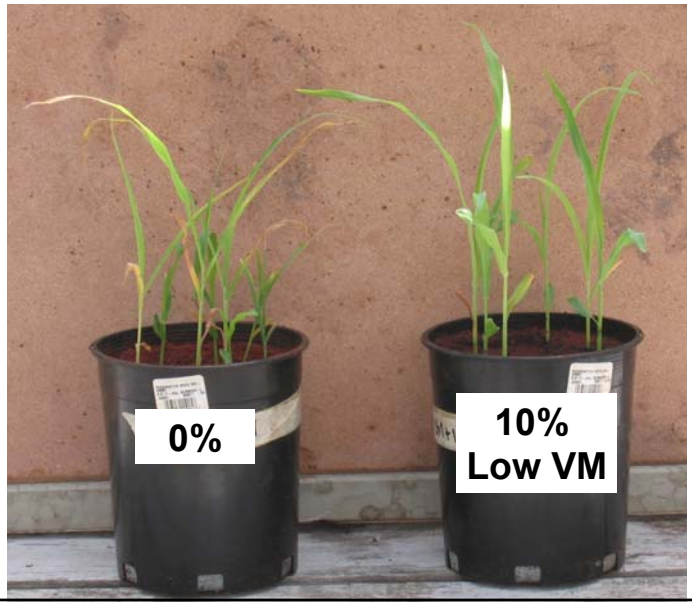
10% High VM

10% Low VM

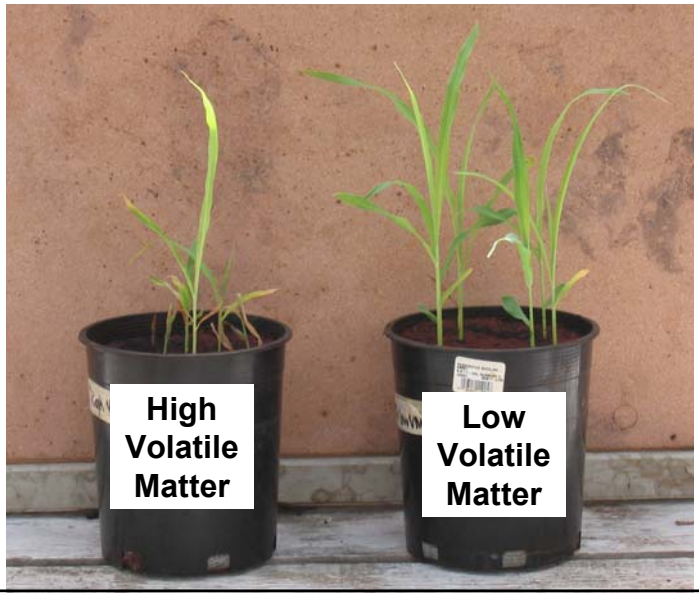
Effect of High Volatile Matter (22.5%) Charcoal on Plant Growth



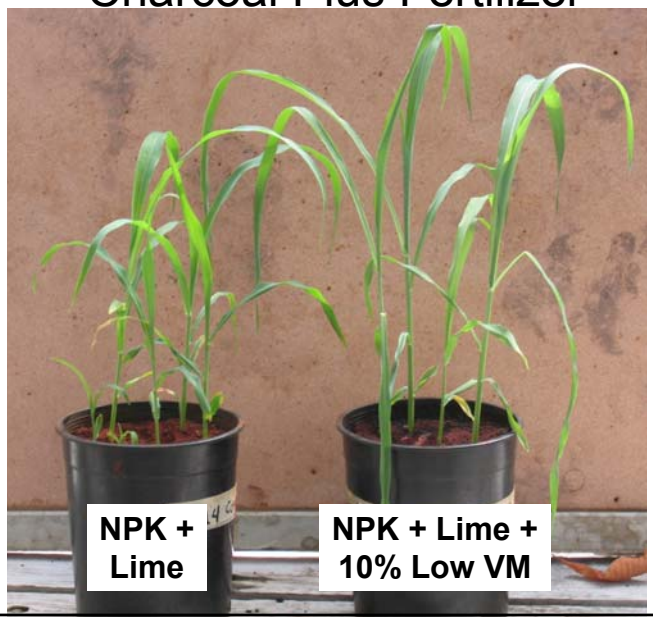
Effect of Low Volatile Matter (6.3%) Charcoal on Plant Growth

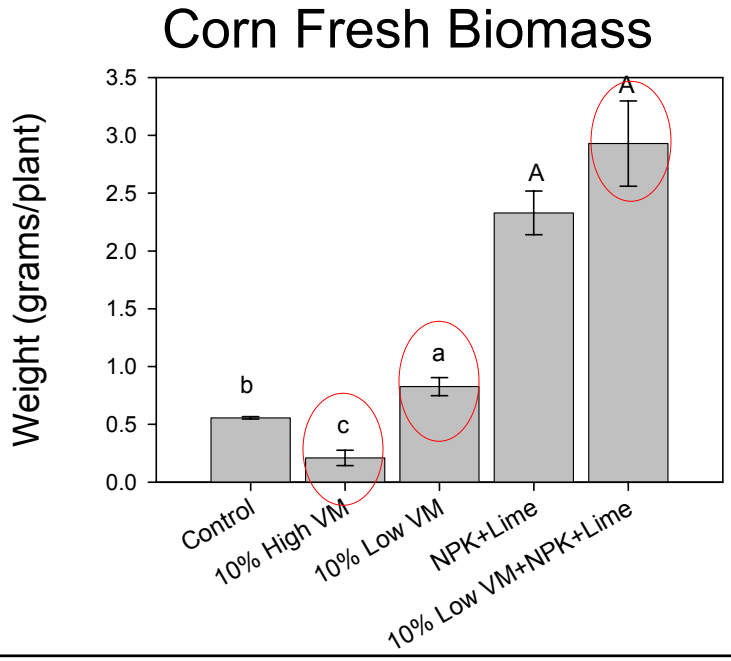


Low Volatile Matter Charcoal (6.3%) versus High Volatile Matter Charcoal (22.5%)



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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