

Potential of Biochar from Biomass for Asia and the Pacific

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1. What is “Biochar” ?

Basically, “Biochar” is a char from “Biomass”.

The precise definition has been discussing at an international society (International Biochar Initiatives, (1996)).

Carbon Products

- ① Light
- ② Higher Absorbent
- ③ Alkali
- ④ Black Color

These features depends on resource and pyrolysis conditions such as temperature.

Pyrolysis

- ① Reduction of weight and volume
- ② Non Smell
- ③ Easy to be handled with
- ④ Reduction of Dioxin gas

These are different from resources and pyrolysis conditions such as temperature.

Agriculture

- Soil amendment (Improve soil physical, engineering properties)
- Provide nutrients such as P and K
- Absorbents (gas, water etc.)
- Stable carbon sink ??

Others

- Coke and fuel
- Humid control

Impact of Farmland application (Beans)

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Soil: relatively poor

Char: powder^l(cedar)<3mm

Amount:

C 500g/m²+CaPO₄ 5g/m²

Result:

Harvest increased 7 fold,

Better taste,

High quality

1983 Sugiura, Ogawa

Paddy Rice

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Soil: paddy soil (clayish)

Char: powder^l(oak)<3mm

Amount: 500kg/ha

Result: yield A 4,8t B 4,5t (control = A 2,6t B 3,7t)

Soil Temperature = stable

→ no cold damage

Less falling down,
much feeder root,
fast growing

1981(A),82(B) Sugiura, Seki, Unryuun,



Alfalfa

6



Type: powder char^B (larch)

Char:

300g/m²+W.V.1liter/m²
(20 times solution)

Result: height 143%

Fresh weight 310%

compared to control

Better quality as forage

No disease like Fusarium

1985 Sugiura,



Seedling of Cedar Tree

7



Soil: relatively poor

Char: activated charcoal
of rubber tree (for industry)

Method: 5cm layer under 40cm depth

Result: (after 1.5 year)

Little disease in C.A.

(Fusarium, Rhizoctonia)

Length = 4.1times growth

(control = 2.8 times) ---1.5 times

Diameter = 4.6 times growth

(control = 3.4 times) ---1.3 times

1976 Sugiura, Unryuuin, Endou, Terao,



Reviving Pine tree

8



Soil: poor, hardly stamped

Char: powder^l (oak tree)

Method: dig ditches of
W=30cm D=50cm, put in
char 20cm thickness and
fill up with soil.

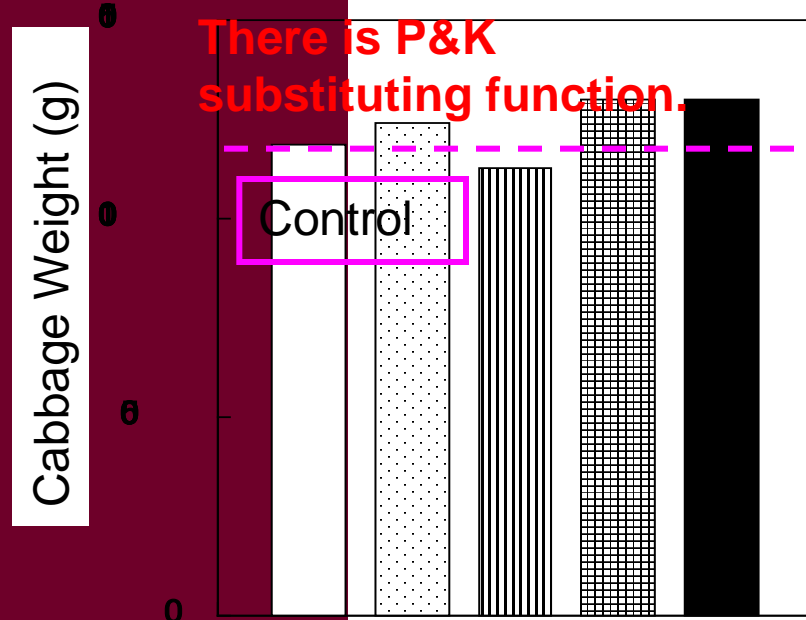
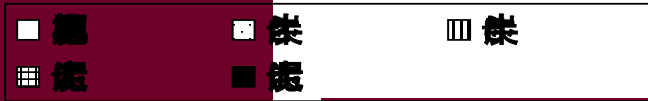
Result: After 4 years,
a nearly dead pine tree
aged more than 350years
was revived !!!

