Effect of Charcoal Application to Early Growth Stage of *Acaia mangium*

Carbon Fixing Forests Management
in Indonesia

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Why charcoal? : Hypothetical framework

1. Activate mycorrhizae
   → Enhance nutrient uptake from soil
   Protect roots of seedlings
2. Increase pH of acid soil
   → Increase available phosphorus
3. Provide minerals (Ca^{2+}, K^{+}, Mg^{2+}, etc.)
4. Improve physical properties of soil
   → Improve water permeability and water retention potential

GREENHOUSE EXPERIMENTS :

1. **Examining soil amendment through charcoal application with the potential to enhance better plant growth.**

2. **Evaluate the plant growth response to promote the most judicious use of charcoal in the plantation of *Acacia mangium*.**

EXPERIMENTAL DESIGN

- Completely randomized design with four replications
- One experimental unit : five seedlings in pot
- Medium : 4000 gr air dry soil
- No fertilizer added in pot seedlings
- Soil moisture: field capacity

Tree species	Charcoal Concentration
Acacia mangium	0%, 10%, 15% and 20% (v/v)

Chemical properties of charcoal

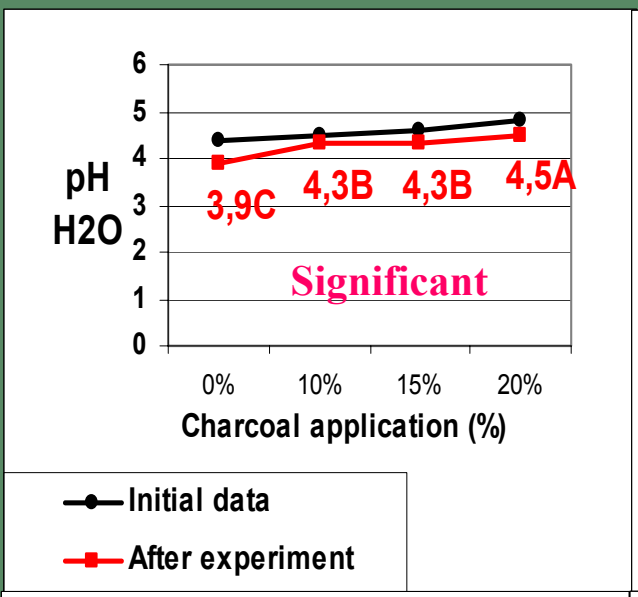
pH (H_2O)	8
pH (KCl)	8
C – Organic, %	55
N – Kjeldahl, %	0.1
P Potential (HCl 25%, P_2O_5), ppm	290.6
K Potential (HCl 25%, K_2O), mg/100 g	18
P – available (Bray, P_2O_5), ppm	69
K – available (Morgan, K_2O), ppm	133
Ca (1 N NH4Oac, pH 7.0 extraction), me/100 g	28
Mg(1 N NH4Oac, pH 7.0 extraction), me/100 g	8
K (1 N NH4Oac, pH 7.0 extraction), me/100 g	17
Na (1 N NH4Oac, pH 7.0 extraction), me/100 g	2
Total (1 N NH4Oac, pH 7.0 extraction), me/100 g	55
CEC (1 N NH4Oac, pH 7.0 extraction), me/100 g	19
BS, %	> 100
KCl 1 N, Al^{3+}, me/100 g	0
KCl 1 N, H^+, me/100 g	0

