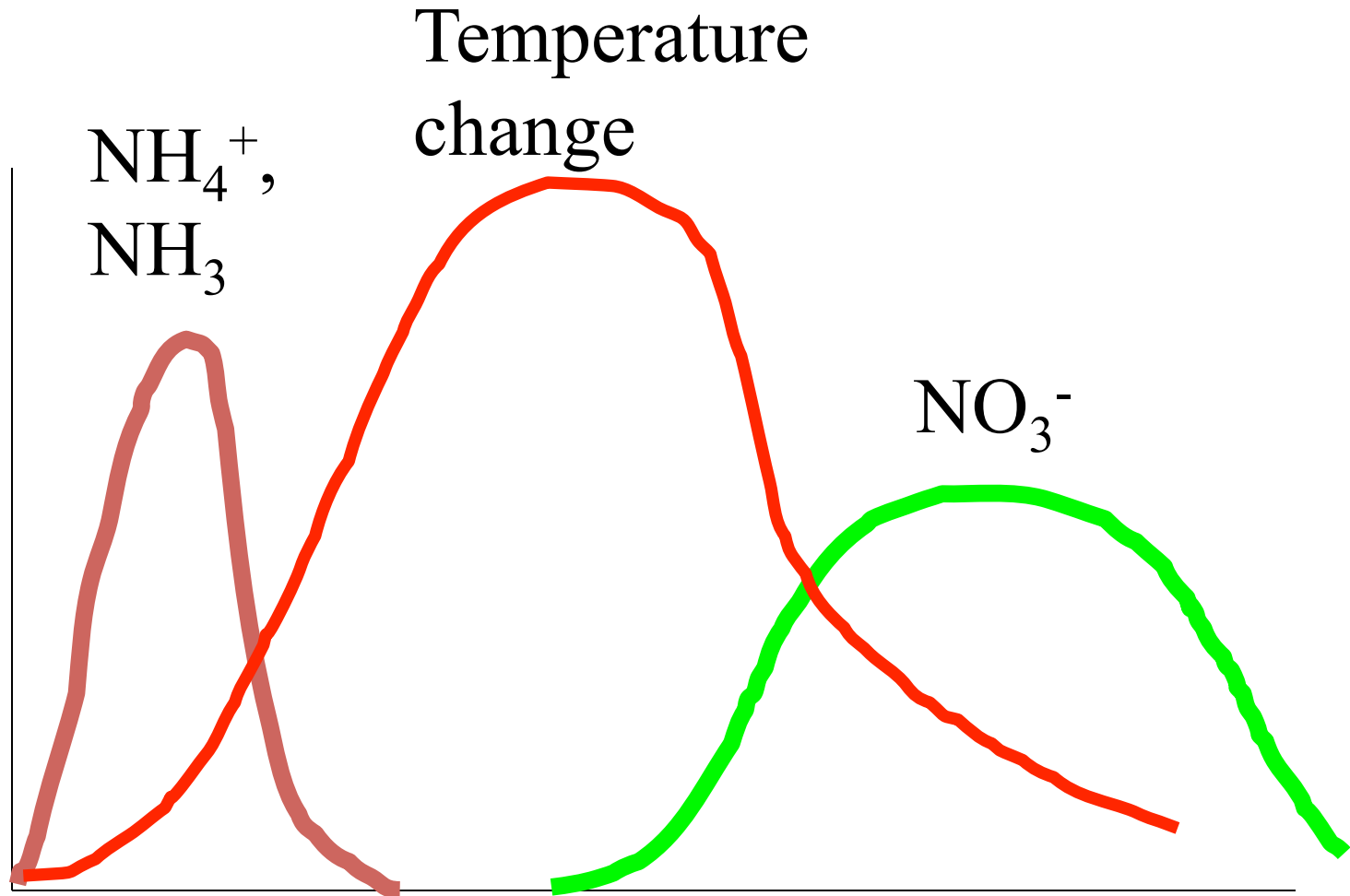


# Criteria for the maturity of compost



Detection of ammonium and