

# Recovering soil fertility after stripping the Cs contaminated-top soil off at Iitate Village in Fukushima Prefecture.



The Asahi Shimbun DEGITAL , Image credit: DigitalGlobe

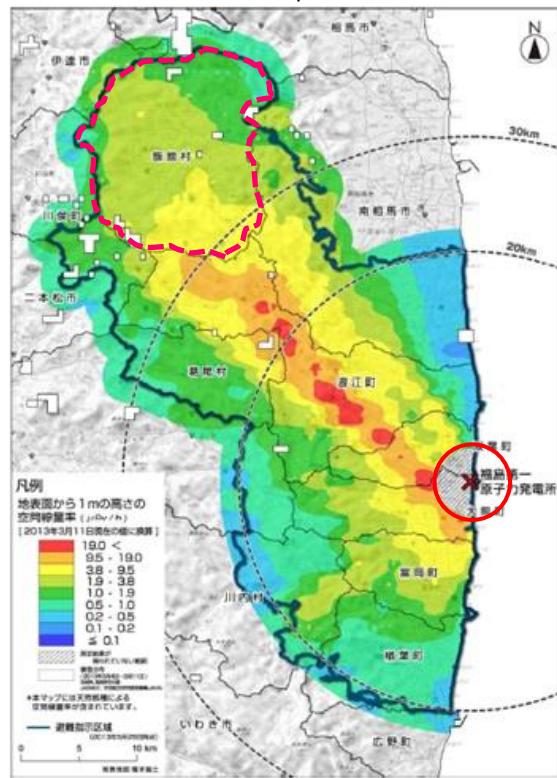
The accident of the Tokyo Electric Power Company, Fukushima Daiichi Nuclear Power Plant in 2011

JUNKO NISHIWAKI, NAOMI ASAGI AND  
MASAKAZU KOMATSUZAKI (IBARAKI UNIV.)  
MASARU MIZOGUCHI (THE UNIV. OF TOKYO)  
KOSUKE NOBORIO (MEIJI UNIV.)

# Results of the air and soil dose

Air dose at 1 m from the soil surface, Cs-134 and Cs-137 conc. per unit area.

