



**Carbon sequestration and plant growth  
by using biochar and/or compost  
in farmland**

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**S. Tanaka, S. Mineki\*, S. Goto\*\*,  
S. Yoshizawa**

**Meisei University,**

**\* Tokyo University of Science,**

**\*\* Azabu University**



**Introduction**

**In order to establish the sequestration mechanism of carbon in the soil used with charcoal, analysis method of the undegradable carbon (UDC) amount in the soil was developed for quantitative estimation of the carbon sequestration. Finally, the effect of charcoal using in the farmland on the spinach growth was studied.**

# Biochar and Compost Using for Farmland for Carbon Sequestration

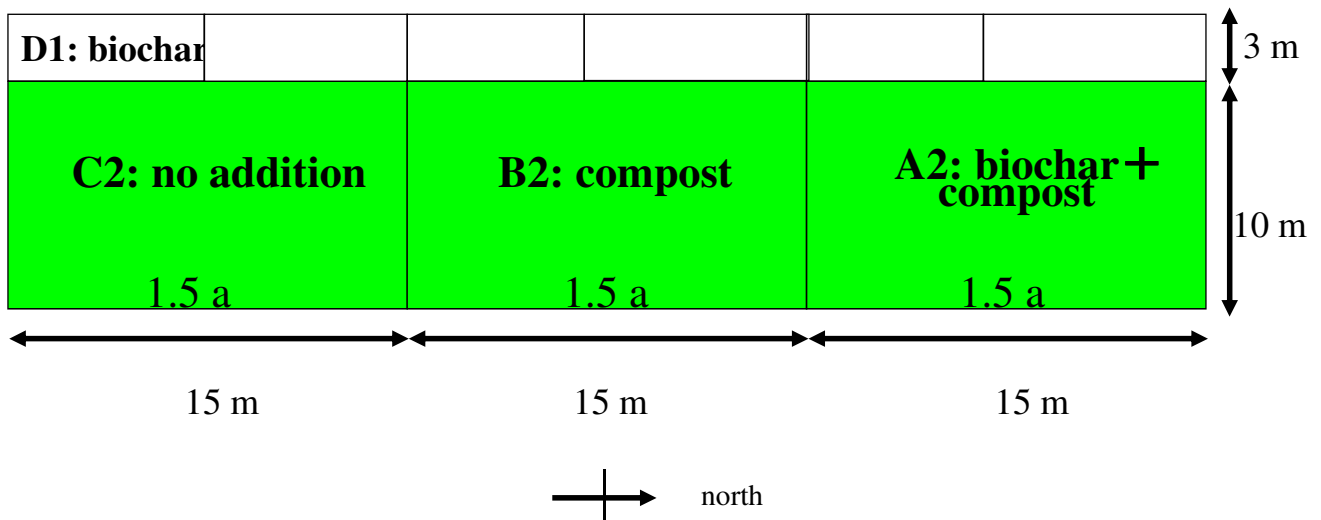
## Farmland and using condition

Red clay soil: Hinode Tokyo (suburbs of Tokyo)

Testing period: Oct., 2009 ~ March, 2011

	Using condition	vegetable	Biochar (t/10a)	Compost (t/10a)	Area (m <sup>2</sup> )	Carbon storage effect (kg/m <sup>2</sup> )
A2	Biochar+compost	vegetable	2	1	140	0.812
B2	compost	vegetable	0	1	140	0.012
C2	No addition	vegetabel	0	0	140	0
D1	Biochar		2	0	21	0.800

# Illustration of farmland and using condition of biochar and compost



Pile of biochar and compost



Dispersion of biochar and compost



Plowed farm land

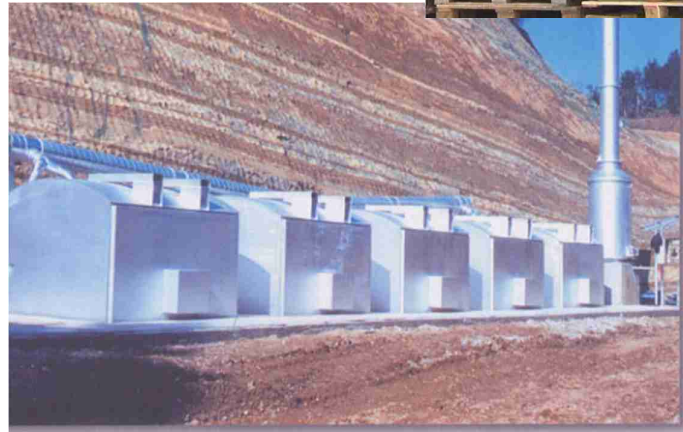


## Low cost carbonization

Waste of wood pallet for transportation with folk lift

Cage with wood is covered with iron furnace.