1983 Sugiura

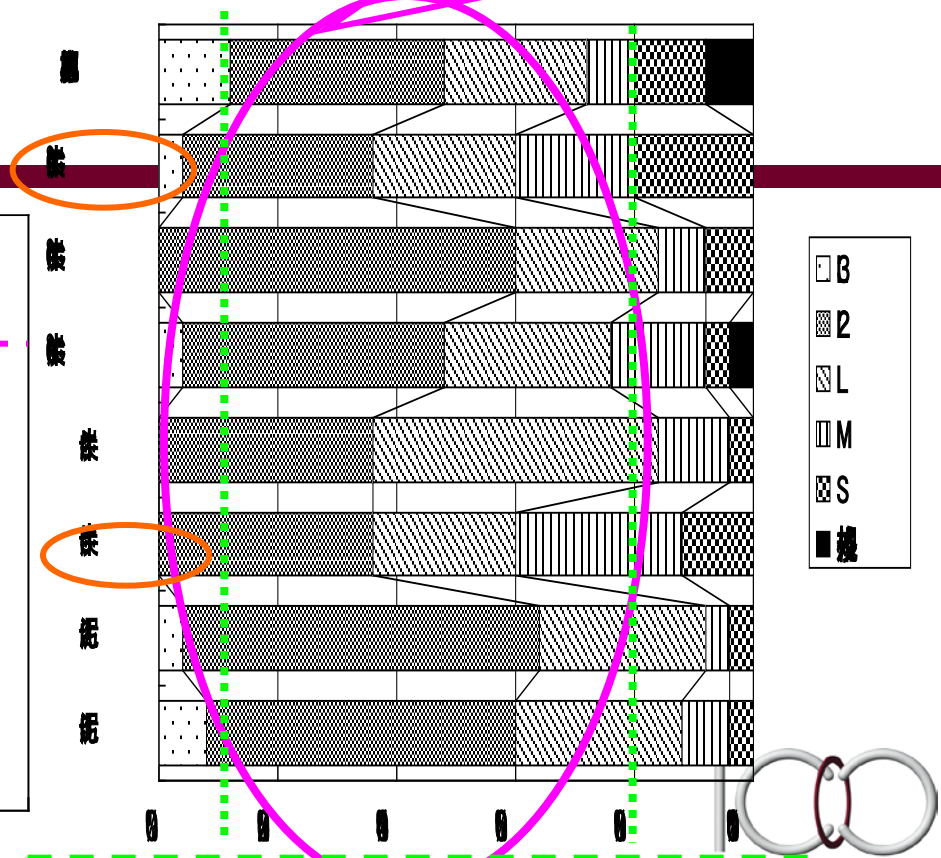


Application impact of charcoal from **sewage** and **cattle sludge** to cabbage weight and size.

Legend



There must be an optimal application amount.



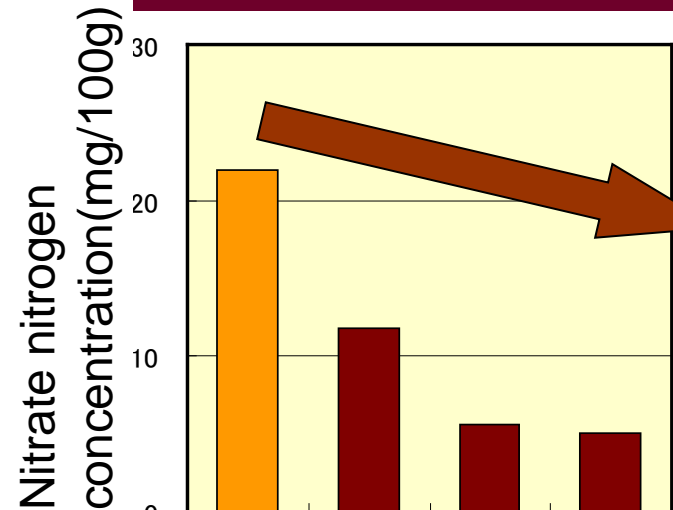
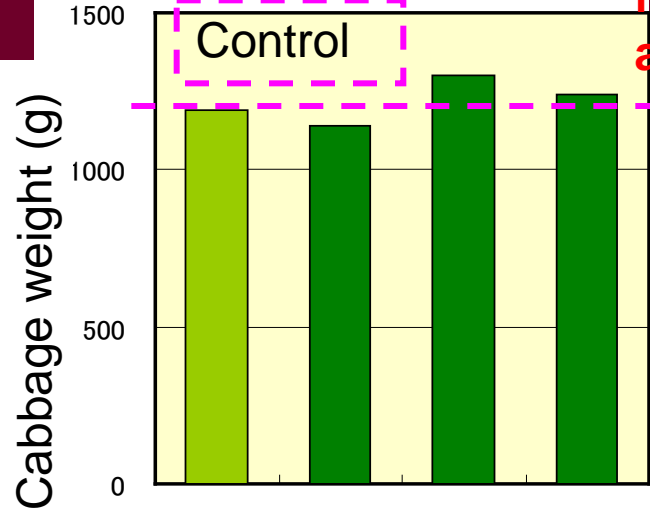
Nutrient

Substituting Chemical Fertilizer

K substituting function with carbon from cattle waste.

Almost no significant difference comparing with chemical fertilizer application

Absorption of nitrate nitrogen with carbon product from cattle waste.



