Radioactive cesium contamination of grasslands in Japan

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Overview in 2011

● March 11, The Great East Japan Earthquake occurred

●Government notification（MAFF）

March 19, Precaution regarding feed, water, feeding locations, etc.
(Ex. Feeding forage and rice straw harvested before the accident)

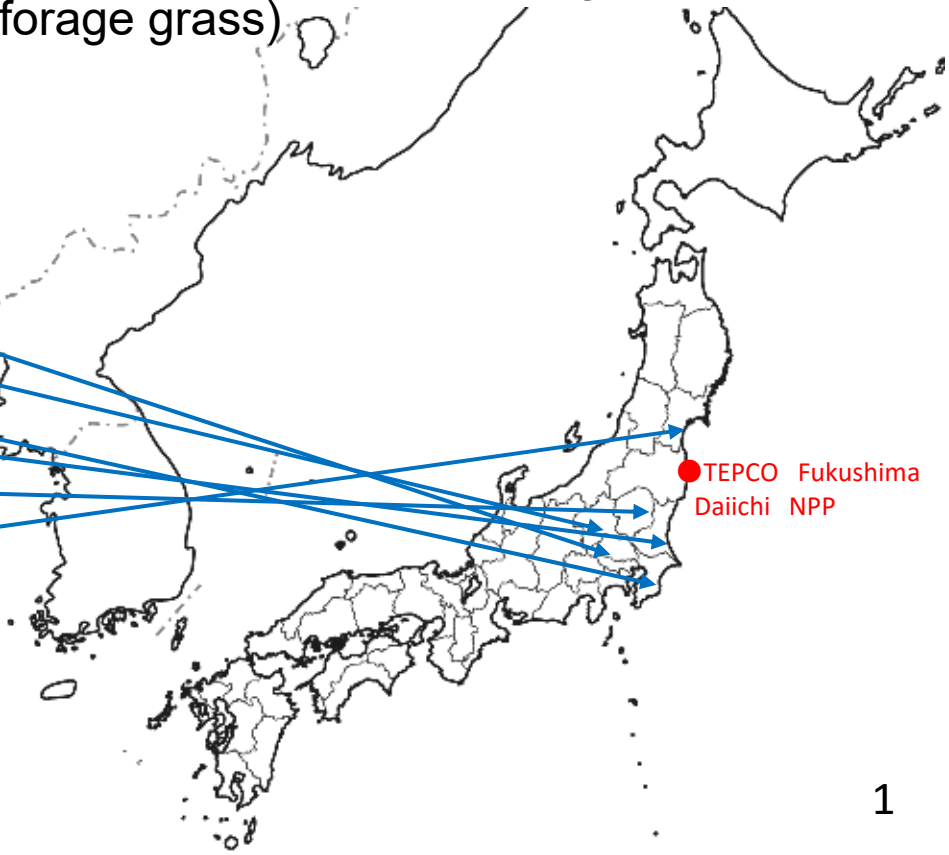
April 14, The provisional reference value for radioactive Cs in forage （300 Bq/kg assumed 20%DM ）

April 22, Guideline on the production and utilization of feed for avoiding radioactive contamination (monitoring for forage grass)

●Cancellation of voluntary restriction of feeding forage grass

May 24, Saitama prefecture
May 31, Gunma prefecture
June 16, Chiba and Ibaraki prefectures
Sep. 1 , Tochigi prefecture
Sep. 16, Miyagi prefecture

※Voluntary restriction had been continued in a part of Fukushima and Iwate



Revise the reference value for feeds

<Food>

Group	Old level (Bq/kg)
Drinking water	200
Milk/dairy product	200
Vegetable	500
Grain	
Meat/Egg/ Fish	