Carbonized at 500 - 600°C



## Some characteristics of charcoal

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Specific surface area	205 m <sup>2</sup> /g
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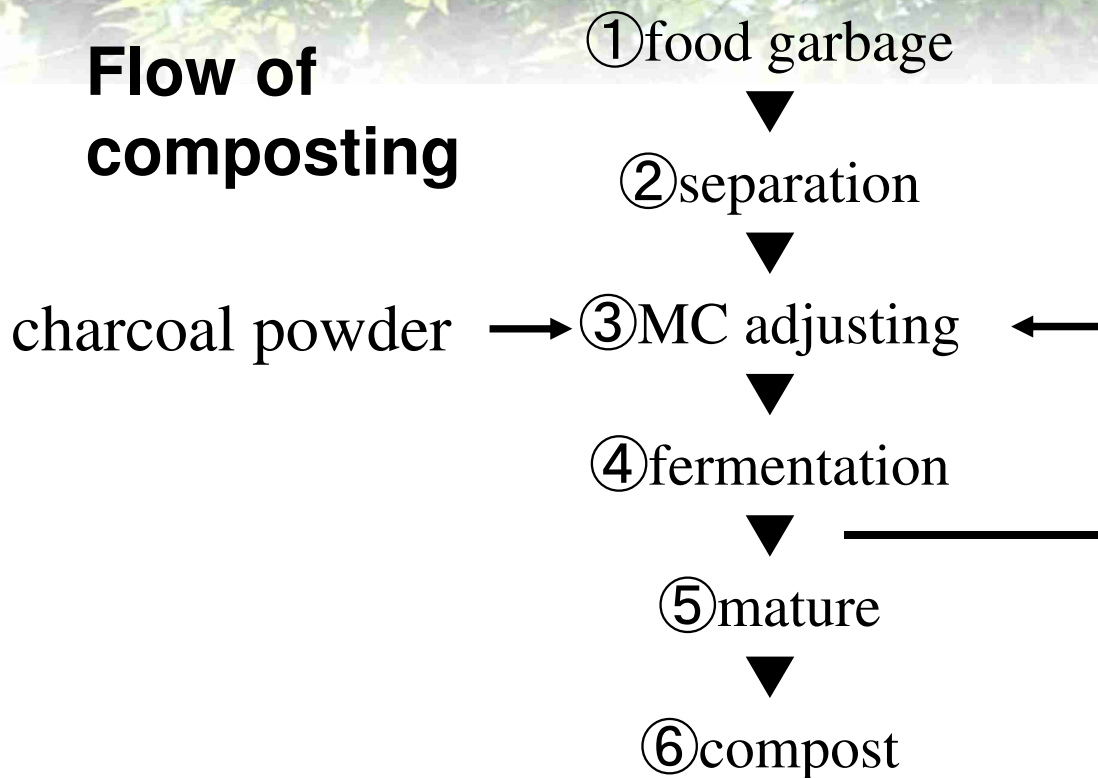
Bulk density	0.2 g/ml
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pH	8.1
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Grain size	under 3 mm
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# Flow of composting



# Main equipments in the factory

Two separators of food garbage from plastic bags



Twelve 65 m<sup>3</sup> fermentation tanks



# Component analysis of compost

Analysis items	Feb. 2009	
	Sample A	Sample B
T-N (%)	3.2	3.8
NH3-N(mg/100g)	151	102
NO3-N(mg/100g)	46	35
P2O5 (%)	1.9	2.0
K2O (%)	1.2	1.1
C/N ratio	10.2	9.9
MC(%)	20.5	16.4
charcoal (%)	10.1	14.7
pH	8.55	8.60

# Estimation of charcoal carbon (non-degradable carbon) amount in the soil

(Measurement of total carbon)

Charcoal
Organic carbon
Inorganic carbon

Solid sample combustion method

Heating at 900°C, CO2 evolution

(Measurement of inorganic carbon)

Inorganic carbon

Solid sample combustion method

Heating at 200°C CO2 evolution

(Measurement of organic carbon)

Organic carbon

Tchulin method

(Estimation of charcoal carbon)

