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Life cycle analysis of environmental load and reduction potential related to food consumption in Japan

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Introduction

Background.

- Lack of typical inventory data covering generally consumed food reflecting actual condition of Japan.
- necessity for assessment of reduction potential of environmental road before implementing measures

Objectives.

1. Building inventory data covering general food consumed in Japan
2. Evaluating reduction potential of some measures contains cost analysis

Methodology

1. LCI

- LC-GHG (CO_2,CH_4,N_2O) estimation of 22 commodities (Table 1).
- Evaluate 2 processes: Agricultural production & transportation
- CO_2 emission is estimated by emission factor from I-O analysis & production cost in production process, wholesale market data in transportation process.

Table 1 commodities in GHG emission estimation

Cereals	*Meats*	*Sea food*	*Vegetables*	*Fruits*
Rice	Beef	Tuna	Cabbage	Apple
wheat	Pork	Salmon	Lettuce	Manderin orange
	Chiken	Sardine	Potato	Strawberry
		Sea bream	Carrot	Grape
		Oyster	Onion	
		Cuttlefish	Tomato	
			Green pepper	

2. Reduction potential & cost efficiency

(1) Utilization of rice straw

- Utilizing rice straw treated as soil reduction normally as feed or raw material of bioethanol.
- Compost is supplied instead of straw as organic matter application.

Bioethanol production

- Assume 1 plant construction in each 47 prefecture of Japan.
- Assume concentrated sulfuric acid method.
- Reduces CH_4 emission from methane fermentation in rice field.
- Reduces GHG emission from gasoline.

Feeding

- Utilize as cattle feed instead of straws mainly imported from China.
- Reduces CH_4 emission from methane fermentation in rice field.
- Reduces GHG from transportation of import.

(2) Energy conservation of greenhouse farming

- Introduction of heat pump system & multiple covering in greenhouse.
- Simulating energy use of a model greenhouse in various situation of climate, crude oil price, and preset temperature.

Results

1.LCI results

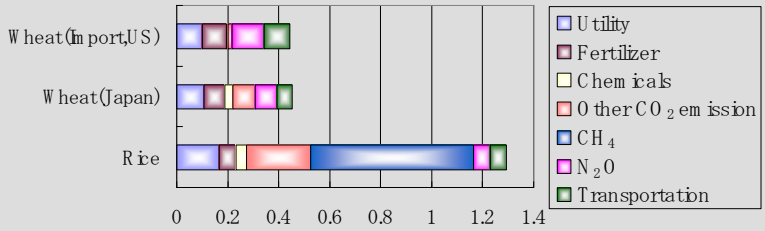


Fig.1 GHG emission of cereal production/transportation

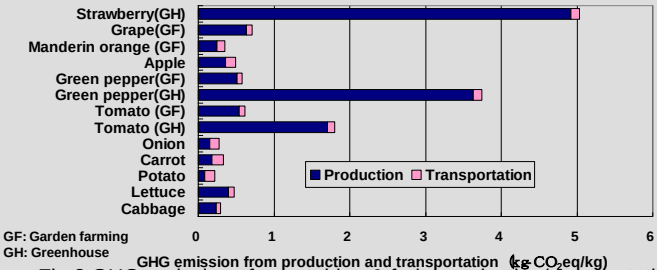


Fig.2 GHG emission of vegetables & fruits production/transportation

2. GHG reduction potential

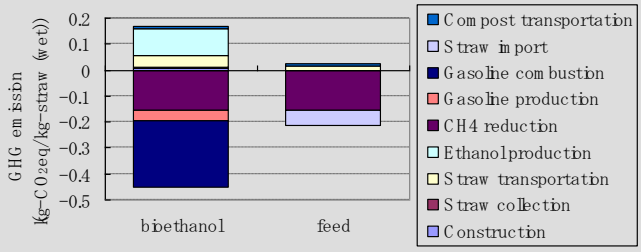
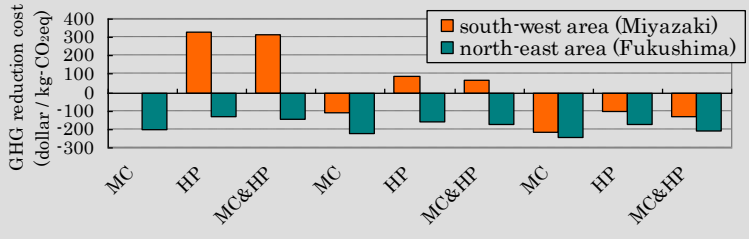


Fig.3 GHG reduction potential by rice straw utilization



Preset temprature: 283K 285K 290K

MC: introducing multiple covering HP: introducing heat pump system

Fig.5 Cost efficiency of GHG reduction by energy saving technology
(heavy fuel oil A price 0.6$/L case)

Conclusion

(1) Methane emission from rice cultivation, CO_2 from crude oil combustion in greenhouse are keys of GHG reduction in Japanese agricultural sector.

(2) Bioethanol production from straw has higher GHG reduction potential than feed use of straw, though cost efficiency is low by current technology.

(3) Additional energy saving technology of greenhouse seems cost-effective in GHG reduction in many cases.