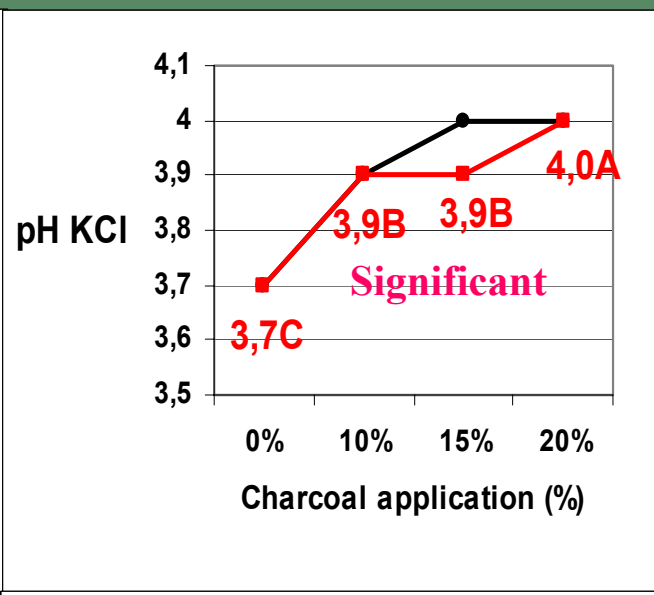
Soil : Chemical Properties

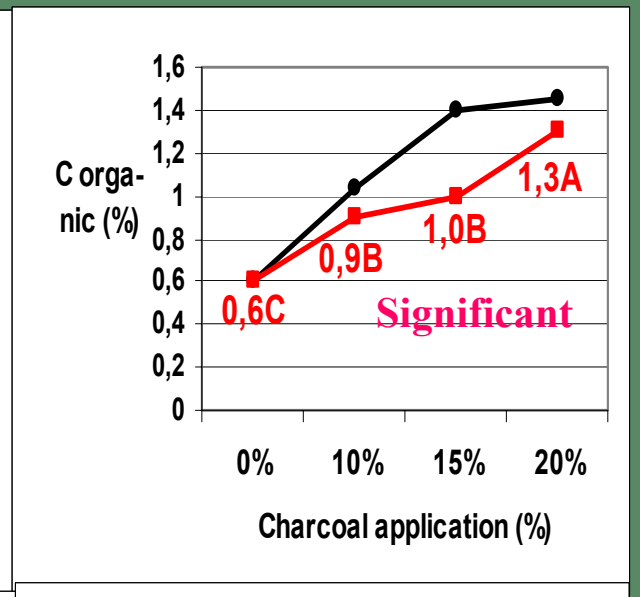
Orthic Acrisol (Very fine, mixed, semiactive, isohyperthermic, Typic Paleudult)

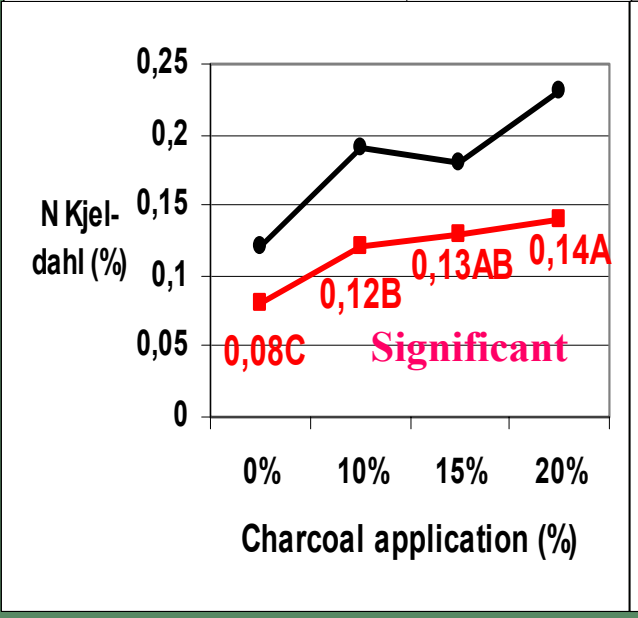
pH (H_2O)	4.4
pH (KCl)	3.7
C – Organic, %	0.61
N – Kjeldahl, %	0.12
C/N	5
P Potential (HCl 25%, P_2O_5), mg/100 g	13
K Potential (HCl 25%, K_2O), mg/100 g	51
P – available (Bray, P_2O_5), ppm	3.0
K – available (Morgan, K_2O), ppm	29.5
Ca (1 N NH4Oac, pH 7.0 extraction), me/100 g	0.25
Mg(1 N NH4Oac, pH 7.0 extraction), me/100 g	0.85
K (1 N NH4Oac, pH 7.0 extraction), me/100 g	0.06
Na (1 N NH4Oac, pH 7.0 extraction), me/100 g	0.13
Total (1 N NH4Oac, pH 7.0 extraction), me/100 g	1.29
CEC (1 N NH4Oac, pH 7.0 extraction), me/100 g	34.83
BS, %	4
KCl 1 N, Al^{3+}, me/100 g	19.17
KCl 1 N, H^{+}, me/100 g	0.95

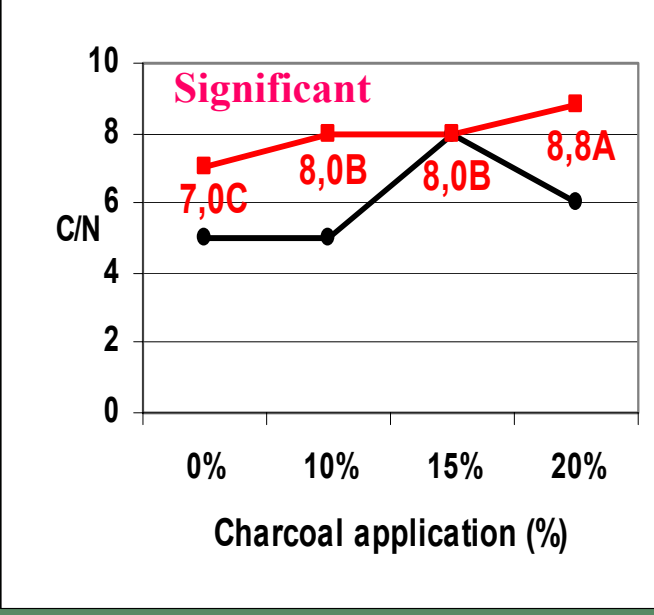
Chemical properties of soil (1)