nitrate ions during composting

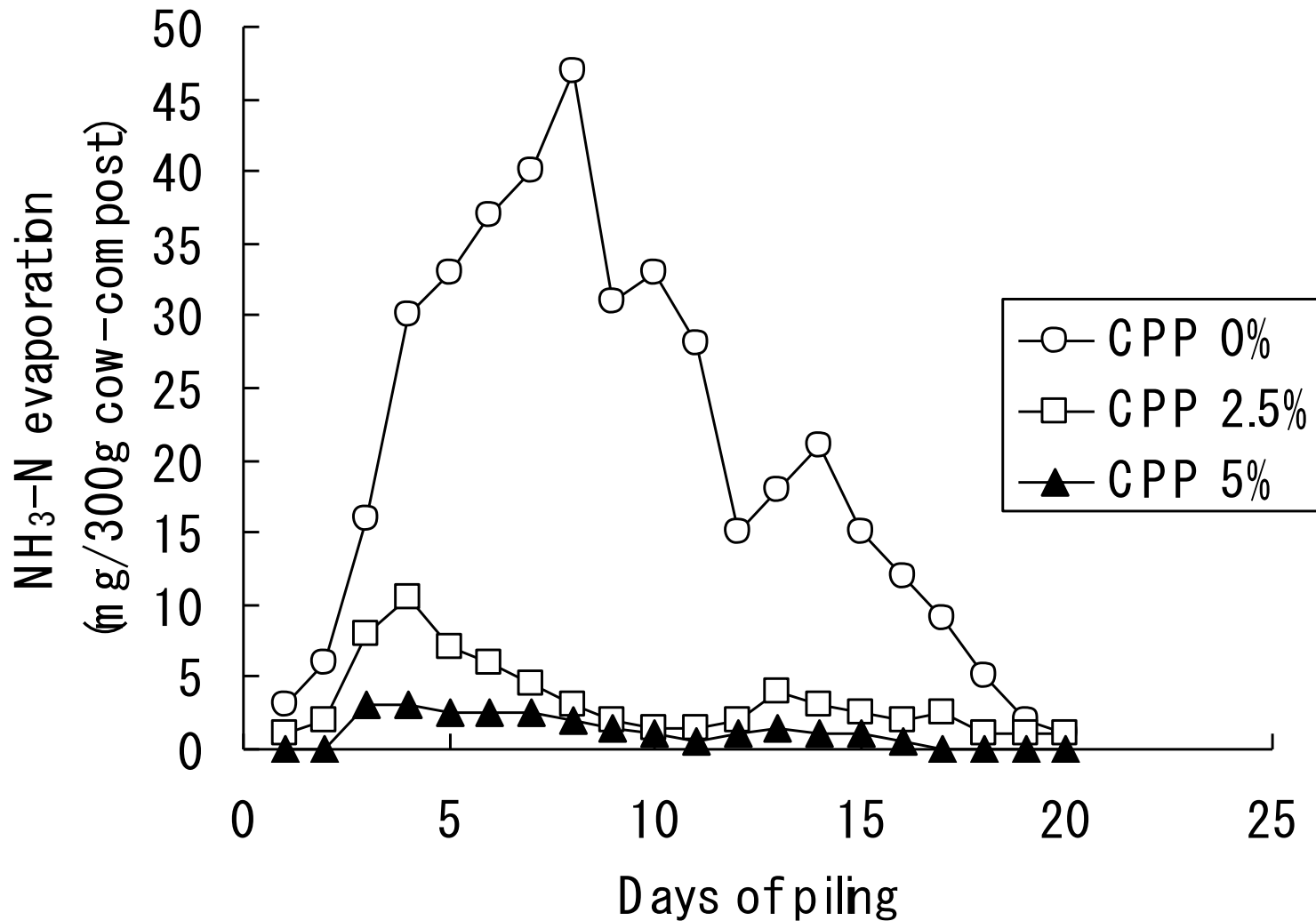
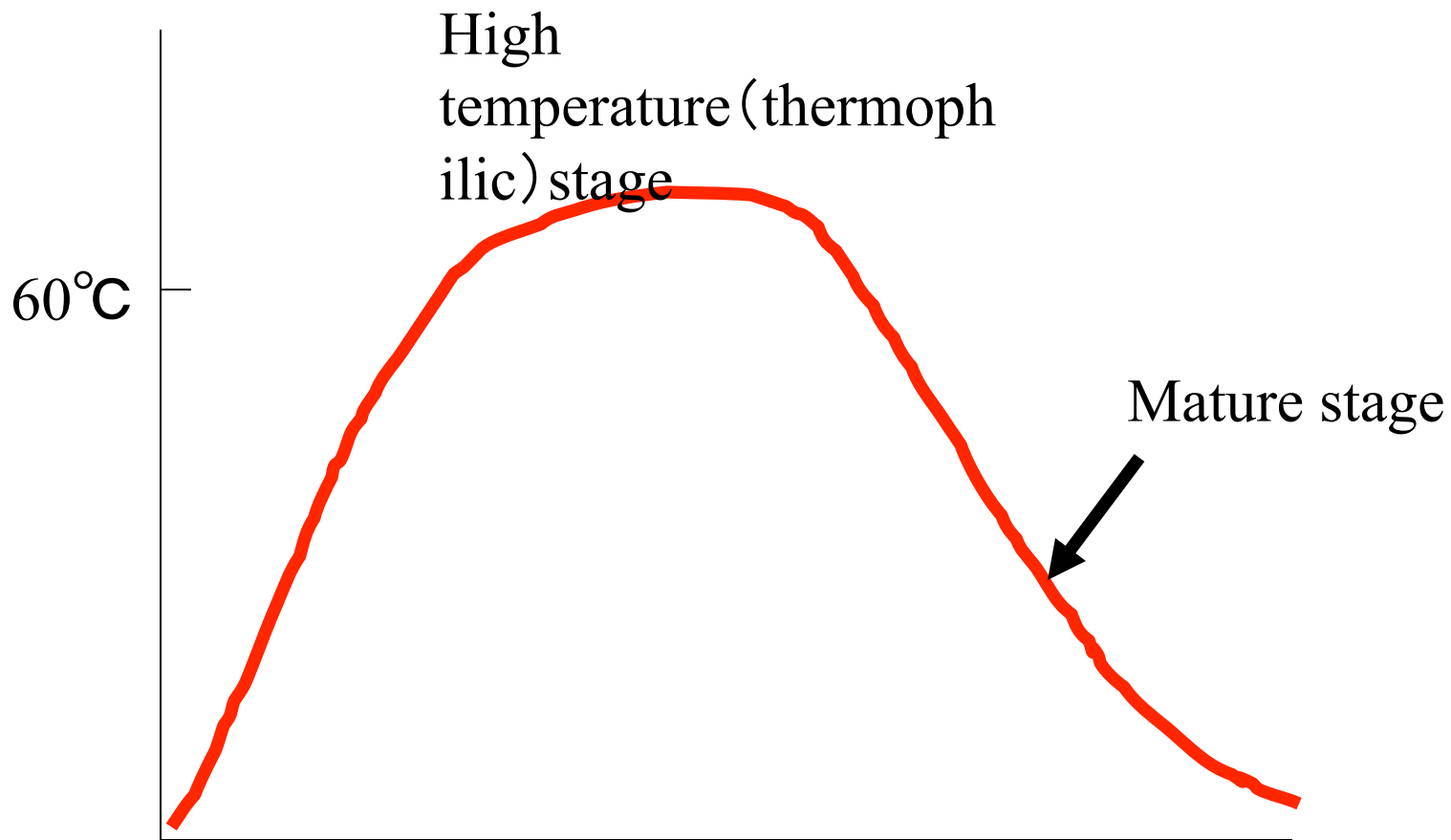