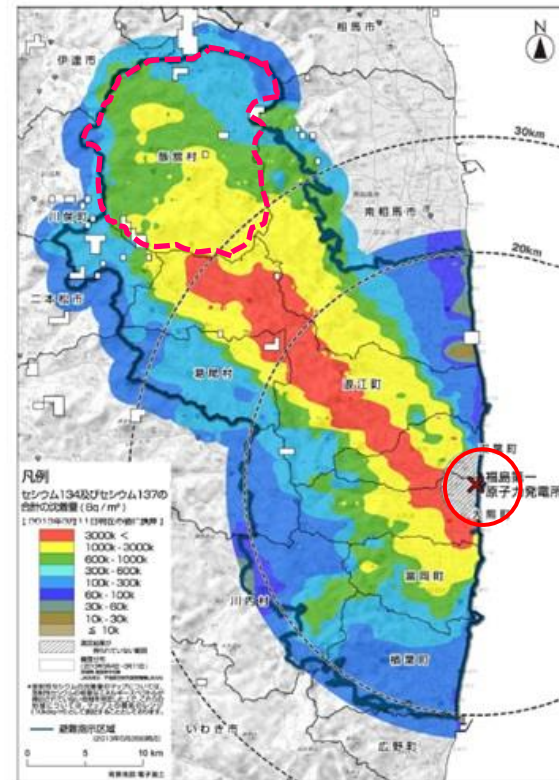
Mar. 11<sup>th</sup>, 2013



※1:測定結果は、避難指示区域の測定の最終日の時点(平成25年3月11日時点)の値に減衰補正。  
 ※2:実線で囲われた白色の領域は積雪等のあった箇所。

Total surface deposition of Cs-134 and Cs-137

Mar. 11<sup>th</sup>, 2013



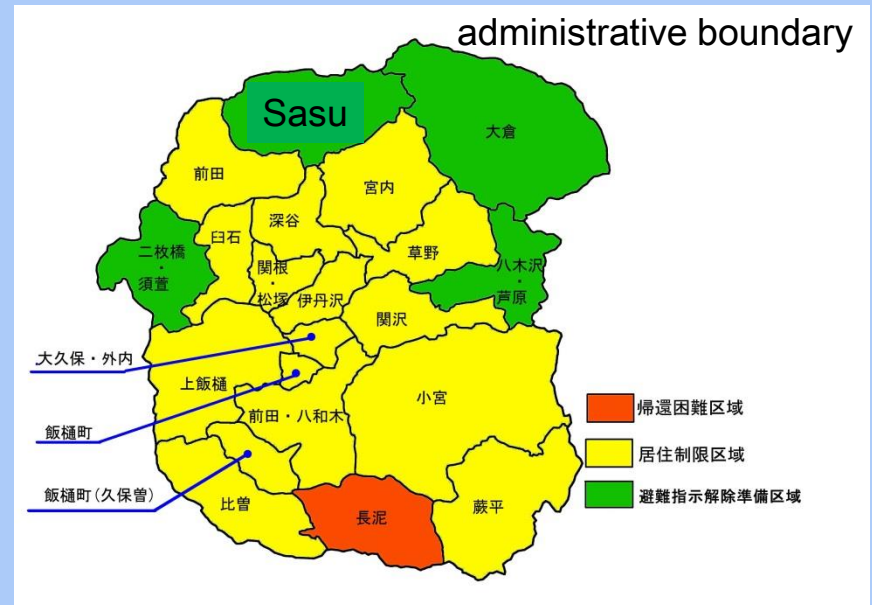
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NRS, Japan web

○ litate Village is at about 40 km northwest from a Fukushima Daiichi nuclear power plant.

# evacuation area, Iitate Village

- Deliberate evacuation areas on Apr. in 2011
  - Reorganized to 3 areas on July in 2012
    - **zone where residents cannot return for a long time**  
(annual cumulative external radiation exposure is higher than 50 mSv )
    - **zone with restricted entry**  
(annual cumulative external radiation exposure is between 20 to 50 mSv )
    - **zone in preparation for having the evacuation order lifted**  
(annual cumulative external radiation exposure of 20 mSv and below)
- \* 6 barricades are built in order to inhibit enter the zone where residents cannot return for a long time.





# Decontamination method proposed by Ministry of Agriculture, Forestry and Fisheries

\* implementation rate of farmland is 2% on August 31st

- **Stripping the top soil off**

**【aspect】** Removal of the non-tilled soil surface.

**【problem】** How to treat a lot of waste soil?

- **Removal of fine particles after soil and water mixing**

**【aspect】** A small amount of waste soil than the method of Stripping the top soil off.

**【problem】** How to treat soils and water contain a high level radioactive materials?

- **Tillage reversal**

**【aspect】** The top soil contains radioactive materials are reversed into the lower layer. This method doesn't make waste soil. One-off technique.

**【problem】** Management of the plowing depth after Resumption of farming is important.



MAFF web:

<http://www.maff.go.jp/j/press/nousin/noukan/pdf/120831-08.pdf>

# Problem of stripping the top soil off



- **Deterioration of soil fertility**

Although stripping the 5 cm top soil off is recommended, it is concerned about the reduction of soil organic matters and deterioration of soil productivity.



stripping the 5 cm top soil



rice planting



# Resurrection of “madei” brand

“madei” is a dialect of Iitate Village, means that when villagers do something good to others, the villagers hope others’ happiness with respect and whole heart.