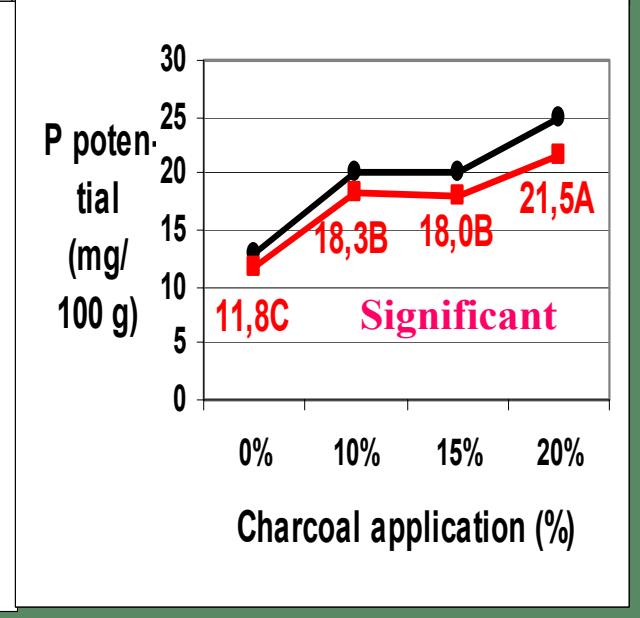




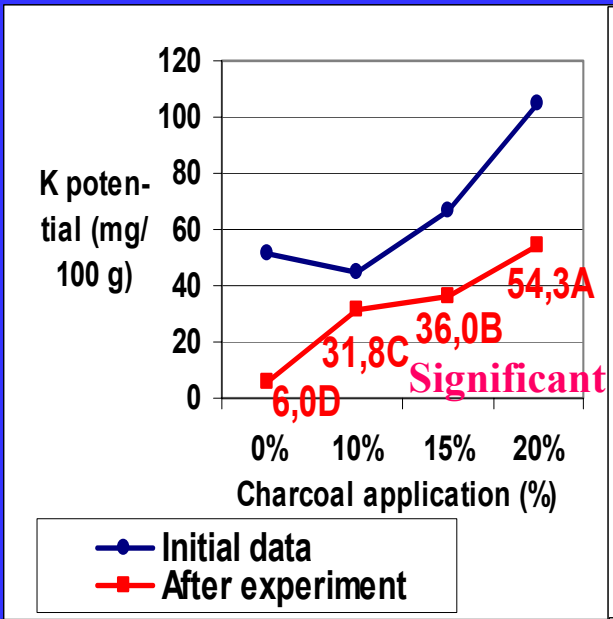


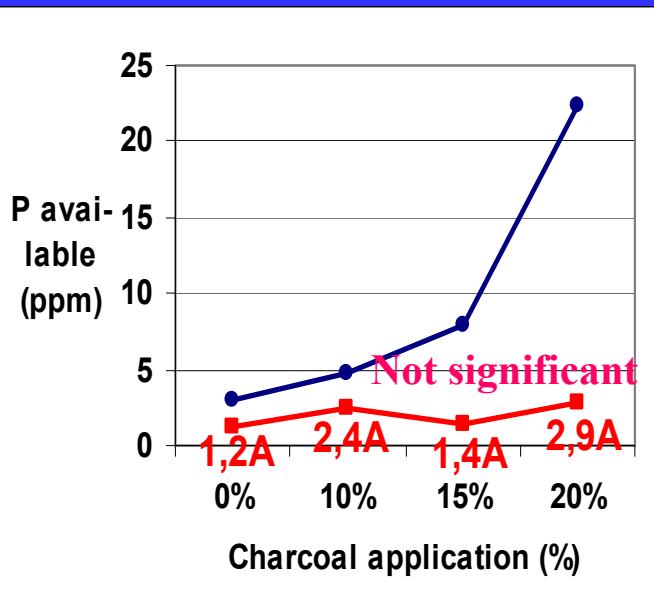