Charcoal carbon

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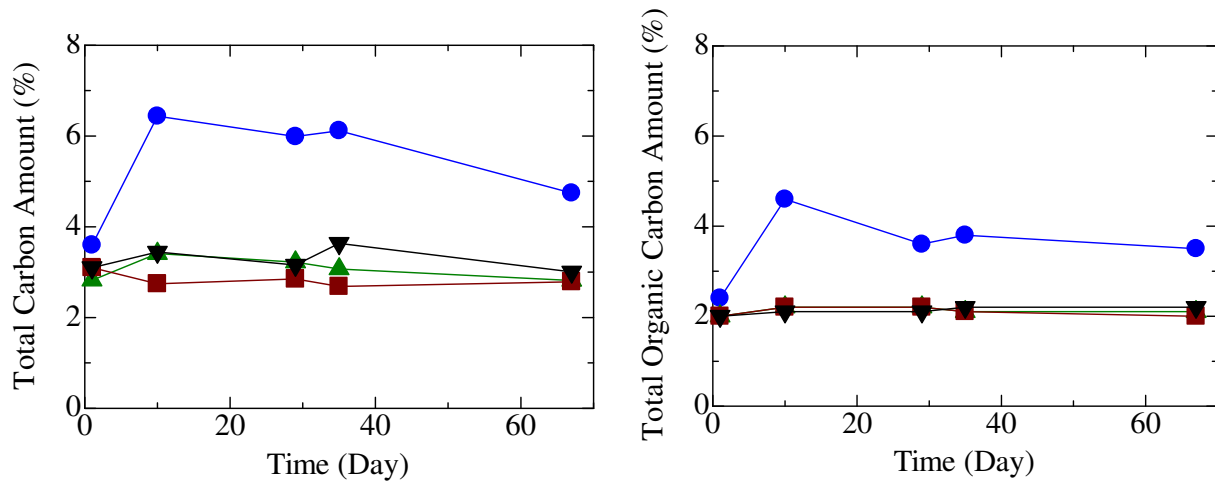
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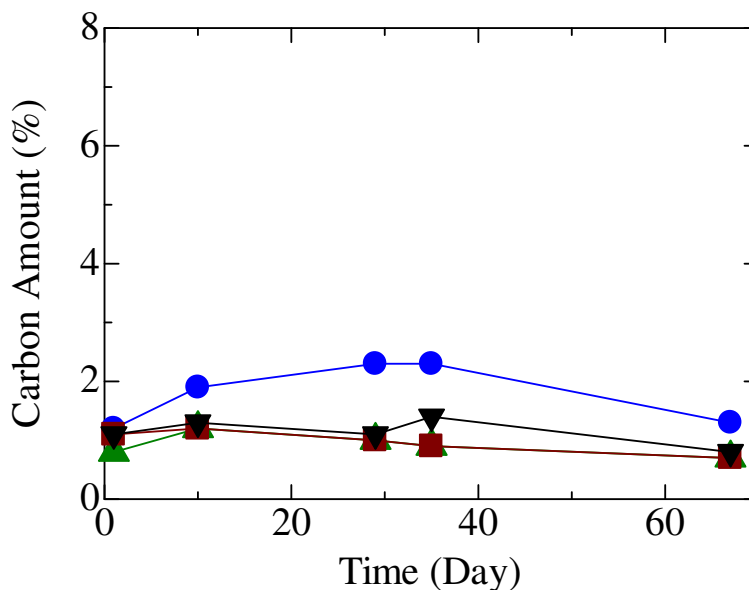
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## Time dependence of T-C and TOC amount in the farmland



● Biochar + compost, ■ compost, ▲ non,

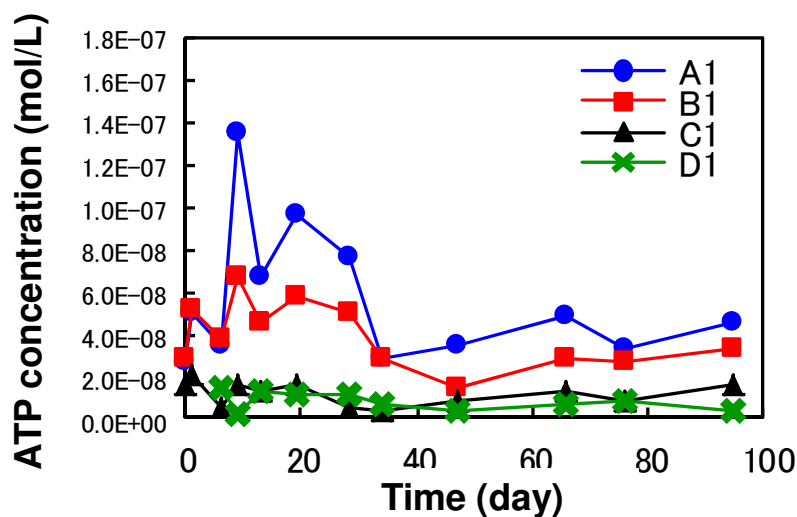
## Time dependence of charcoal carbon amount (non-degradable carbon) in the farm land