Temperature



標準施肥

25°C

60°C

80°C

標準施肥

25°C

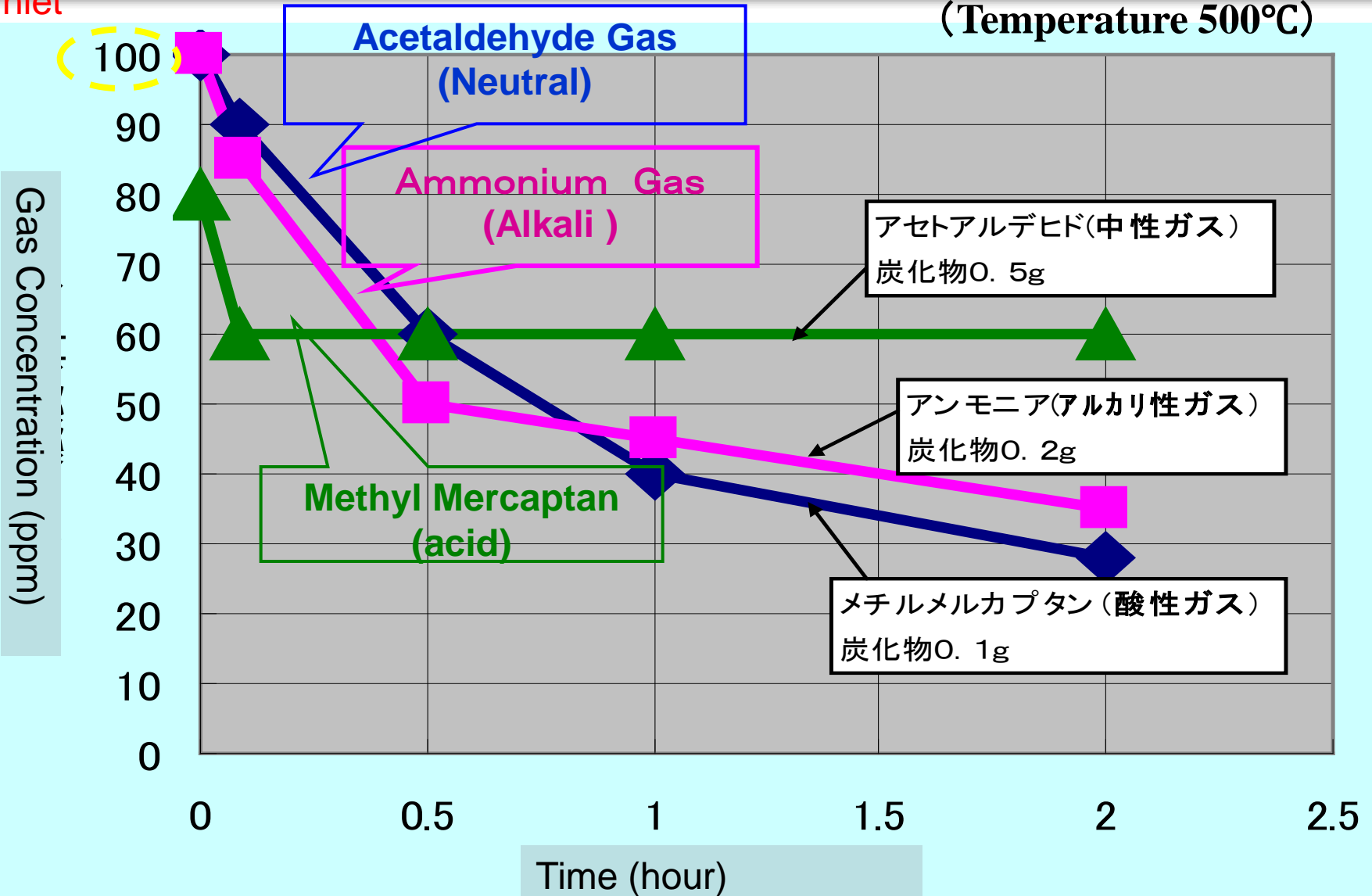
50°C

80°C

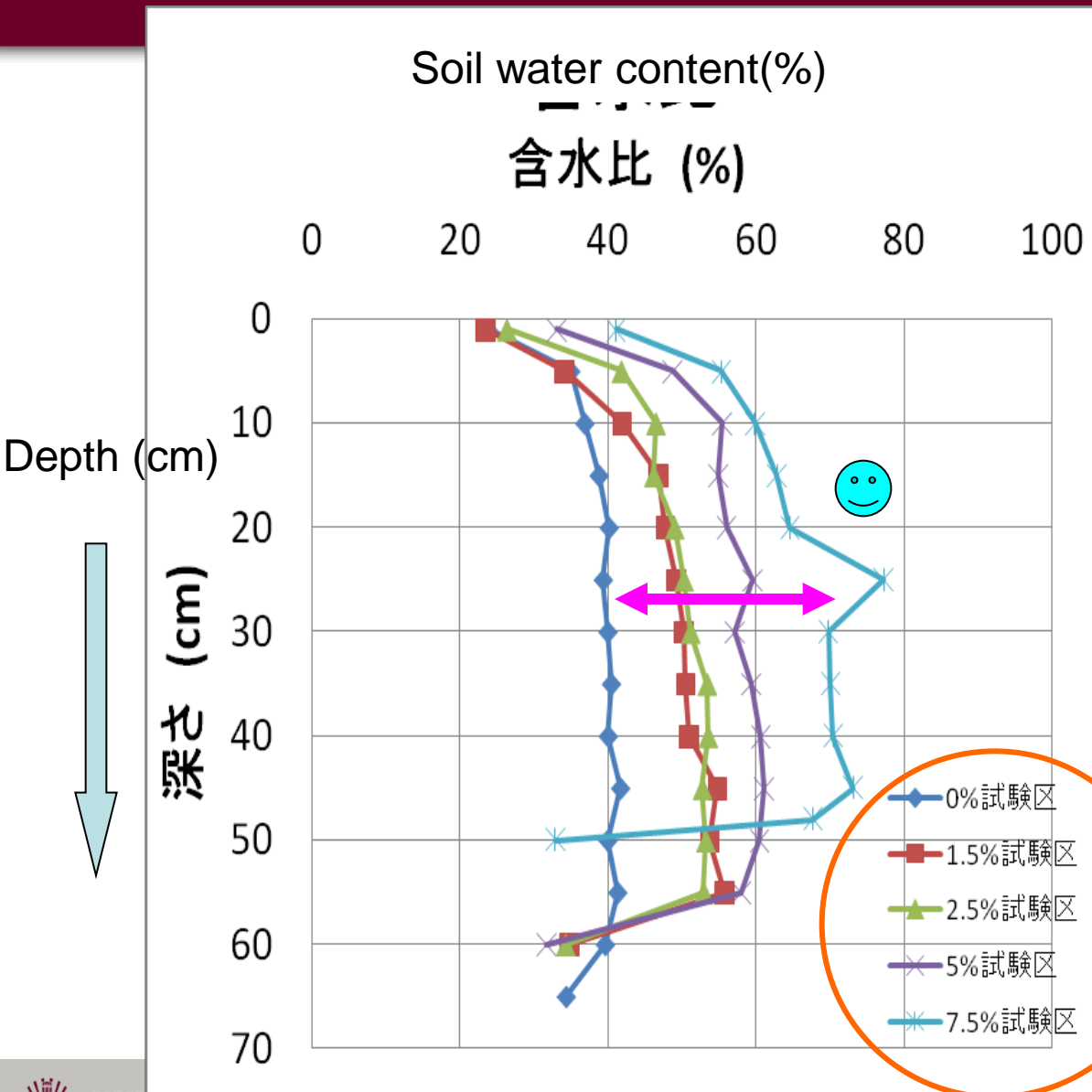
Absorbent function for various gas.