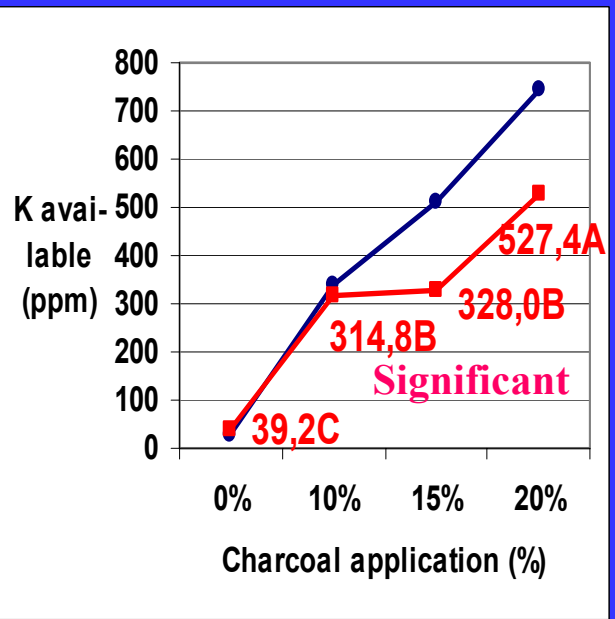


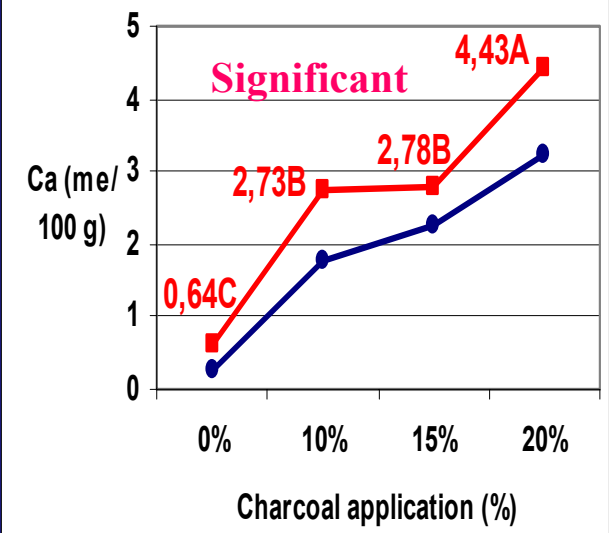


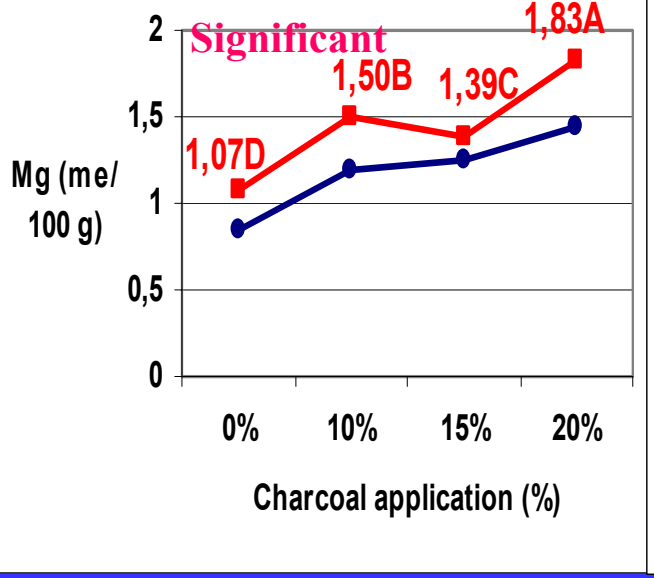
Chemical properties of soil (2)