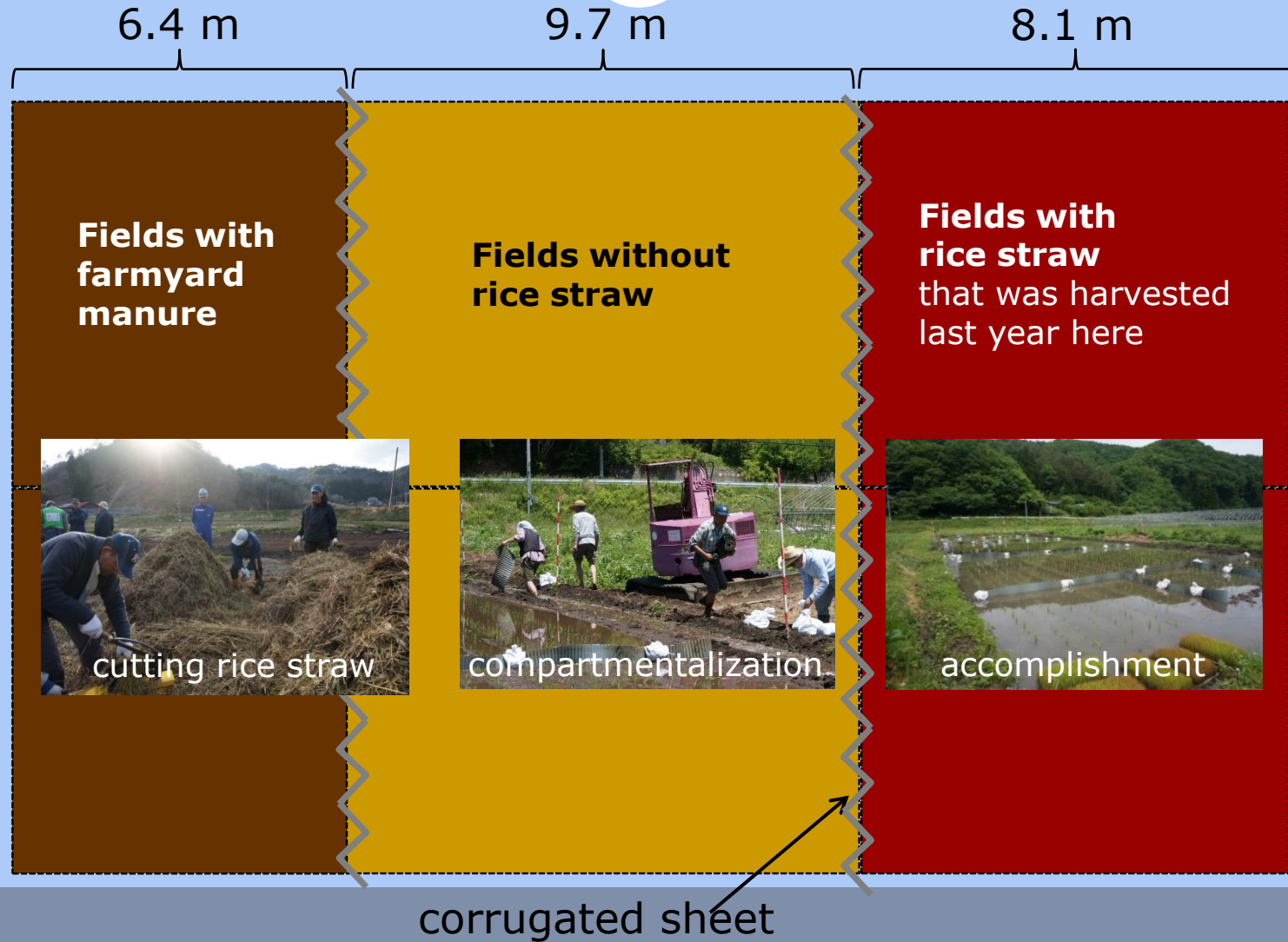
**Object** To recover soil fertility after stripping the Cs contaminated-top soil off at Iitate village in Fukushima prefecture, we checked the soil properties, soil dose and plant growing after mixing the organic resources with decontaminated paddy field.



# Experiment

- \* Resurrection of agricultural fields
- \* Forbid dispersion of Cs to surrounding environment
- \* Forbid transportation of Cs to rice crops

Stripping the top 5 cm soil off  
Japonica "Hitomebore" was planted.





