

# Effects of Biochar on Soil Properties, Soil Carbon Sequestration, and the Growth of Hom Hua Bon Rice



Students Miss Natthakulwadee Tehair and Miss Phanatchakorn Nuannim

Teacher Mrs. Salamiyah Kittibunyatiwakorn

## Abstract

This study aimed to investigate the effects of biochar derived from different types of agricultural biomass on soil properties, soil carbon sequestration, and the growth of Hom Hua Bon rice. The experiment consisted of five treatments: Treatment 1: control treatment (soil only); Treatment 2: soil mixed with biochar derived from para rubber wood sawdust; Treatment 3: soil mixed with biochar derived from corn leaves and stalks; Treatment 4: soil mixed with rice husk biochar; and Treatment 5: soil mixed with rice straw biochar, with biochar applied at a rate of 3% (w/w). The experiment was conducted using a completely randomized design, with three replicates per treatment. Soil properties, including pH, bulk density, water holding capacity, organic matter content, macronutrients (N, P, K), and soil carbon content, were measured before and after rice cultivation following GLOBE protocols. Rice growth parameters, including germination rate, soil moisture, and plant height, were recorded weekly over a four-week cultivation period. Data were analyzed using one-way analysis of variance (ANOVA).

The results indicated that all biochar treatments significantly improved soil physical properties compared with the control ( $P < 0.05$ ). Biochar application reduced soil bulk density to 0.80–1.05 g/cm<sup>3</sup>, while soil water holding capacity increased from 35.00 ± 3.00% in the control to 50.00–65.00% before planting. After planting, soil amended with para rubber wood sawdust biochar exhibited the highest water holding capacity (85.00 ± 6.00%). Soil carbon content increased significantly in all biochar-amended soils, with the para rubber wood sawdust biochar treatment showing the greatest increase, from 4.61 ± 0.07% before planting to 4.99 ± 0.10% after planting, whereas the control showed only a slight increase (from 0.92 ± 0.02% to 1.07 ± 0.03%). Significant differences in rice growth were observed among treatments ( $P < 0.05$ ), with the para rubber wood sawdust biochar treatment achieving the highest germination rate (81.44 ± 0.50%) and the greatest plant height at week 4 (19.12 ± 1.19 cm), while the control exhibited the lowest germination rate (25.89 ± 0.50%) and plant height (13.56 ± 0.56 cm). These findings indicate that biochar, particularly that derived from para rubber wood sawdust, has strong potential for improving soil quality, enhancing soil carbon sequestration, and promoting sustainable cultivation of Hom Hua Bon rice.

**Keywords:** Biochar / Hom Hua Bon Rice / Soil Quality / Carbon Sequestration

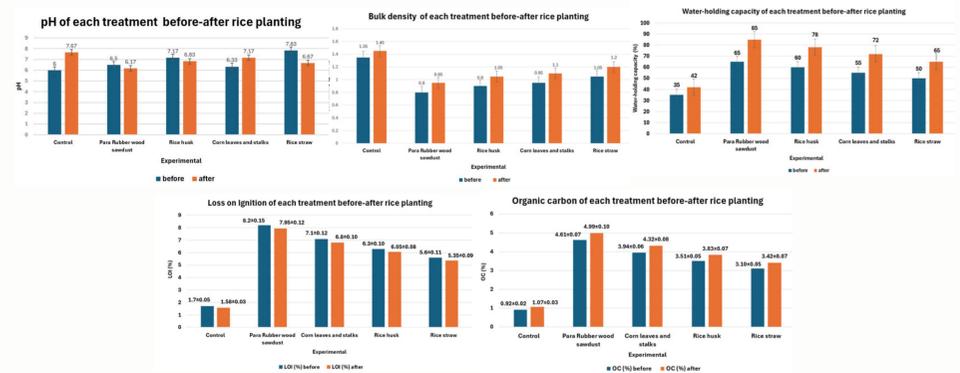
## Results

	Mineral Content			pH	water holding capacity (%)
	N	P	K		
Control	Low	Low	Medium	6.00±0.20	43.00±3.00
Para rubber wood sawdust biochar	Medium	High	Medium	8.00±0.20	85.00±3.00
Rice straw biochar	Low	Medium	High	8.00±0.20	78.00±3.00
Rice husk biochar	Low	Medium	Medium	9.00±0.20	59.00±3.00
Corn leaves and stalks biochar	Low	Medium	High	8.00±0.20	61.00±3.00