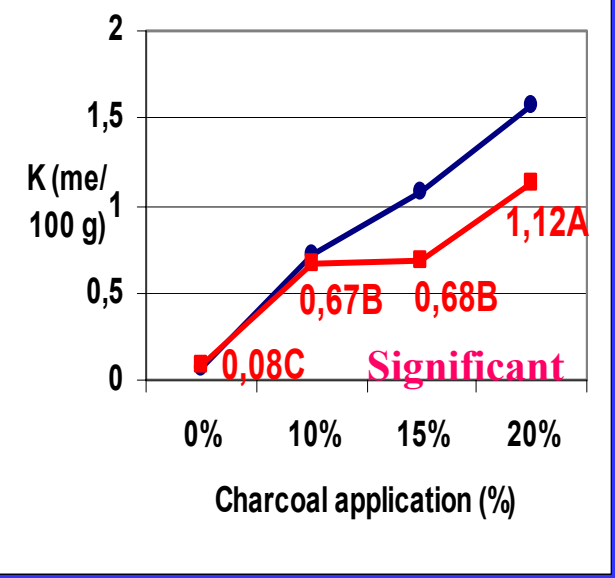




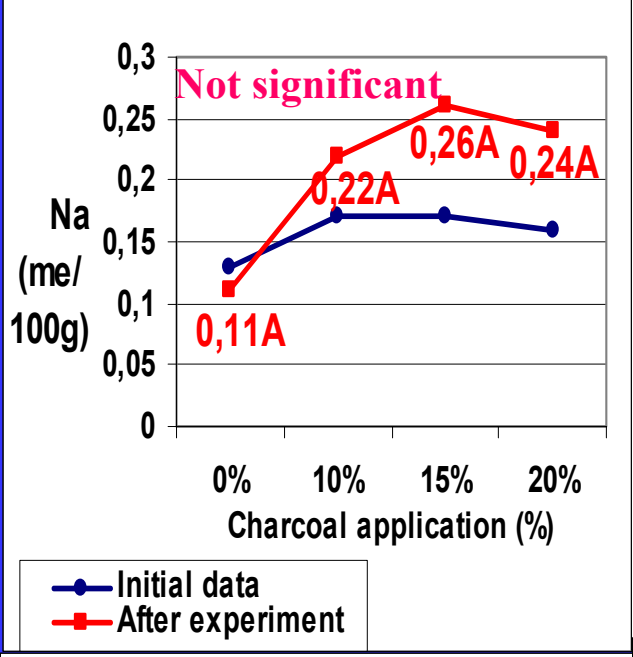


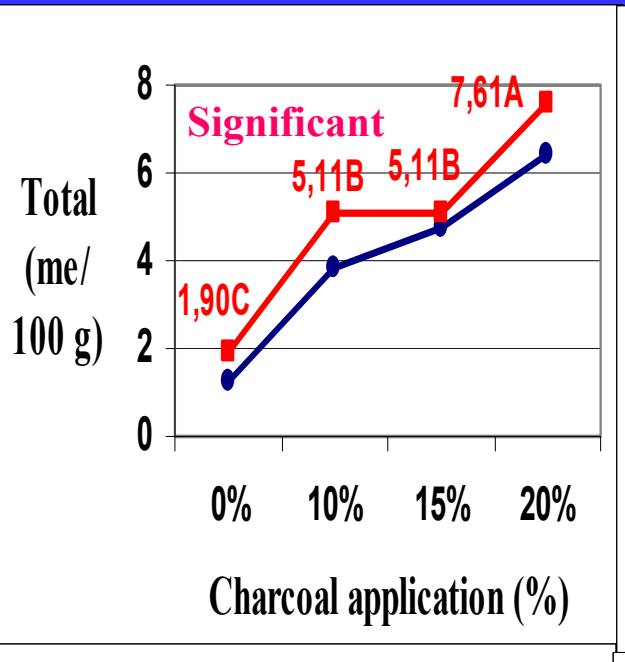