Inlet

(Temperature 500°C)



Long term observation



Application (mixture) of charcoal from bagasse.

It enables to increase available water (moisture) of the soil (crop) and it can held (last) more than **55** months after application.

Courtesy to Professor Y. Komiya (Ryukyu Univ. Japan)

LC-CO₂ calculation results

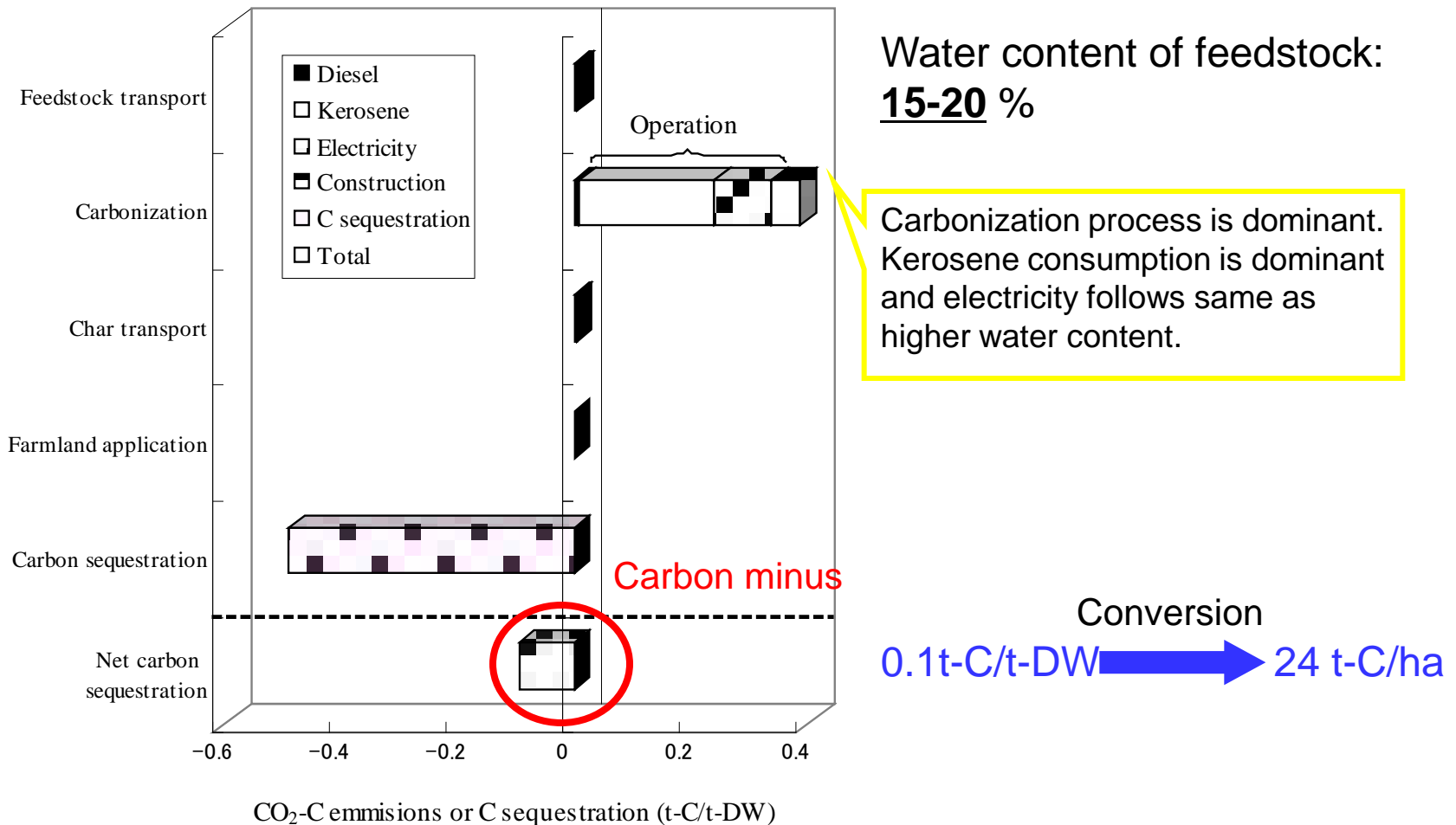


Fig. CO₂-C emission and C sequestration from each process

LCA assessment results

Table LCA Analysis of Pyrolysis

Group	capacity	kg-CO ₂ /t-waste		kg-NO _x /t-waste		kg-SO _x /t-waste	
	kg/h	average	s.d.	average	s.d.	average	s.d.
A)	15-20	1044	314	1.239	0.504	0.553	0.177
B)	30-60	865	345	1.087	0.579	0.463	0.170
C)	90-300	413	191	0.416	0.199	0.210	0.093
D)	800-1200	111	61	0.102	0.059	0.065	0.031

Environmental burdens originated from different carbonization (pyrolysis) devices were calculated with observed data. The results showed that large differences in environmental burdens existed between different devices. The CO₂, NO_x, and SO_x emissions decreased as the capacities of carbonization devices increased (Y. Kanri, et. al., 2007) .