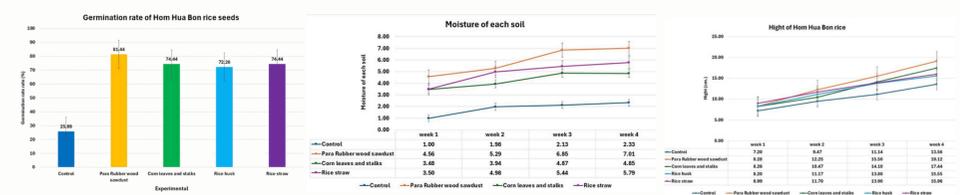
Table 1 shows the soil quality and properties of each biochar type.

treatment	Soil texture	Nutrient content					
		N		P		K	
		before	after	before	after	before	after
Control	Silty clay loam	Low	Low	Low	Low	Medium	Medium
Para rubber wood sawdust	Clay loam	Medium	High	High	Medium	Medium	High
Rice husk	Clay loam	Low	Low	Medium	Medium	Medium	Medium
Corn leaves and stalks	Clay loam	Low	Medium	High	Medium	High	High
Rice straw	Clay loam	Low	Medium	Medium	High	High	Medium

Table 2 shows the soil characteristics and mineral contents of each treatment.



Graph 1 shows soil quality before-after the experiment



Graph 2 shows soil moisture and the growth rate of Hom Hua Bon Rice for 4 weeks throughout the experiment

## Introduction



## Study site



**Rice field** which is located in Khok Saba Subdistrict, Nayong District, Trang Province.  
(the coordinates 7°30'48.1"N, 99°44'19.4"E)



**Princess Chulabhorn Science High School Trang** which is located Bang Rak Subdistrict, Mueang Trang District, Trang Province  
(the coordinates 7°33'13.1"N, 99°33'26.8"E)

## Research Question

1. Do different types of biochar have different effects on soil properties and soil carbon sequestration ?
2. Do different types of biochar have different effects on the growth of Hom Hua Bon rice ?

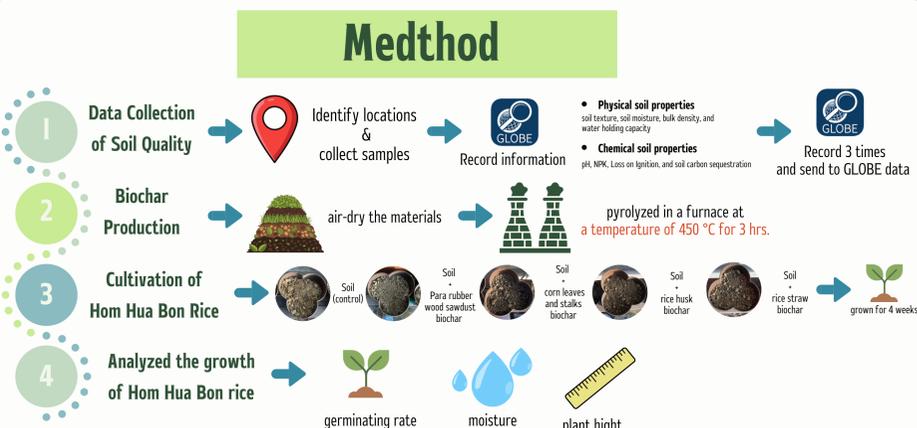
## Hypothesis

1. The different types of biochar have different effects on soil properties and soil carbon sequestration ?
2. The different types of biochar have different effects on the growth of Hom Hua Bon rice ?

## Objective

1. To study the effects of biochar on soil quality including soil texture and color, Loss on Ignition, bulk density, moisture content, water-holding capacity, pH, organic carbon and NPK.
2. To study the effects of biochar on the growth rate of Hom Hua Bon rice.

## Method



## Citations

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