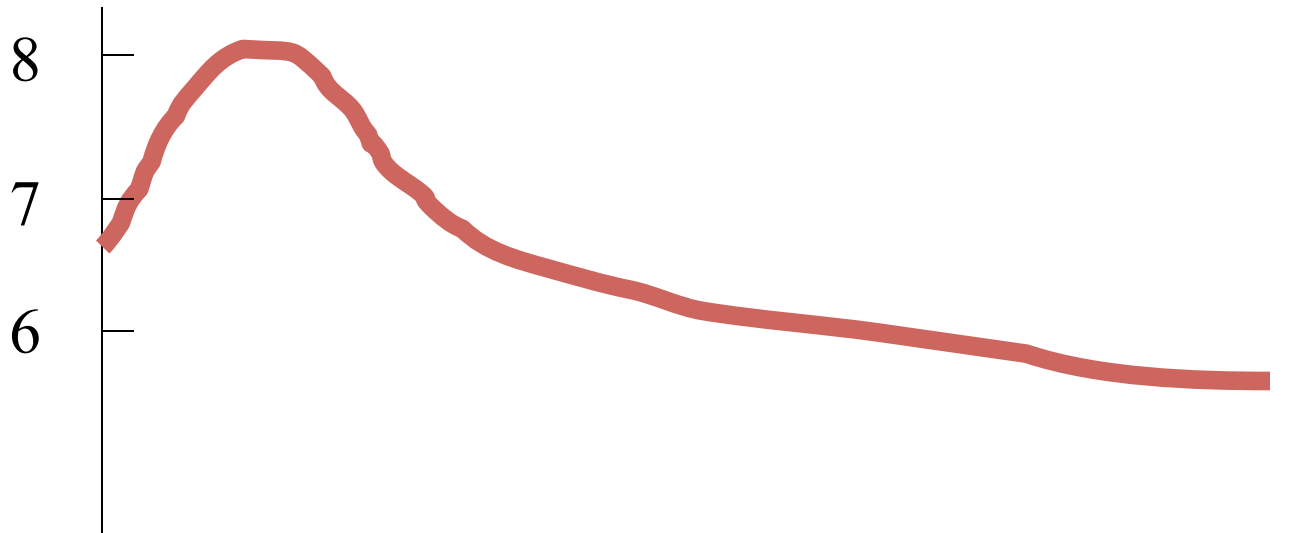
Fig. 2. Suppression of the evaporation of Ammonia N from cow manure by mixing calcium perphosphate (CPP) (Shintoku Experiment Station of Animal Husbandry, 1998).