Biomass Refinery Systems at Miyako-Island, Japan

① Pyrolysis (Bagasse)



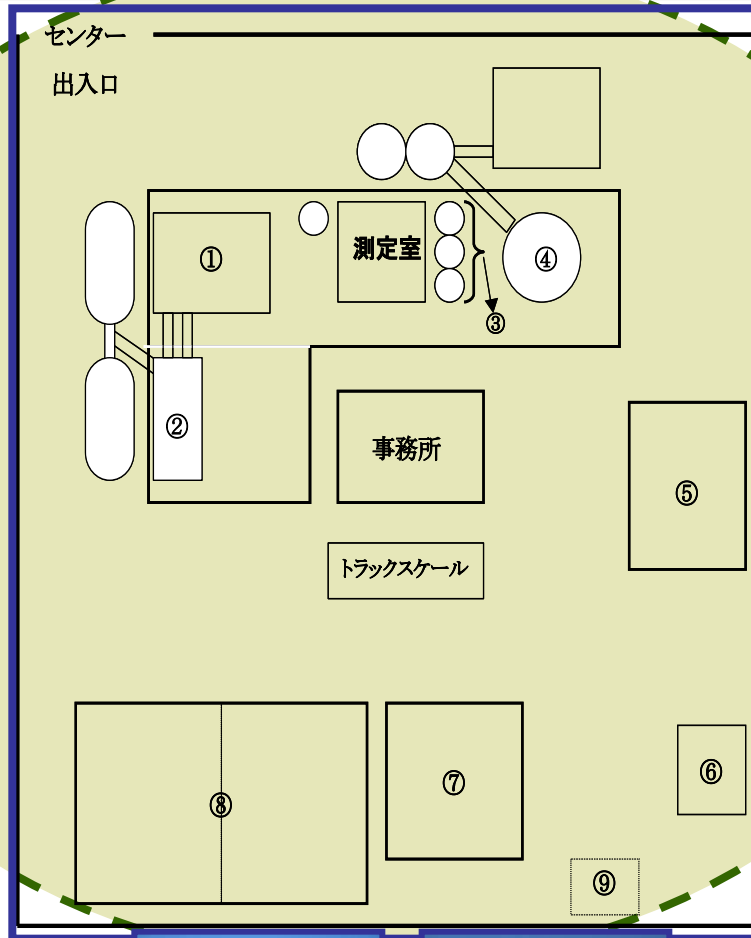
② Gasification



⑦⑧ Stock yard



③ Waste Honey stock



④ Bio-gas



⑤ Pyrolysis (Sludge)