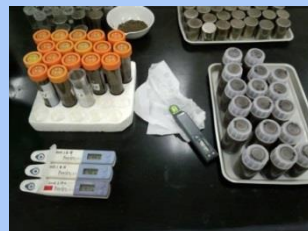
# measurements



season		measurements	methods
<b>Before planting</b>	After decontamination	Soil dose	Ge semiconductor detector
		Soil fertility and others*	*
<b>During growing periods</b>		Soil dose	Ge semiconductor detector
		Growing of crop	plant length, total number of stems, SPAD
		Soil fertility and others*	*
<b>At harvest</b>		Cs transportation to rice crops	Ge semiconductor detector
		Soil dose	Ge semiconductor detector
		yield	dry matter weight
		Soil fertility and others*	*

\* ~ 10 cm depth soil that the about several millimeters surface was removed.  
 Soil was air-dried and passed a 2 mm sieve except for pH and EC measurement.

- pH ... 1:2.5
- EC ... 1:5
- CEC ... Schollenberger method
- nitrogen, carbon ... CN Corder
- phosphoric acid ... Bray No.2
- inorganic nitrogen ... KCl extraction
- exchangeable base ... atomic absorption





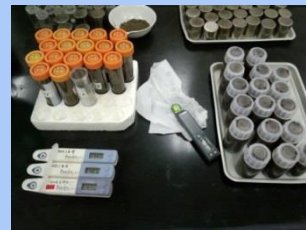
# Results I can introduce today



season		measurements	methods
Before planting	After decontamination	Soil dose	Ge semiconductor detector
		Soil fertility and others*	*
During growing periods		Soil dose	Ge semiconductor detector
		Growing of crop	plant length, total number of stems, SPAD
		Soil fertility and others*	*
At harvest		Cs transportation to rice crops	Ge semiconductor detector
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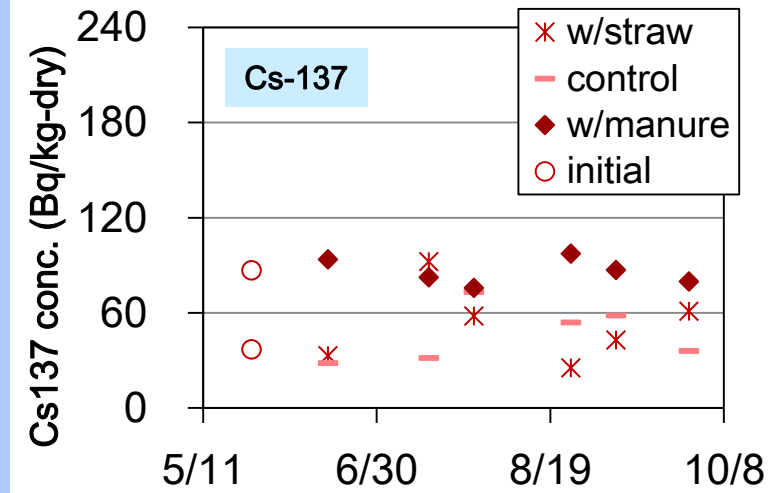
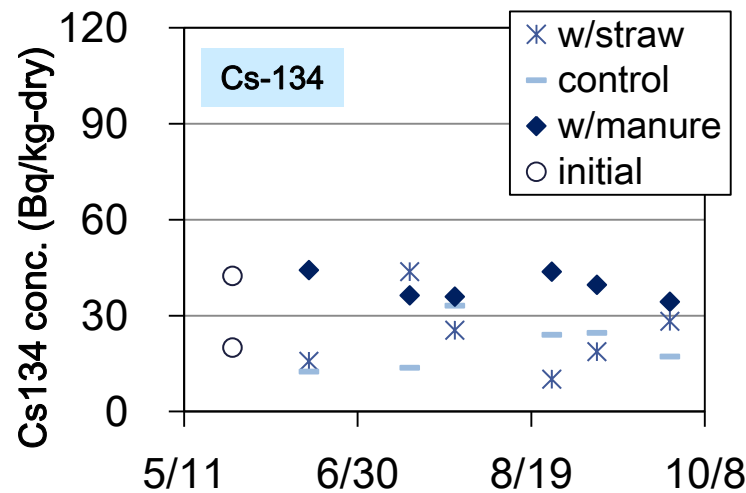
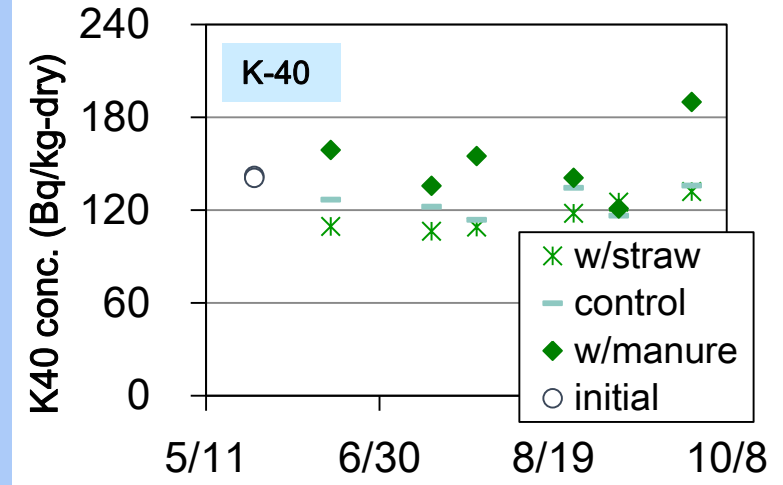
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# Soil dose (Bq/kg-dry)

