Prefectural-level life cycle inventory dataset of vegetable and fruits production in Japan

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Background

- Inventory databases of agricultural products have been developed with country-level data
- Despite these data will be useful and suitable for background data of life cycle assessment, it is insufficient to use inventory data as benchmarks for consumer product choice
  For example, conventional agriculture is very varied by production area, when considering its detail of practices. Seasonal variation of inventory data would be high if target products are grown in greenhouse with heating.

Benchmarks of consumer product choice are required to contain regional- and seasonal-level inventory data to compare with other type of practice in same area and season

Develop LCI data of vegetables and fruits produced by prefectural level in Japan, considering standard practice of each area

Methodology

Development of LCI databases

- **Target crops**
  41 cprops produced in 10 prefectures in Japan
- **Functional unit and inventory**
  1 kg of product, greenhouse gases (GHG)
- **System boundary**
  Including consumptive materials for crop production (energy, fertilizer, agrichemicals)
  Durable goods and facilities are excluded
- **Data collection**
  Standard practice and production cost data published by each prefecture
  Technology level are usually set as „a top runnner“

DEA (data envelopement analysis)

have been implemented to analyze technology level toward low carbon production and potential of GHG reduction

- **Input & output data**

Input: labor input (hour) and GHG (kg-CO_2eq)
Output: agricultural income (JPY) and amount of product (kg)

- **Lenear plannning**

$$min\ c = \sum x_2$$

$$s.t. \sum_{j=1} \lambda_j x_{ij} < x_i \ (i=1,2)$$

$$x_{ij} \leq x_i$$

$$\sum_{j=1} \lambda_j y_{rj} < y_r \ (r = 1,2)$$

$$\sum_{j=1} \lambda_j = 1\ , \lambda_j > 0, x_i > 0, y_r > 0$$

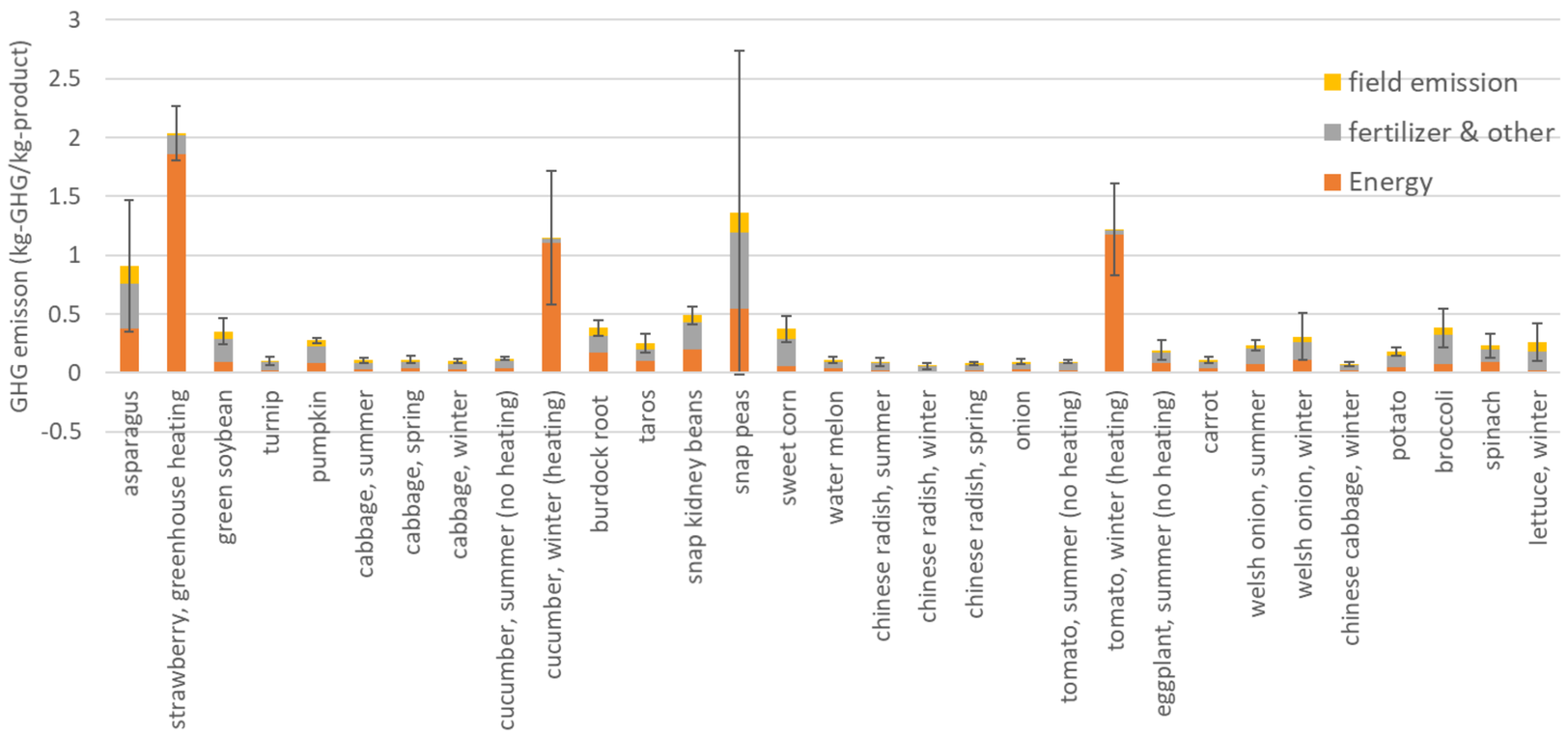
c: *GHG emission* , x_{ij}: *input data of each practice*
y_r: *output data of each practice*
i: *types of input data*, r: *types of output data*,
j: *types of practice*, x_i, y_r, λ_j :*variables*