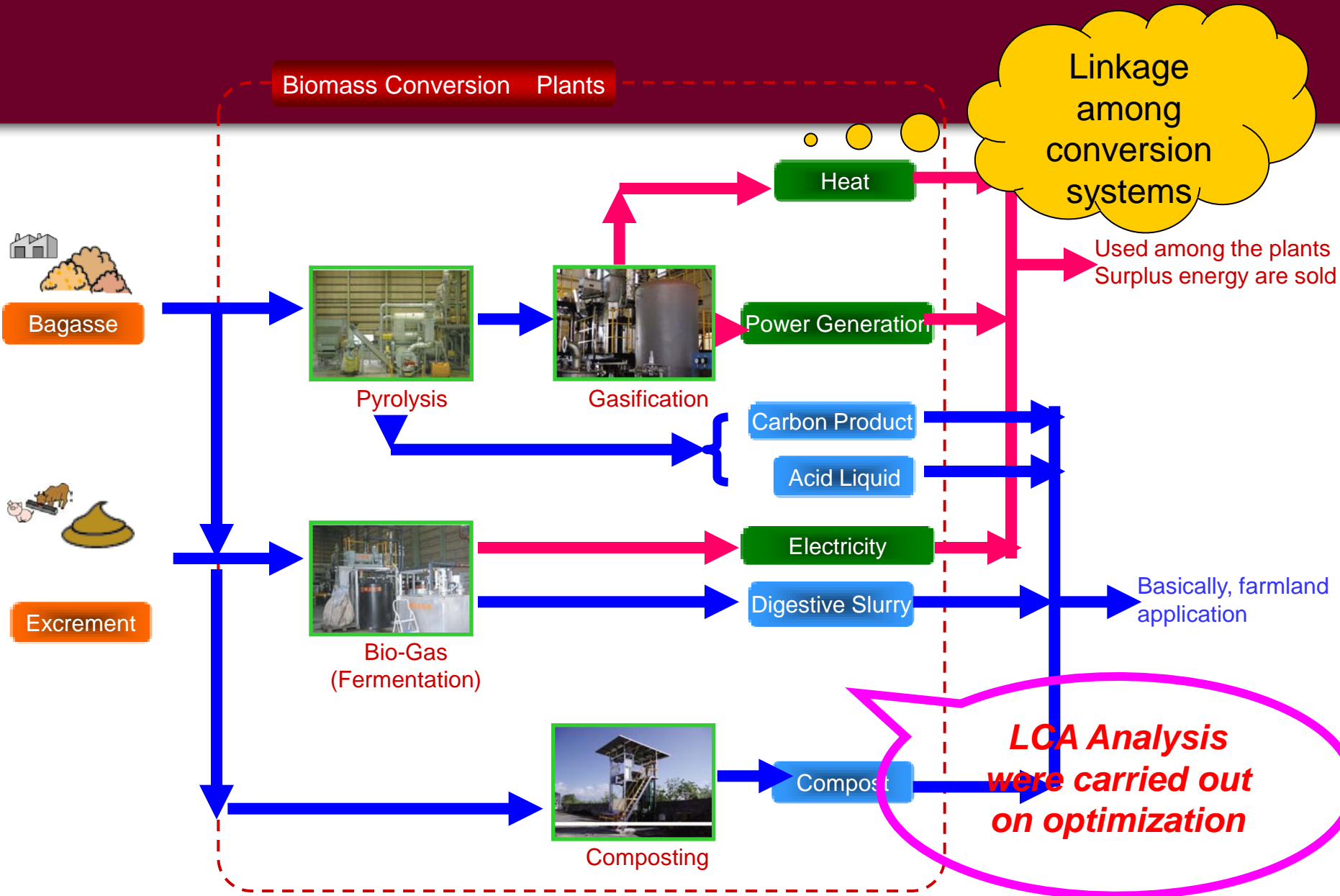


⑥ Speedy compost

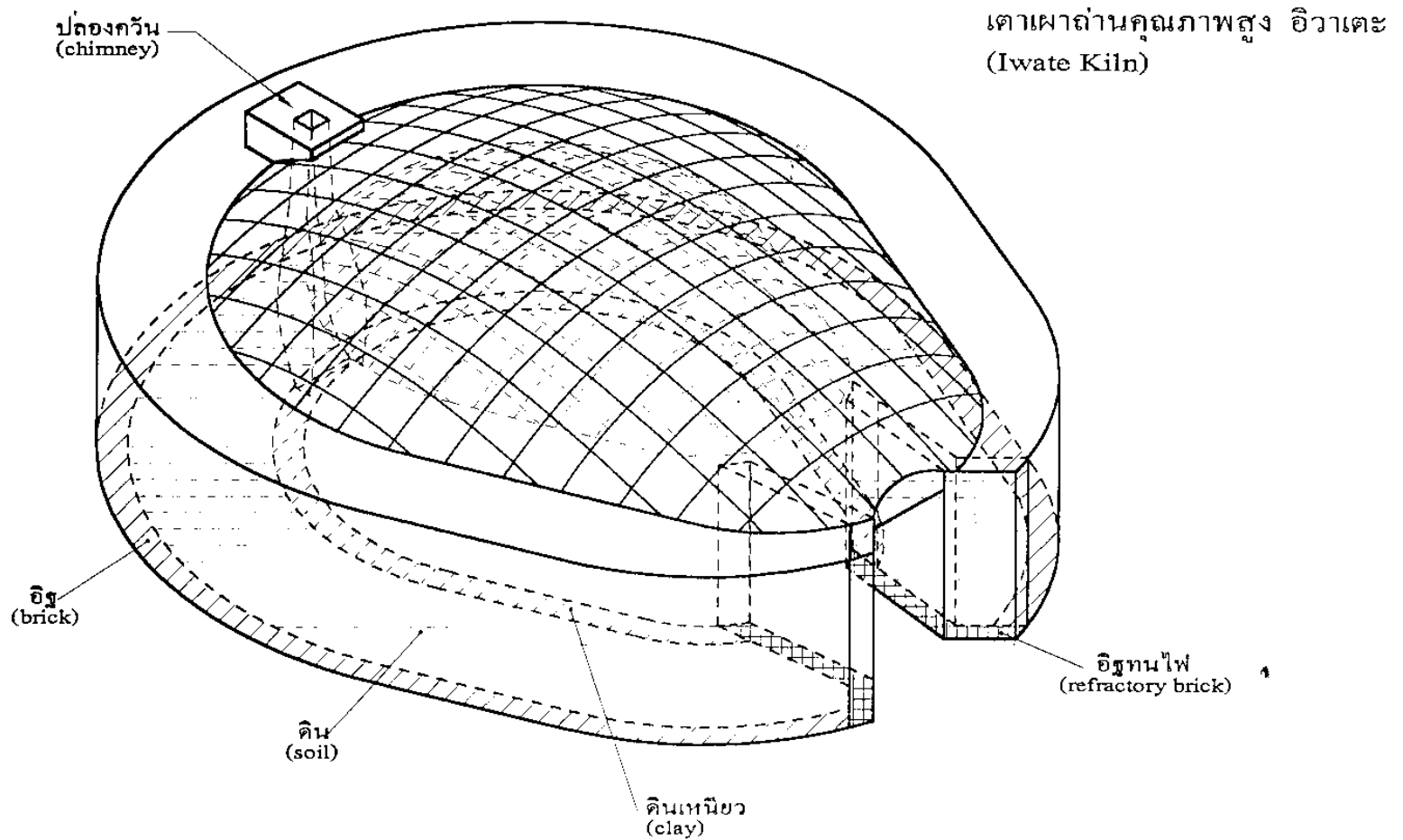


⑨ Wind & solar power generators





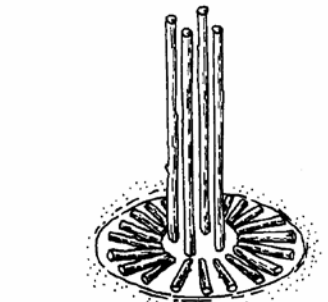
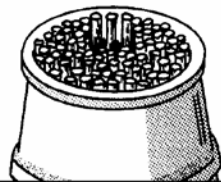
Manufacturing (Traditional Iwate kiln H1.1-1.4xW4.3xL5.4)¹⁷



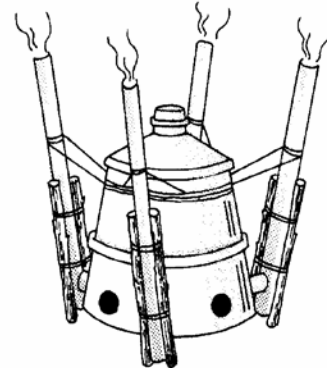
Portable iron D1.9 H1.8 Thickness1mm, 8-16hrs.