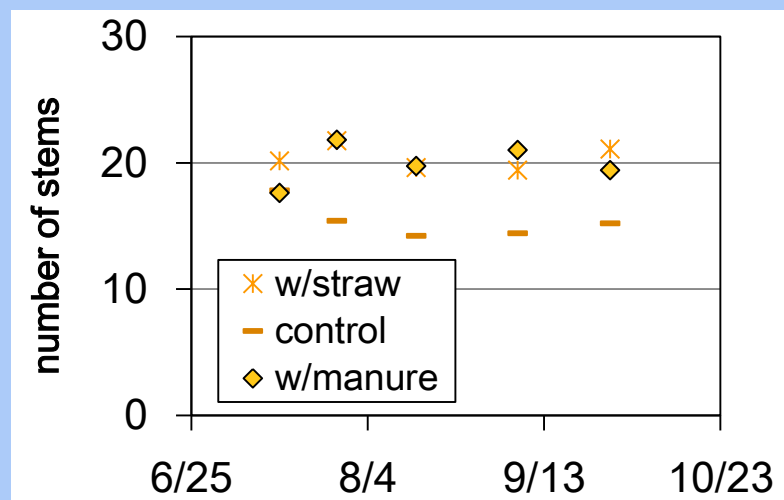
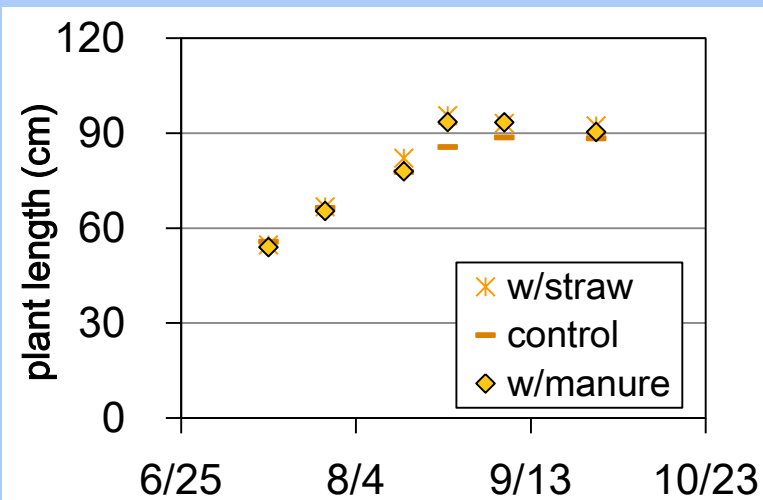
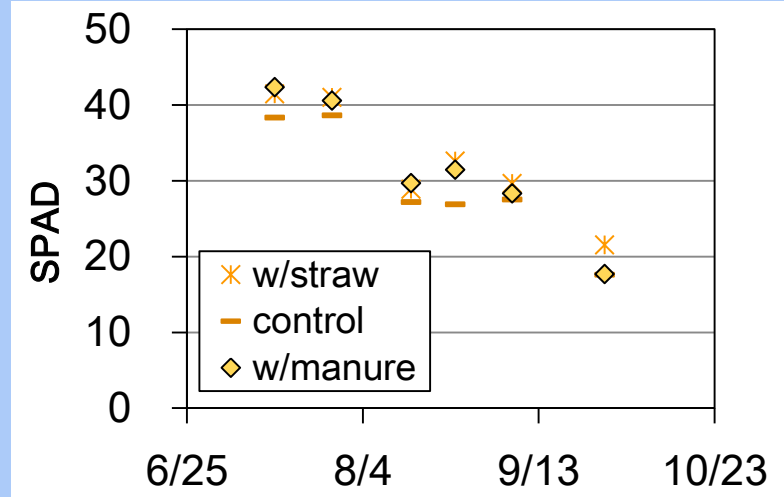