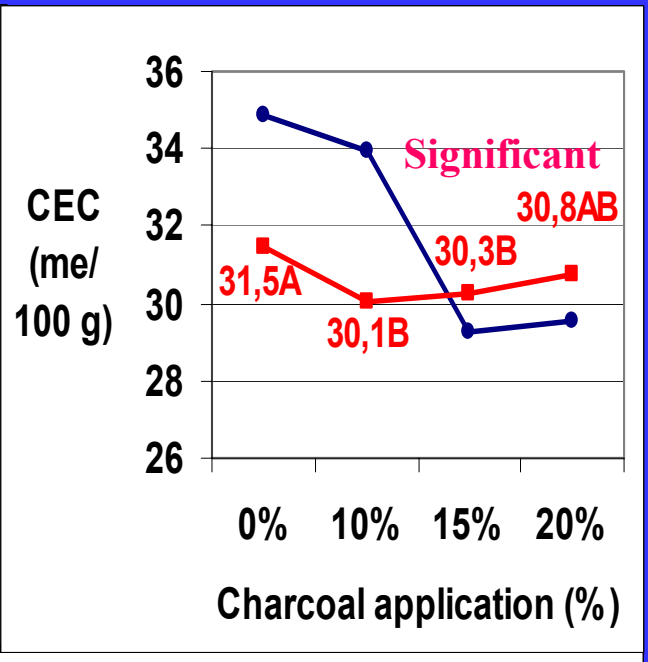


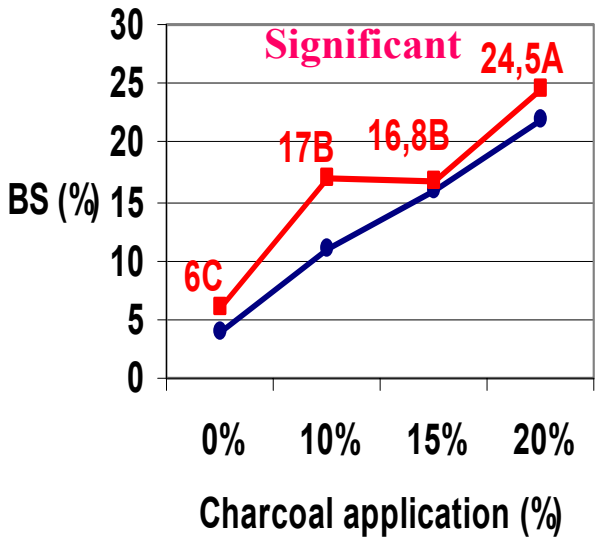


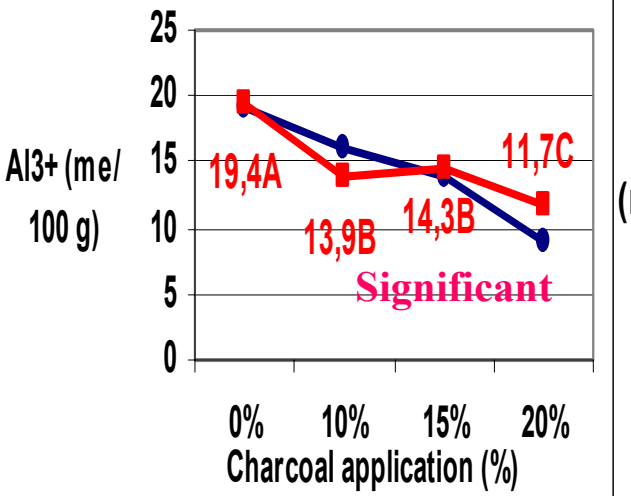
Chemical properties of soil (3)