- *Iniicator of “environmental efficiency” was used for analyzing result,*

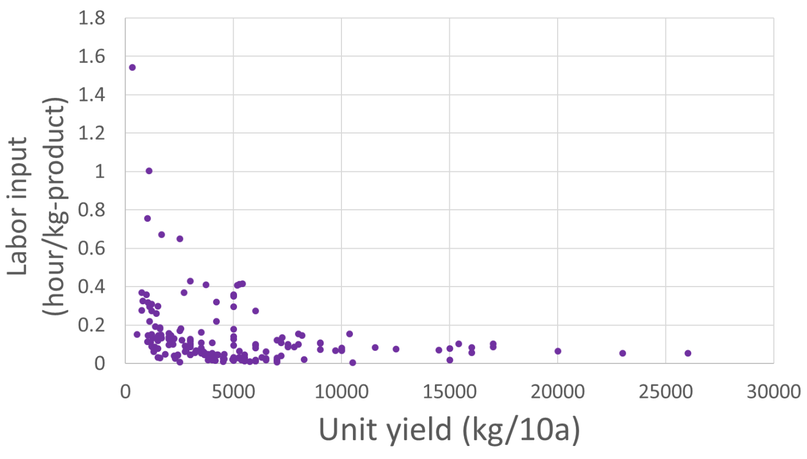
$$EE = \frac{c_j}{x_{2j}}$$

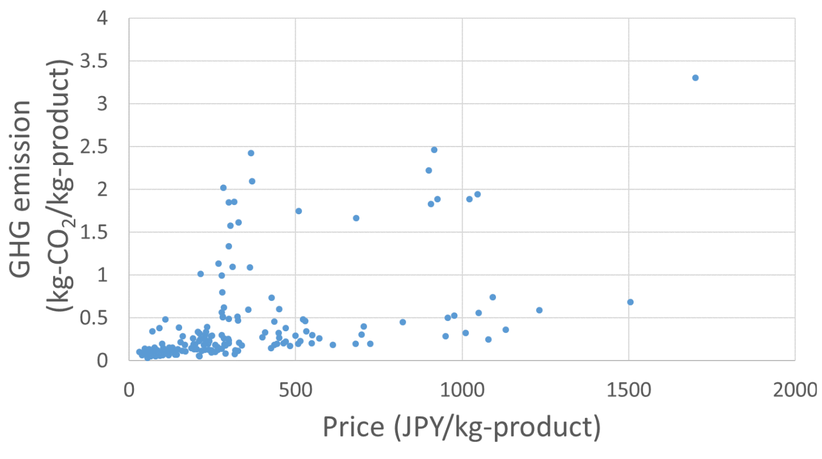
Results and Discussion

(1) Preliminary result of LCI and its geographical deviation (crops which >2 samples collected)



(2) Relationship between indicators





Result (1)

- Seasonal defference is not small especially practice using greenhouse heating
- Variaition of LC-GHG by prefecture is large in energy-consuming practice

-> Average of coefficient of variation (CV) is 0.15

Result (2)

- Price and LC-GHG has midium relationship

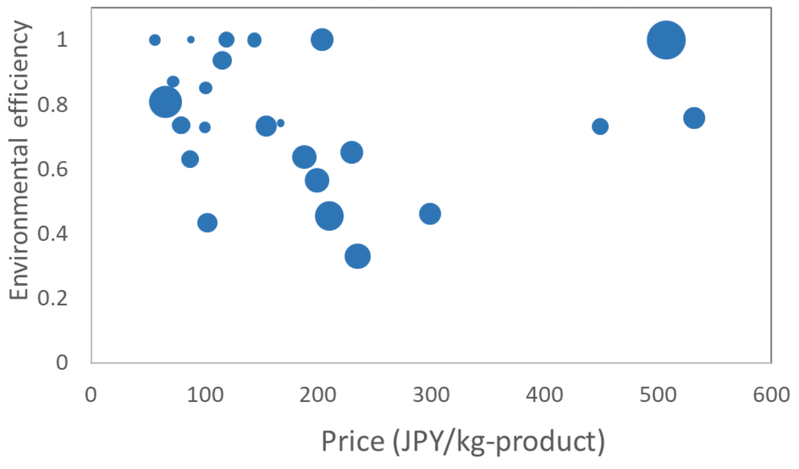
(correlation coefficient:0.43)

Result (3)

- Not noly big-producing regions be on the frontier (EE=1)
- High price commodities (practice) is not far from frontier, lower potential (percentage) to reduce GHG

(3)Result of DEA

(Size of bubbles: share of production in Japan)



Conclusions

✓Developing regional-level of LCI in 40 vegetables and fruits to consider seasonal/regional difference of practices
✓Variation of LC-GHG is high in energy-consuming practice like that including greenhouse heating
✓There is no relation ship share of production and EE, but high-price commodities seems be close to frontier