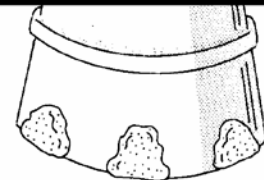
① 現地を整地し、周囲に排水溝を掘る



② 中央部に杭を打ち周りに敷木を敷く



⑦ 煙突を一つおきにとりつける。残り四つは通風口になる



⑧ 粘土で八カ所の穴を密閉する

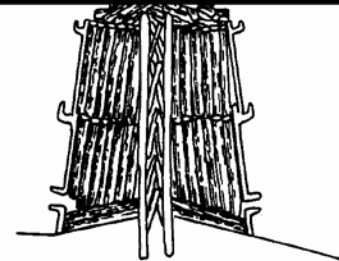
⑨ 炉壁が完全に冷却したら上段から取りはずす



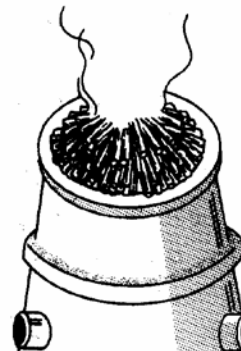
⑩



③ 炭材を下段から立て詰めする



④ 炭材の上に、乾燥材、枝条など着火材を上げ木として積み上げる

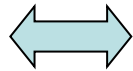




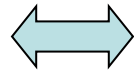
Char making Pan



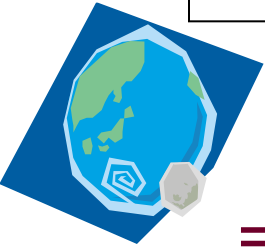
Global Warming



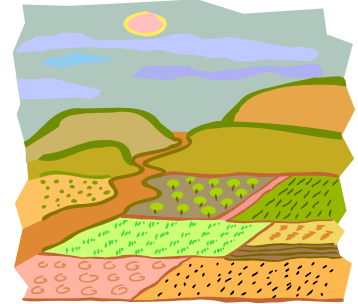
Greenhouse Effect



Carbon Dynamics



Biomass = "Carbon Neutral"
 = Crop = CO₂ User (Absorber)
 + Pyrolysis = Carbon Fixation
 + Land Application = Carbon Mitigation
 by farmland
 + Agricultural Use = Sustainable
 Our Direction = ???