Temperature change during composting (simplified)

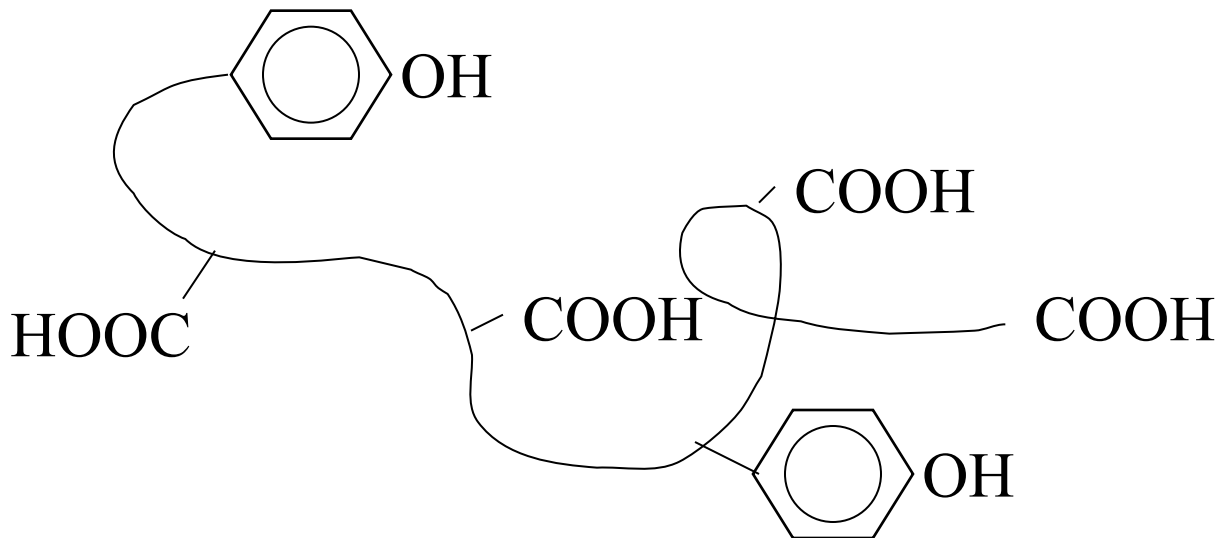
# Change in pH of compost

- First rise in pH is due to ammonia formation.
- Following decrease is due to the formation of nitrate, carbonate, and humic substances.



# Increase in cation exchange capacity (CEC)

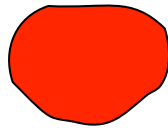
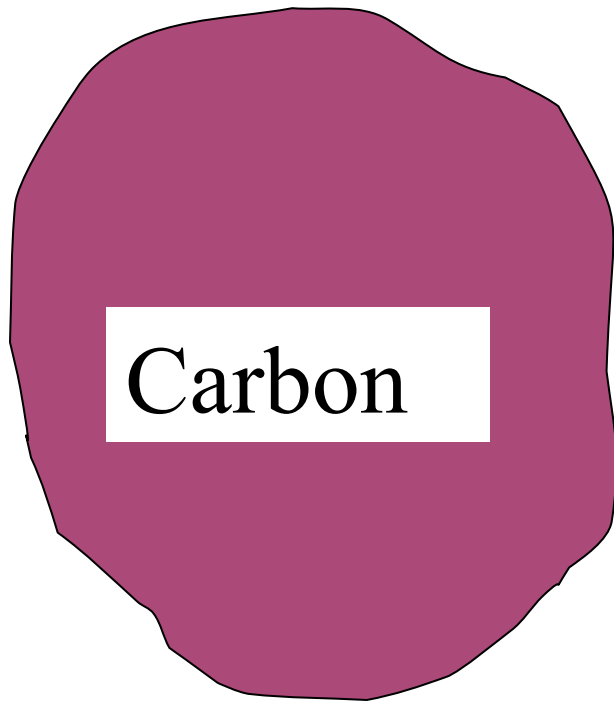
- Increase in CEC is remarkable in composts made from rice straw, woods, bark, sewage sludge, and municipal refuse



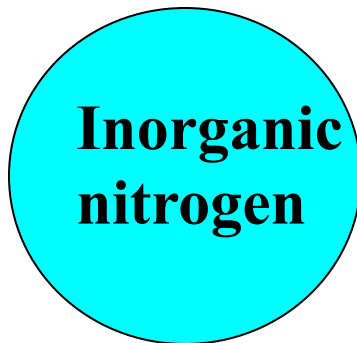
# C/N ratio

- C/N ratio was higher than 30 in the beginning, then reaches 15-20, it will be the sign of maturity. However, when the C/N was low from the beginning (such as cow manure), this criteria cannot be applied.

