

Use of Green Manure in Agriculture



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Green-manure in agriculture

- Increase soil fertility
- Suppress the problems associated with continuous cropping
- Improve soil physical properties (permeability, water holding capacity)
- Increase arbuscular mycorrhizal fungi.
- Increase root nodule bacteria/ Rhizobium.
- Kill nematodes
- Absorb excess nutrients
- Absorb toxic elements

Concept of Green manure utilization

- Use of solar energy
- Conversion of CO₂ to organic carbon
- Soil improvement by plant
- Increase of soil fertility by symbiotic microbes

- Use of natural rehabilitation process in agriculture



Experiment plot for green manure





Plowing in the oats grown after harvesting wheat

August 09, 2004,

Kamiyubetsu

Onion field in Kami-Yubetsu Hokkaido

Rye will be grown after harvesting



August 11, 2004,

Chiebung

Sun flower field in Chiebung Contribution to tourism



Brassica juncea (L.) Czern. et Coss.
Application to phytoremediation



White mustard (*Sinapis alba*, *Brassica alba*)



Angeria

Prevent the disease of leek



Crimson Clover

Prevent cyst-nematodes of soy-bean



Hay-oats (Wild oats)

Prevent root nodule causing nematodes



Milk vetch

used for paddy field



Various green manures recommended in Hokkaido



Sunflower



Hairy vetch



Sinapis alba

Use of harvest residue of ear-corn for green manure



To increase forage production in Japan

Combination of green manure and crops

| | Green manure | Following crops | Effects |
|------------------------|-----------------------|-----------------|---|
| Successive cultivation | Oats | Soy bean | Root nodules, mycorrhiza infection, nematodes suppression |
| | Sunflower, legume | Corn, onion | Nitrogen supply, mycorrhiza |
| | White mustard, legume | Sugar beet | Nitrogen supply |
| Fallow | Legumes | Winter wheat | Nitrogen supply |

Green manure and compost comparison

1) Increase soil fertility

Green manure (G) = Compost (C)

- Nutrients in green manure will be released on decomposition.

2) Improve soil physical properties. G = C

- Increase soil pore space by organic matter application.

Green manure and compost comparison 2

3) Increase water permeability in soil

$$G > C$$

Root of green manure is long and strong. It penetrates through a hard sub-layer soil. Therefore, it improves water drainage.

Green manure and compost comparison 3

4) Suppress the problems associated with continuous cropping. $G \geq C$

Suppress plant pathogenic microbes

$G \geq C$

Suppress the activity of nematodes

$G > C$

Increase the activity of soil microbes

$G > C$

Green manure and compost comparison 4

- 5) Increase arbuscular mycorrhizal fungi. G > C

- 6) Increase root nodule bacteria/ Rhizobium. G >
C

Green manure and compost comparison 5

- 8) Contribution to environmental conservation $G > C$
- a. Soil erosion is suppressed by cover crop. $G > C$
 - b. Growing green manure absorbs excess nutrients in soil. Fix mineral nitrogen temporarily into decomposing organic matter. only G

Green manure and compost comparison 6

- 8) Contribution to environmental conservation G > C
- c. Absorb heavy metals (contribute to phyto-remediation) only G
 - d. Contribute to the beautiful scenery of rural area. only G
 - e. Fix CO₂ in air. No emission of greenhouse effect gasses. only G

Merits of green manure

- 1) Green manure can be applied uniformly to large area. $G > C$
- 2) Quality of organic matter applied to the field is uniform. $G > C$
- 3) Labor may be less compared with compost application. No transportation cost is necessary. $G > C$

Demerits of green manure 1

1) Adverse effects

$G = C$

- Stunt due to insufficient decomposition
- Nitrogen starvation due to high C/N
- Transfer disease and worm hazards due to improper combination of green manure and following crop

2) Need fallow period for growing green manure

$G < C$

Demerits of green manure 2

- 3) Effect of green manure may differ by each species of green manure,
 - Therefore, almighty effects are not expected.

Demerits of green manure 3

- 4) Combination between green manure and following crop should be considered.
- 5) Green manure sometimes increases nematodes by mixing into soil.

Demerits of green manure 4

- 6) Seeds of may be expensive, but pure and good seed is necessary.
- 7) Green manure may turn to weed or wild grass on improper management.