April 2012

Group	New standard (Bq/kg)
Drinking water	10
Milk	50
Infant food	50
Others	100

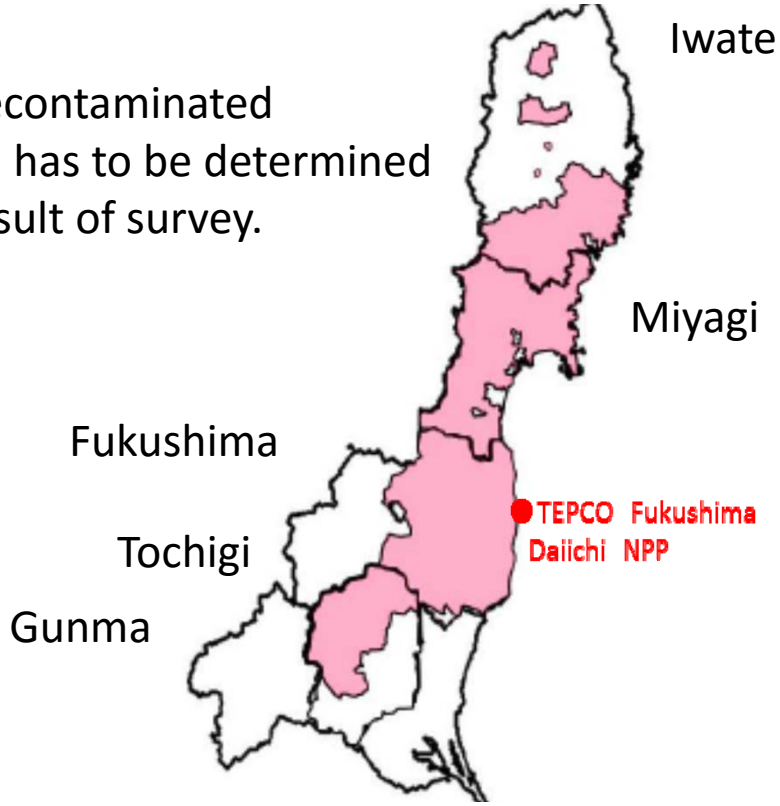
<Feed>

Animal	Old level (Bq/kg)
Cattle	300
Horse	300
Pigs	300
Chickens	300
Cultured fish	100

Animal	New level (Bq/kg)
Cattle	100
Horse	100
Pig	80
Chickens	160
Cultured fish	40

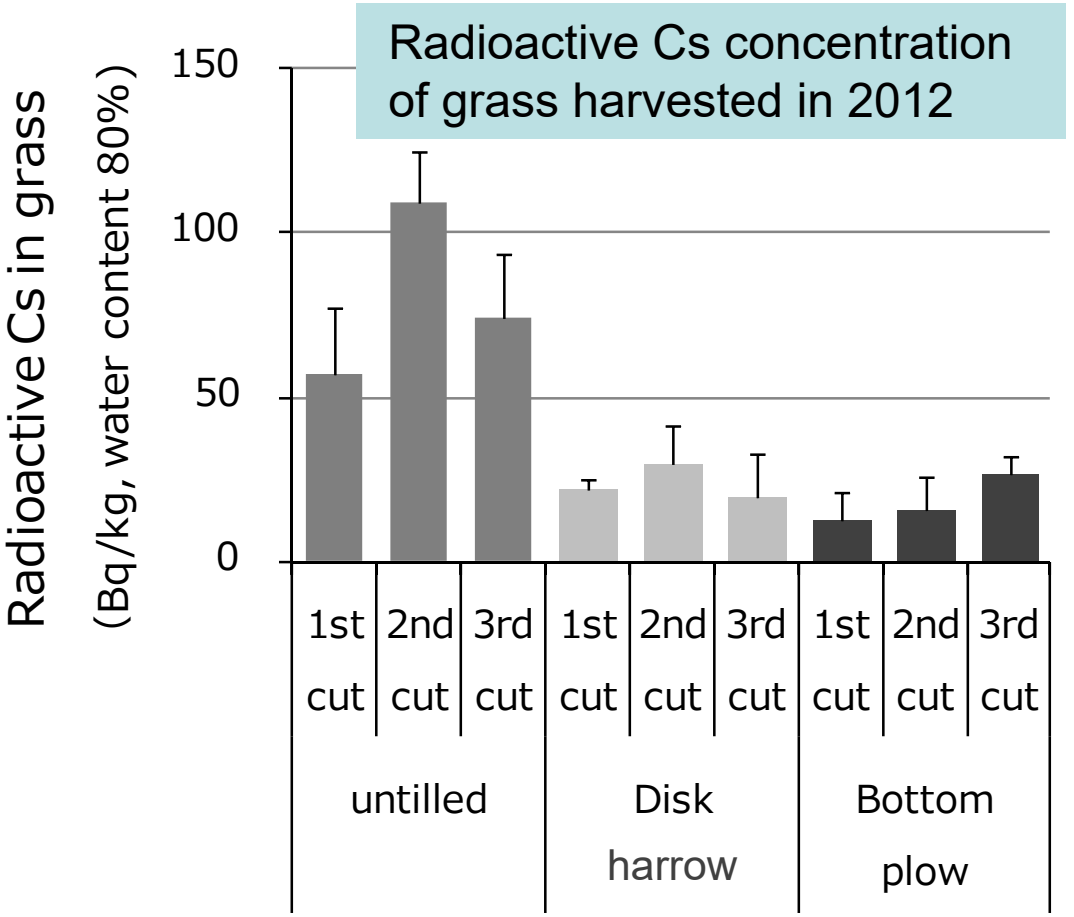
Decontamination (renovation) of grassland has implemented in area where it is predicted to exceed a new reference value based on the result of monitoring survey of 2011-2012 .