**When soil microbes proliferate utilizing organic matter with wide C:N ratio, they also absorb soil inorganic nitrogen.**



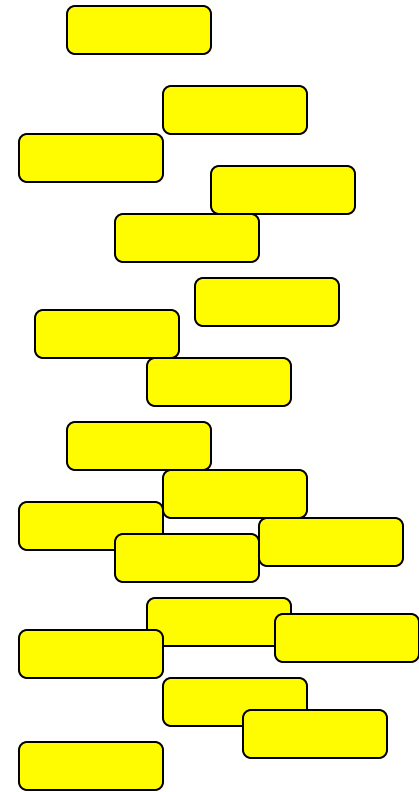
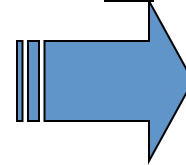
**Organic nitrogen**



Soil  
Microbes



$\text{CO}_2$



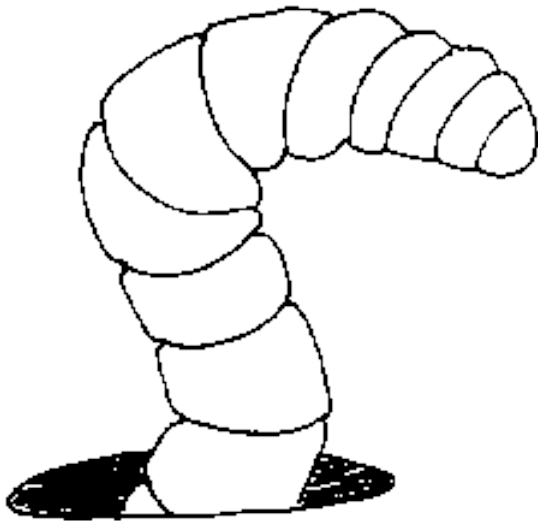
**This causes nitrogen starvation for crops.**



# Earthworm method

- Put a compost sample in a cup.
- Place a few earthworms on it.
- Cover the cup with a black cloth.
- If the earthworms creep into the compost, it is mature.
- If they try to escape, it is immature.

Earthworm escapes if your  
compost does not taste good.