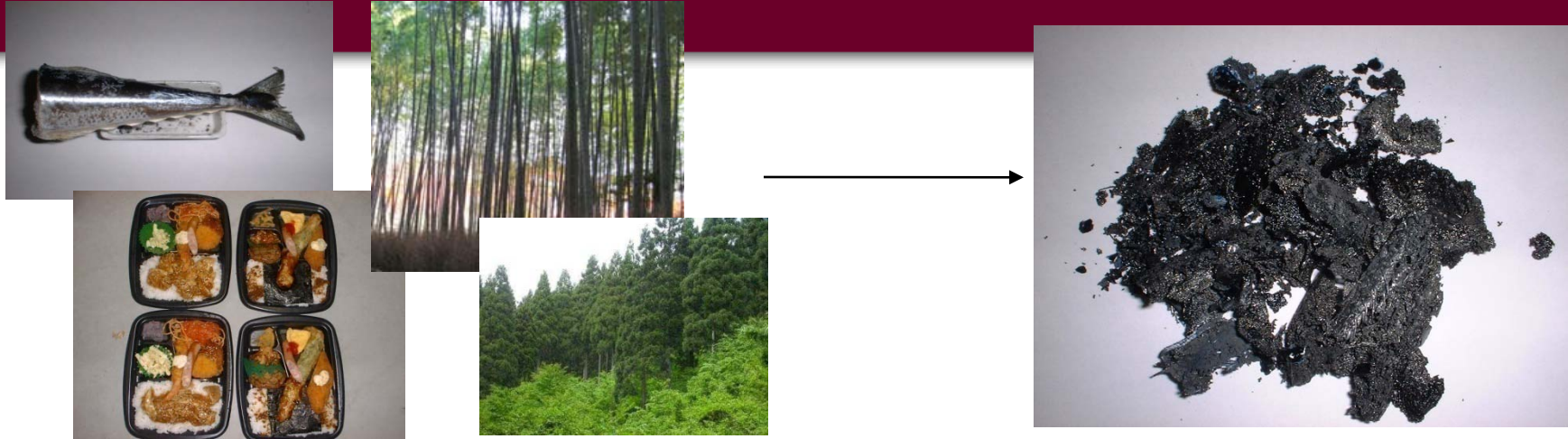


Biomass use →

Carbon Credit



CCS by carbonization of biomass



BIOMASS Waste

Pyrolysis



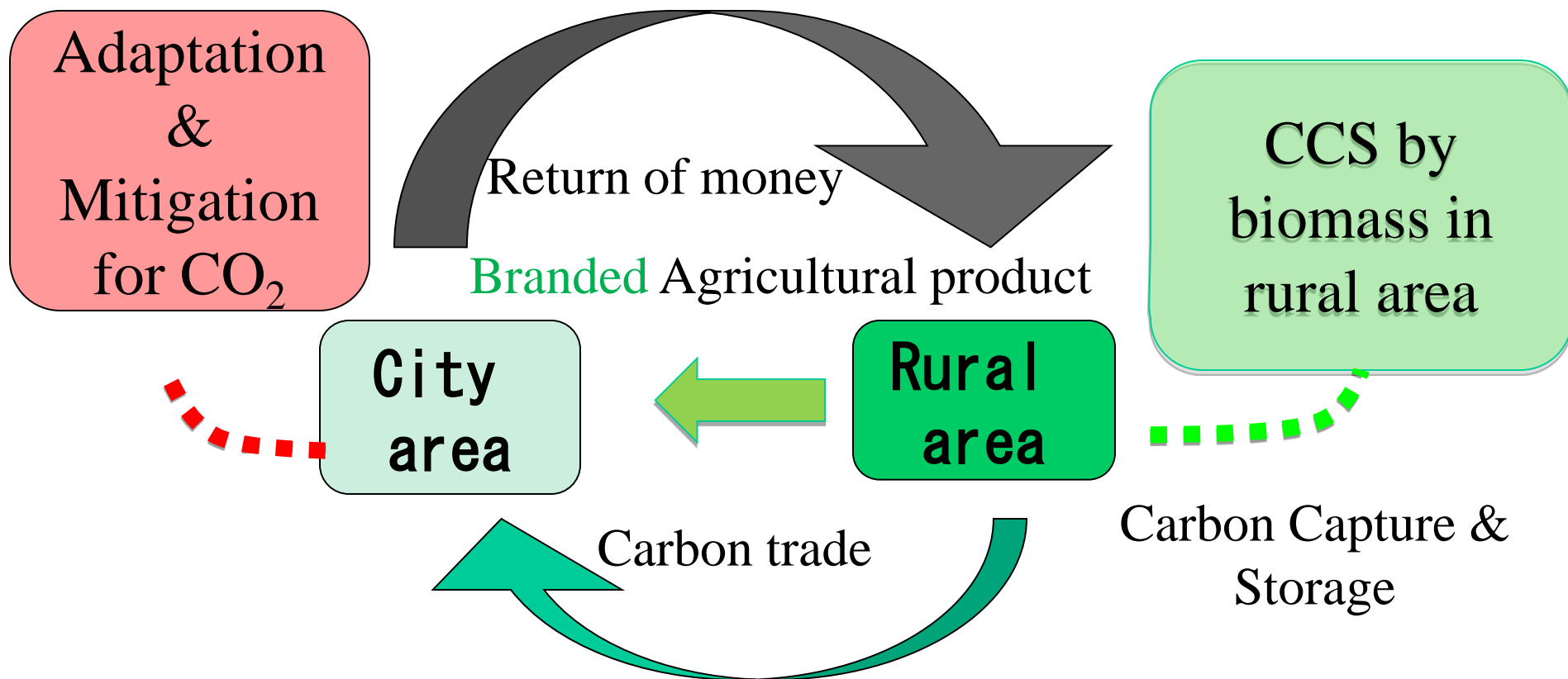
Farmland Application



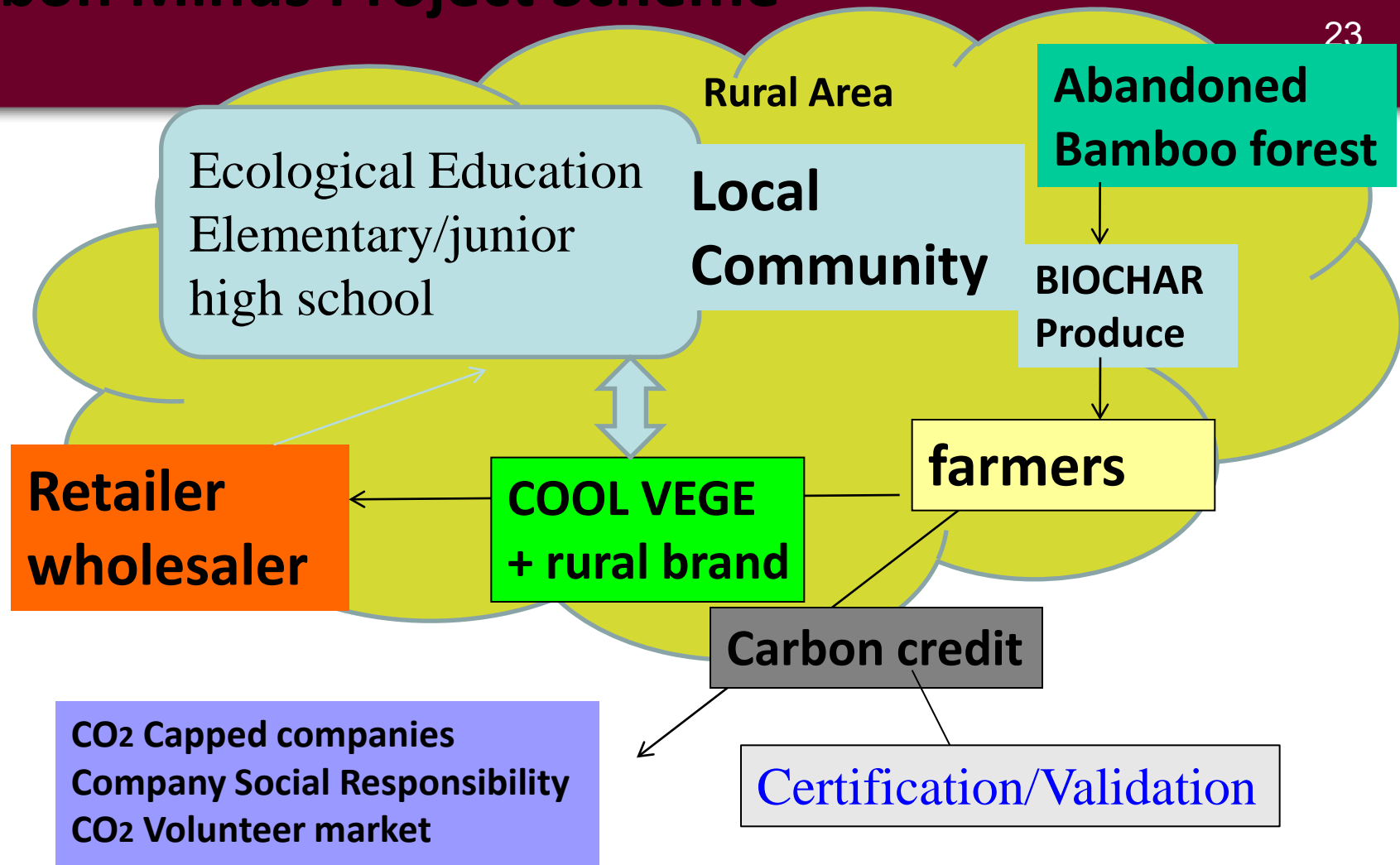
Carbon sequestration

Model of rural area

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Carbon Minus Project Scheme





Experiment for the effect of growing vegetable

地域の小学生が参加したムギ踏み



ムギの坪狩りの様子



Participation of elementary school pupil as environmental education.

Feb.18,2008 Experimental field (wheat) Stepping by children
as environmental education



Biochar can contribute as following;

1. Enhance productivity of farmland
2. Achieve environmental friendly agriculture, organic agriculture
3. Sustainable carbon sequestration
4. Rural promotion (Carbon minus project)
5. Environmental-friendly education

Achievement of sustainable society!!