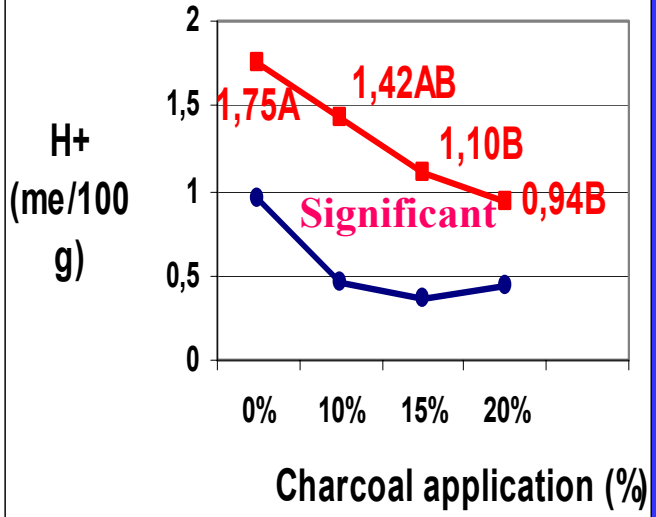




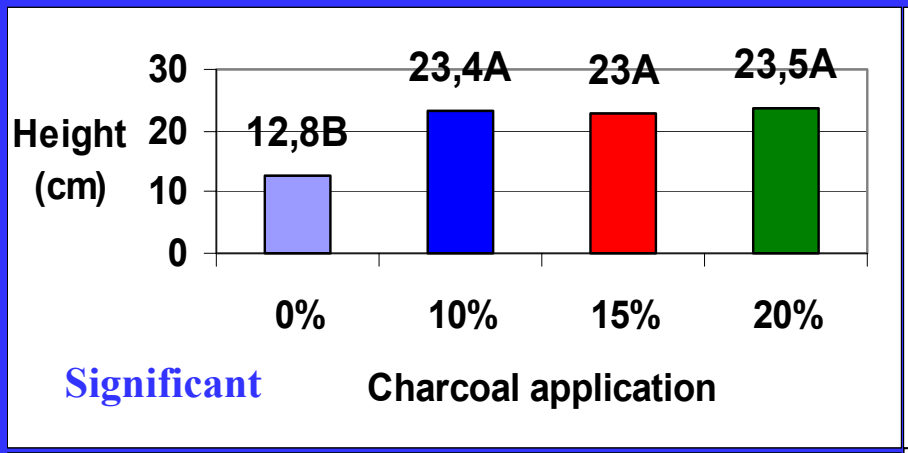


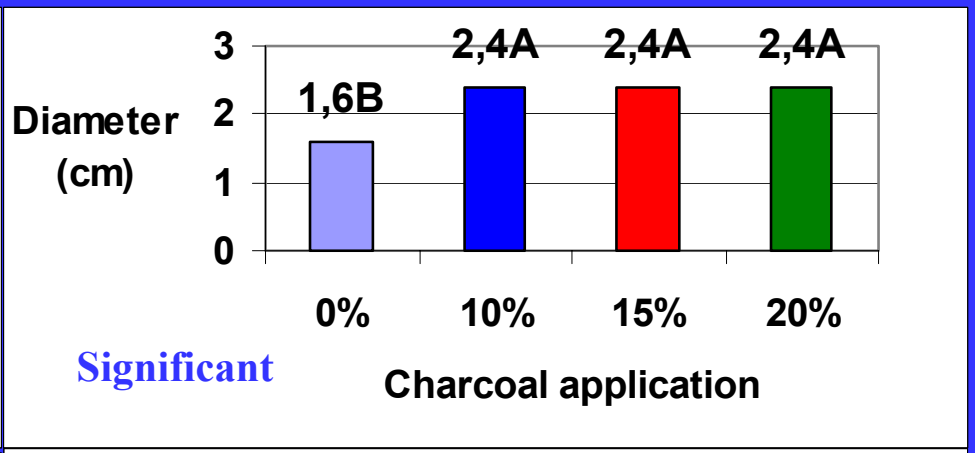


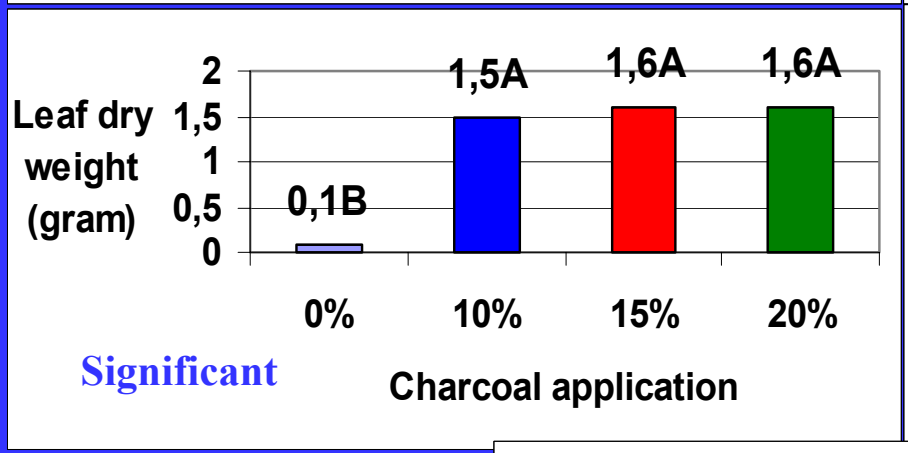


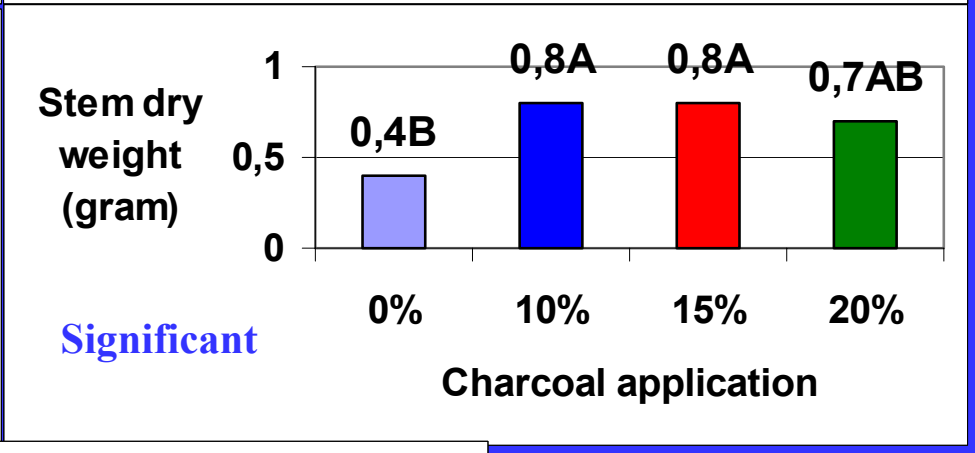


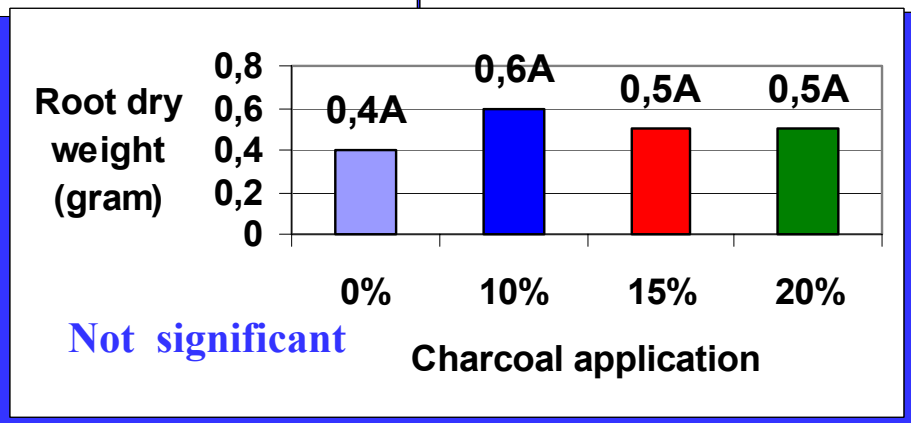
Effect of charcoal concentration on the plant growth (1)



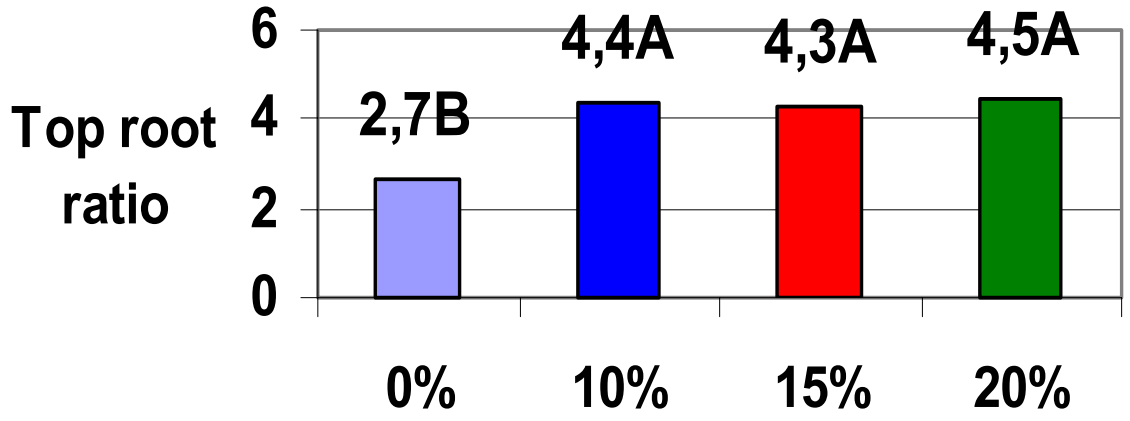




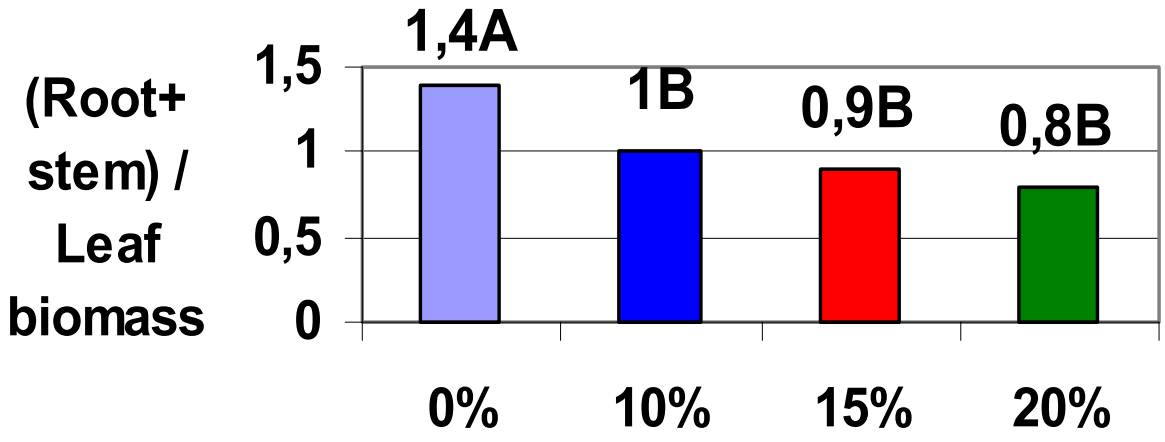




Effect of charcoal concentration on the plant growth (2)



Significant



Significant


A (0%)
B (10%)
C (15%)
D (20%)

CONCLUSIONS

1. Charcoal additions to soil significantly increased height and diameter of *A. mangium* seedlings at age of 6 months in comparison to a control.
2. Charcoal treatment significantly increased soil pH, soil organic C, N, P, K, Ca, Mg, K, percentage of base saturation.
   Significantly decreased CEC, Al3+ and H+.
3. Rate at 10% gave the optimum plant growth.

Thank you