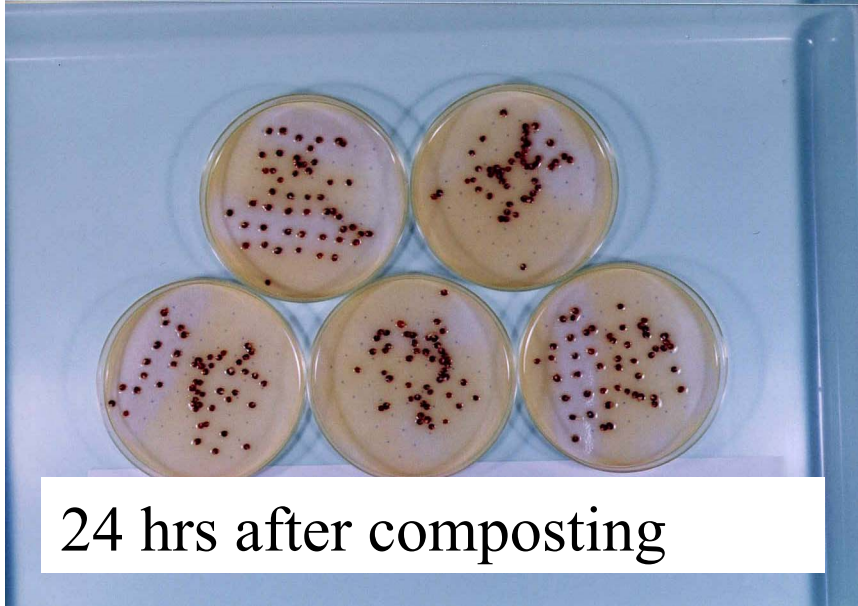
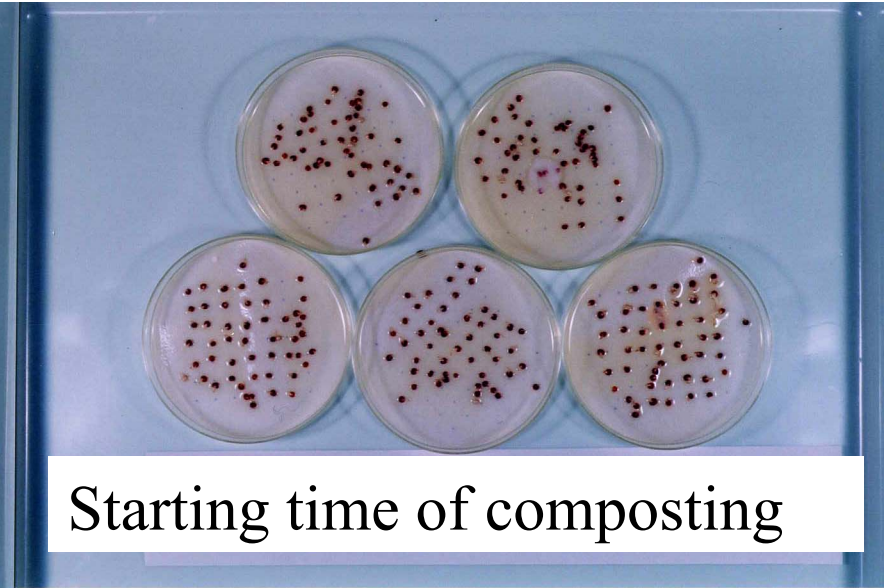
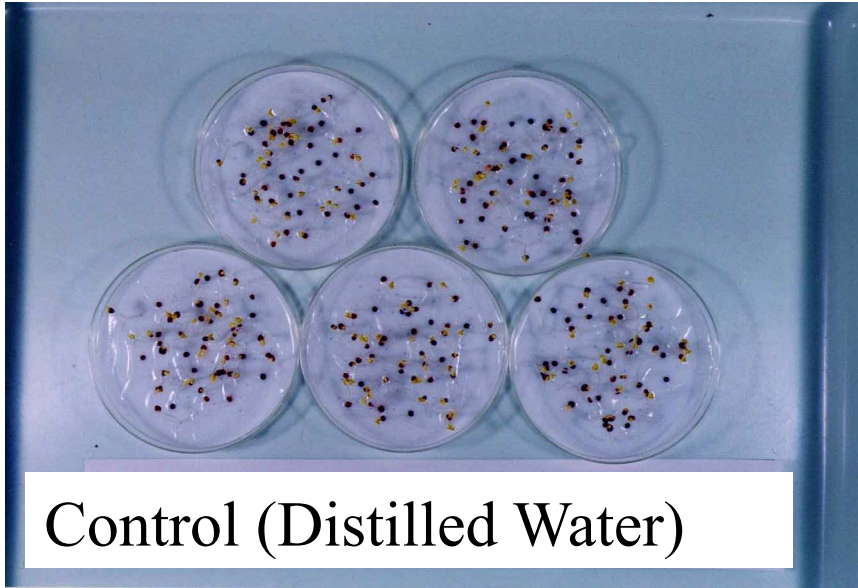
# Vermi-composting

- Earthworm can also be used for preparing compost itself.
- Earthworm is a powerful decomposer of vegetable wastes, and turn the wastes into valuable and safe compost.
- Earthworm cast is enriched with nutrients and it is a soil aggregate already.

# Germination test

- Seeds of Komatsuna(*Brassica campestris*), Cress (*Lepidium sativum*), or radish (*Raphanus sativus*) may be used, because these seed are small, quick to germinate, and sensitive to phytotoxic (plant damaging) substances like the organic acids temporarily present in immature composts. Using the water extract of the compost, germinating rate is compared with the control (distilled water).

# Germination Test



Example of Failure Case in Composting

# Seedling growth method

- Compost (150 g) and soil (350 g) are mixed and put in a Neubauer pot. The control is only the soil (500 g). Each 35mg of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O are applied to each pot in forms of ammonium sulfate, ammonium phosphate, and potassium sulfate. Water is applied to about 60 % of the water holding capacity. Twenty seeds of *Brassica campestris* are sown on the surface of mixture, and germination rate and growth rate are observed.

# Seedling growth method 2

- Compost (equivalent to 100, 200, 300, 400 mg of nitrogen) are mixed with soil (500 g) in Neubauer pots. The control is only the soil (500 g). 25 mg of N, P<sub>2</sub>O<sub>5</sub>, and K<sub>2</sub>O are applied to each pot in forms of ammonium sulfate, ammonium phosphate, and potassium sulfate. Water is applied to about 60 % of the water holding capacity. Twenty seeds of *Brassica campestris* are sown on the surface of mixture, and germination rate and growth rate are observed.