● Biochar + compost, ■ compost, ▲ non,

# Effect of Microorganisms proliferation on plant growth by Using Biochar for Farmland

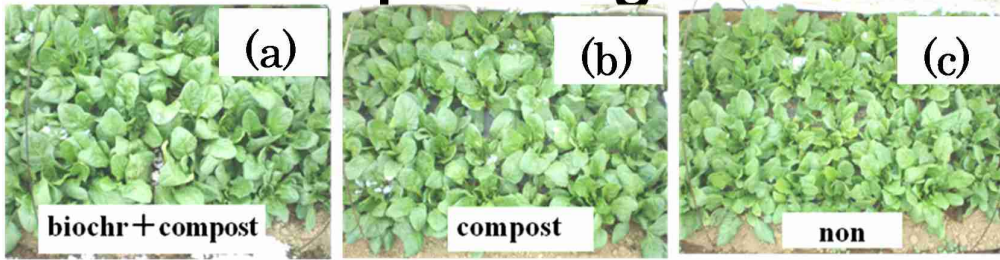
## Change of ATP concentration after using compost in the farmland



● Biochar + compost, ■ compost, ▲ non, × biochar

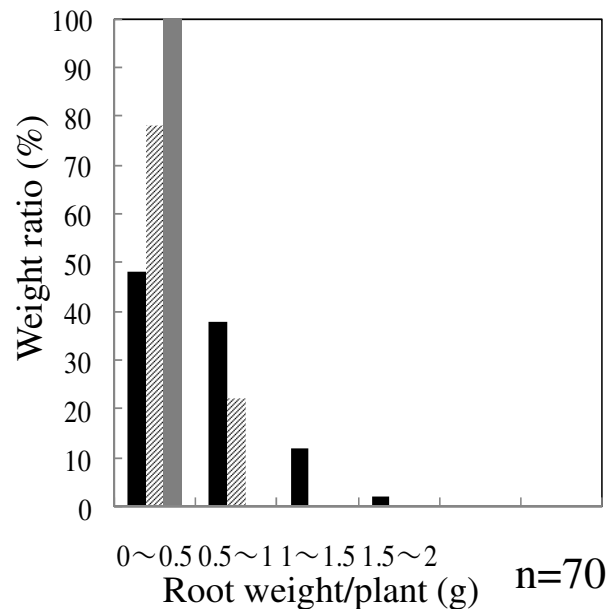
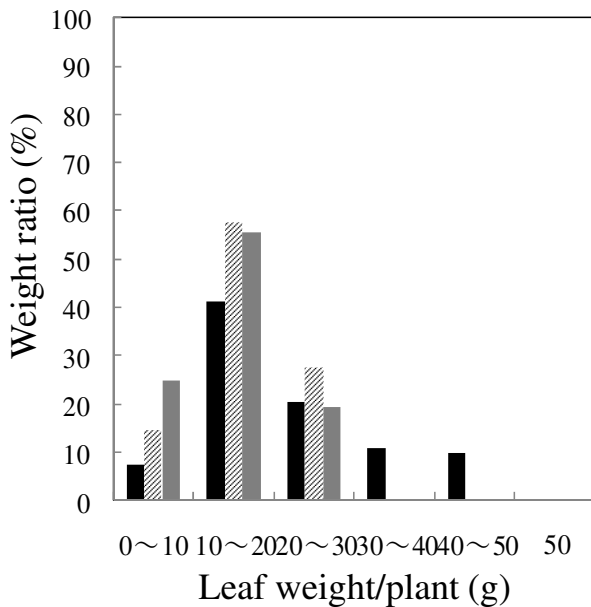


# Usage effect of biochar and compost on spinach growth



# Leaf and root weight distribution of Spinach one plant

■ : with charcoal and compost,  
 ▨ : with compost and  
 □ : no additives



## Discussions

- It was suggested that the stimulation of the spinach growth in the soil used with the charcoal and the compost came from the improvement of the physical and biological property of the soil

## Conclusions

- Carbon storage effect in the farmland was estimated.
- Soil microorganisms were activated which was supported with increase of ATP concentration.
- Plants growth promotion effect was recognized.