Ge semiconductor detector



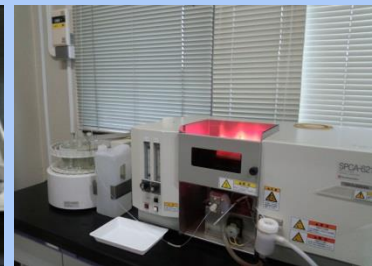
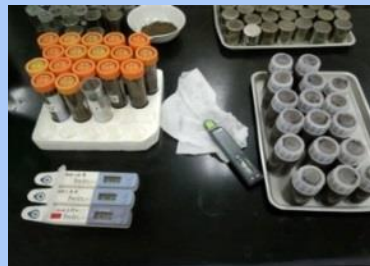
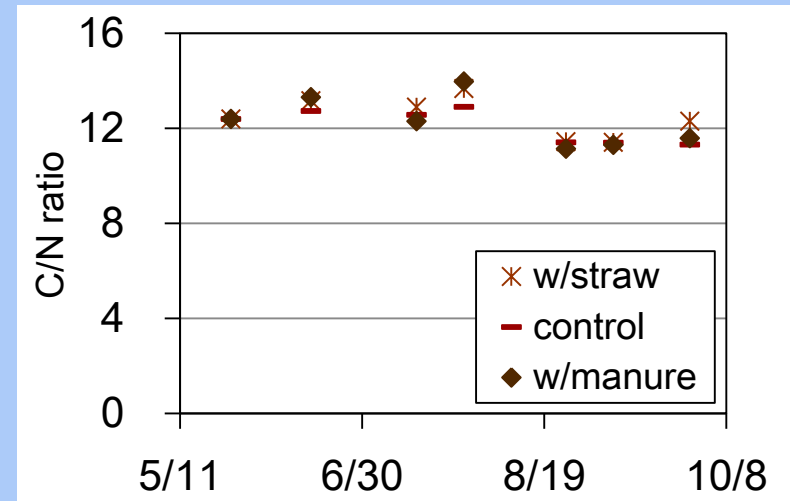
\* Mixed straw (Bq/kg-dry) : 572.93±8.05 / Cs-134, 1089.35±11.41 / Cs-137, 127.29±27.59 / K-40

# Growing of crops



The average of 15 rice plants in each plot.

# Soil properties



Other soil properties are under analysis.



# Conclusion



- There was almost no difference in the C/N by injection of organic resources.
- Although rice length and SPAD measured in control plot were little inferior compared with them in the area with rice straw or with the compost, the number of stems measured in control plot was fewer than others. Since it is concerned that topsoil of 10 cm or more might be stripped off at actual decontamination site, the soil productivity might be more decline.
- There might be almost no diffusion of Cs to the surrounding soil from the straw which was mixed with soil.

If there is no transport of radioactive Cs to surrounding environment and harvested rice from injected rice straw, it is thought that building cyclical form agriculture without waste of the materials which were taken on the site would be possible.

# Acknowledgements



I wish to acknowledge the financial support of the research promotion support by Ibaraki Univ. and Meiji Univ. I am also grateful to the members of (NPO) Resurrection of Fukushima for their assistance with this study.

# Scenery of Iitate Village



Thanks for your attention.  
I hope to Resurrection of Fukushima.

And I really appreciate  
if you don't go too hard  
on me

during a discussion time.