**Soil + Chemical  
Fertilizer (control)**

**Raw Sewage  
sludge**

**After 1<sup>st</sup>  
turning**

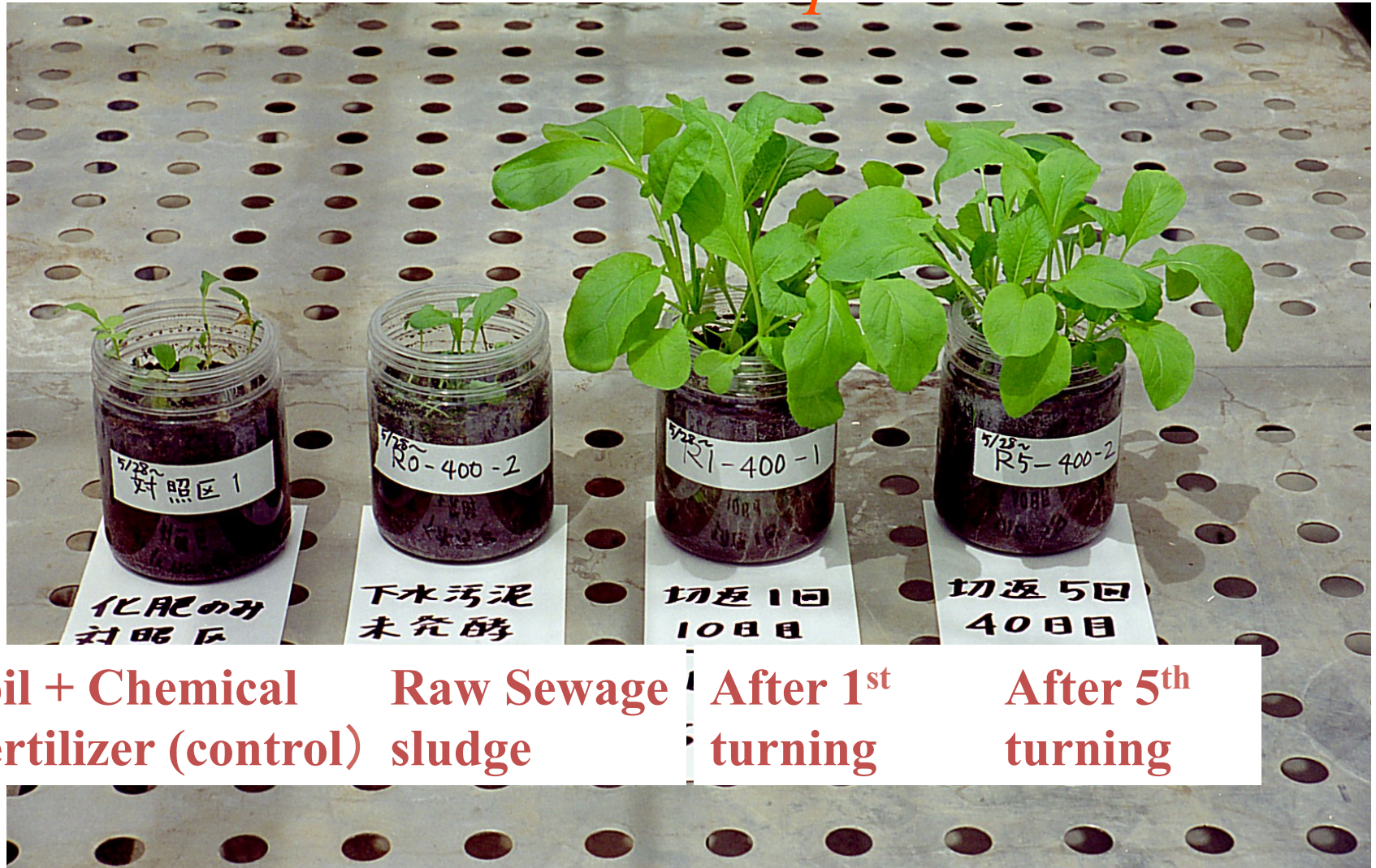
**After 5<sup>th</sup>  
turning**

## **Growth of *Brassica campestris***

To 500mL of soil, compost equivalent to 400mg of N was applied (1 week after seed sowing)



# Effect of Sewage Sludge Compost on the Growth of *Brassica campestris*



Soil + Chemical Fertilizer (control)      Raw Sewage sludge      After 1<sup>st</sup> turning      After 5<sup>th</sup> turning

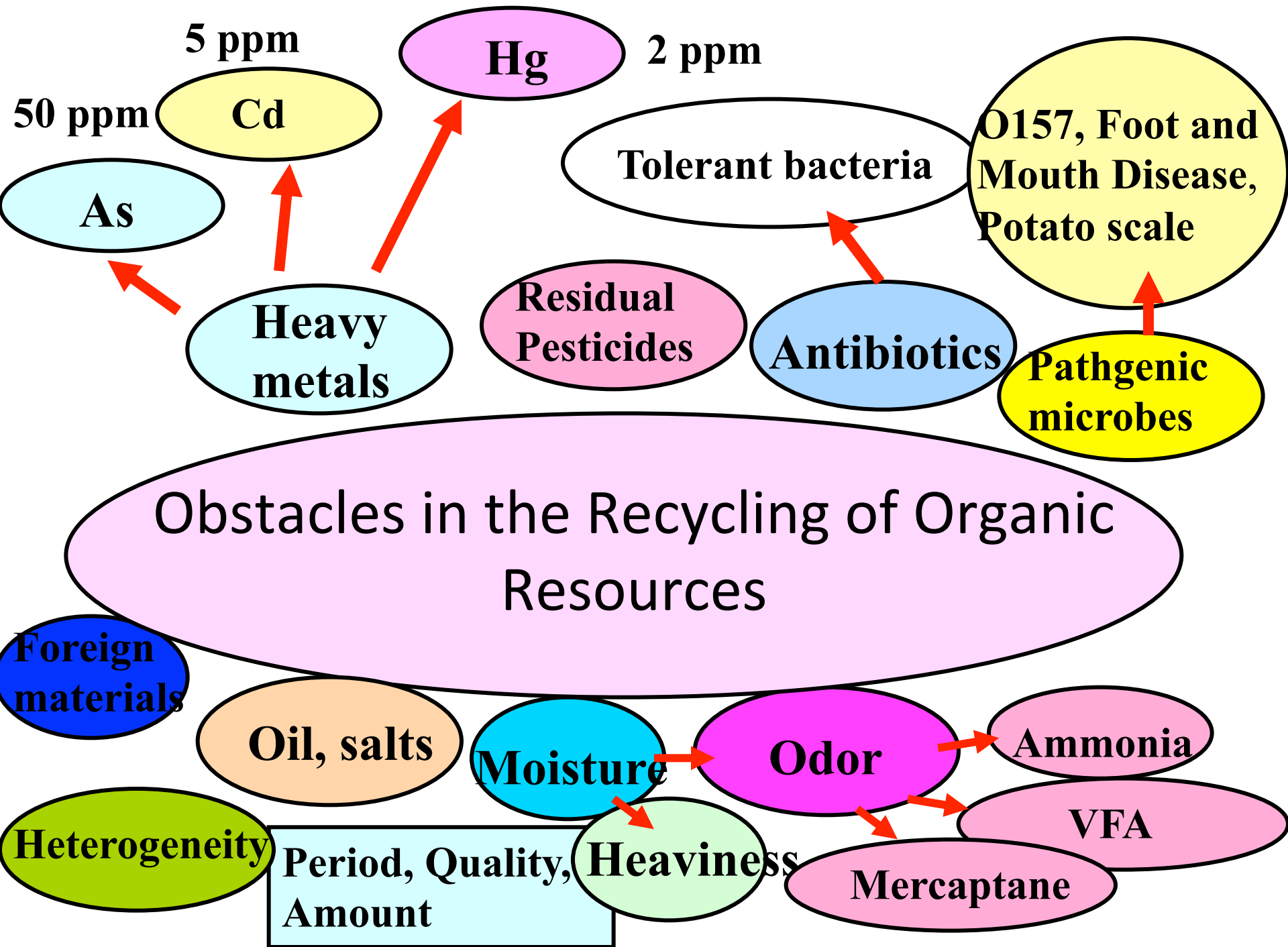
To 500mL of soil, compost equivalent to 400mg of N was applied (19 days after seed sowing)

# Difficulties in Compost Utilization

- Uneven distribution and deficiency of raw materials for compost making
- Hard work for preparation and application of compost
- Special technology, skill, and facilities are required for the production of compost
- Variation in constituents and effectiveness of compost

# Difficulties in Compost Utilization 2

- Occurrence of microbes tolerant to antibiotics, and germ microbes (in case compost was produced at low temperature)
- Enhancement of soil born plant disease for potato and soy bean.
- Contamination of raw materials by heavy metals (by radioactivity, recently)



# Conclusion 1

- Production of compost is indispensable for reducing the environmental load of dairy farming, maintaining the fertility of farm soils, and creating healthy soils and crops. The qualities of composts, however, differ considerably from product to product, because different kinds of raw materials are used besides animal feces and various methods of compost preparation are adopted.

# Conclusion 2

- Some of the composts may be unfavorable for use in agriculture. It is important for us to **keep the principles in compost preparation** (for example, activating aerobic process, experiencing the thermophilic period, providing enough duration for maturing, minimizing the mixing of heavy metals and foreign / artificial materials), in order to make safe and effective composts.



# Conclusion 3

- On the other hand, preparation and utilization of compost both require a huge labor. Reward for this labor is not remarkable, because higher yield of crops can be achieved by the use of cheaper chemical fertilizers and cheaper crops may be imported from foreign countries.

# Conclusion 4

**Community based organic matter recycling project --- Subsidy**

**and the understanding from the consumer is, therefore, very important.**

**Awareness to environment, ecology, and health helps the utilization of compost.**