Use of decontaminated grassland has to be determined by the result of survey.



Plowing reduces radioactive Cs concentrations of grass by mixing of soil and root mat layer

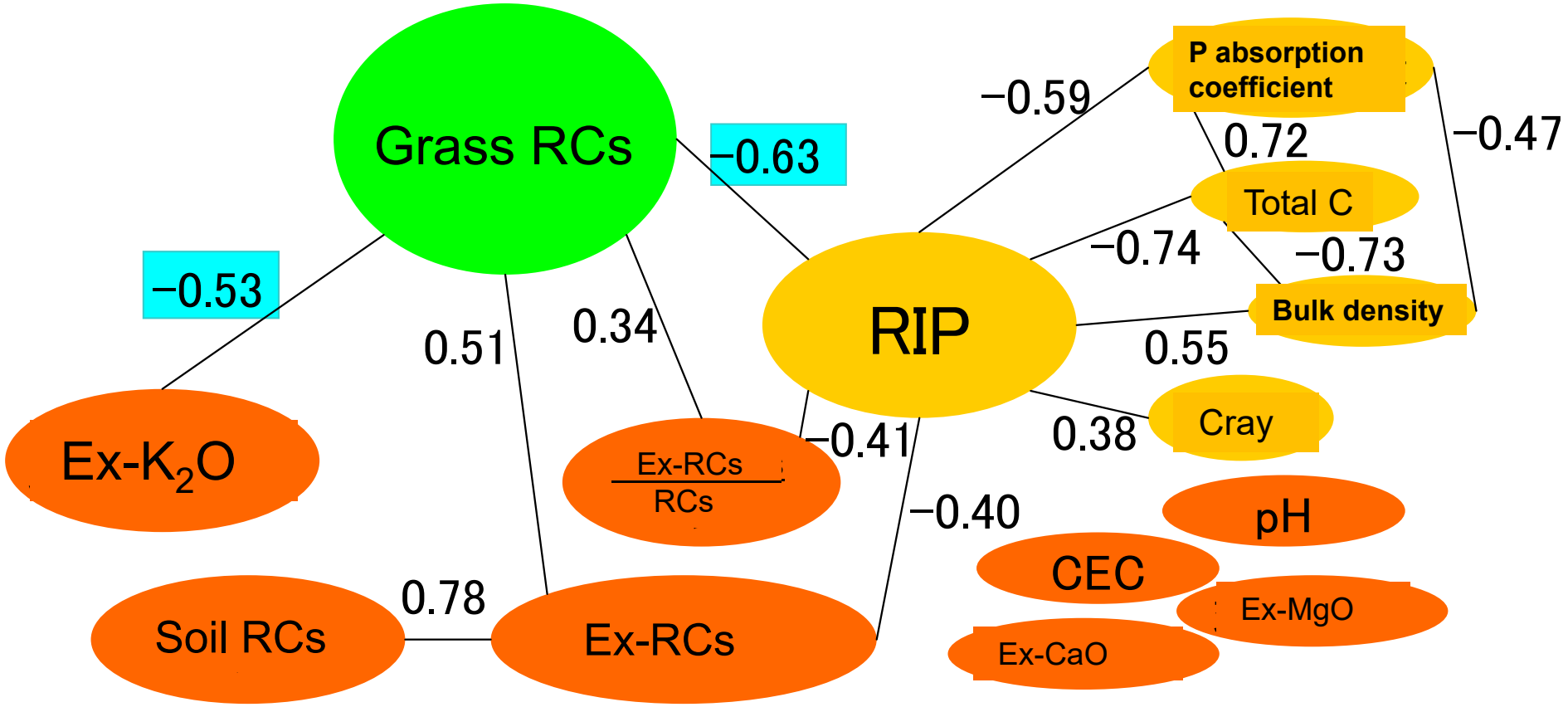
Bottom plowing in NILGS (2011)



(Shibuya *et al.* 2013)

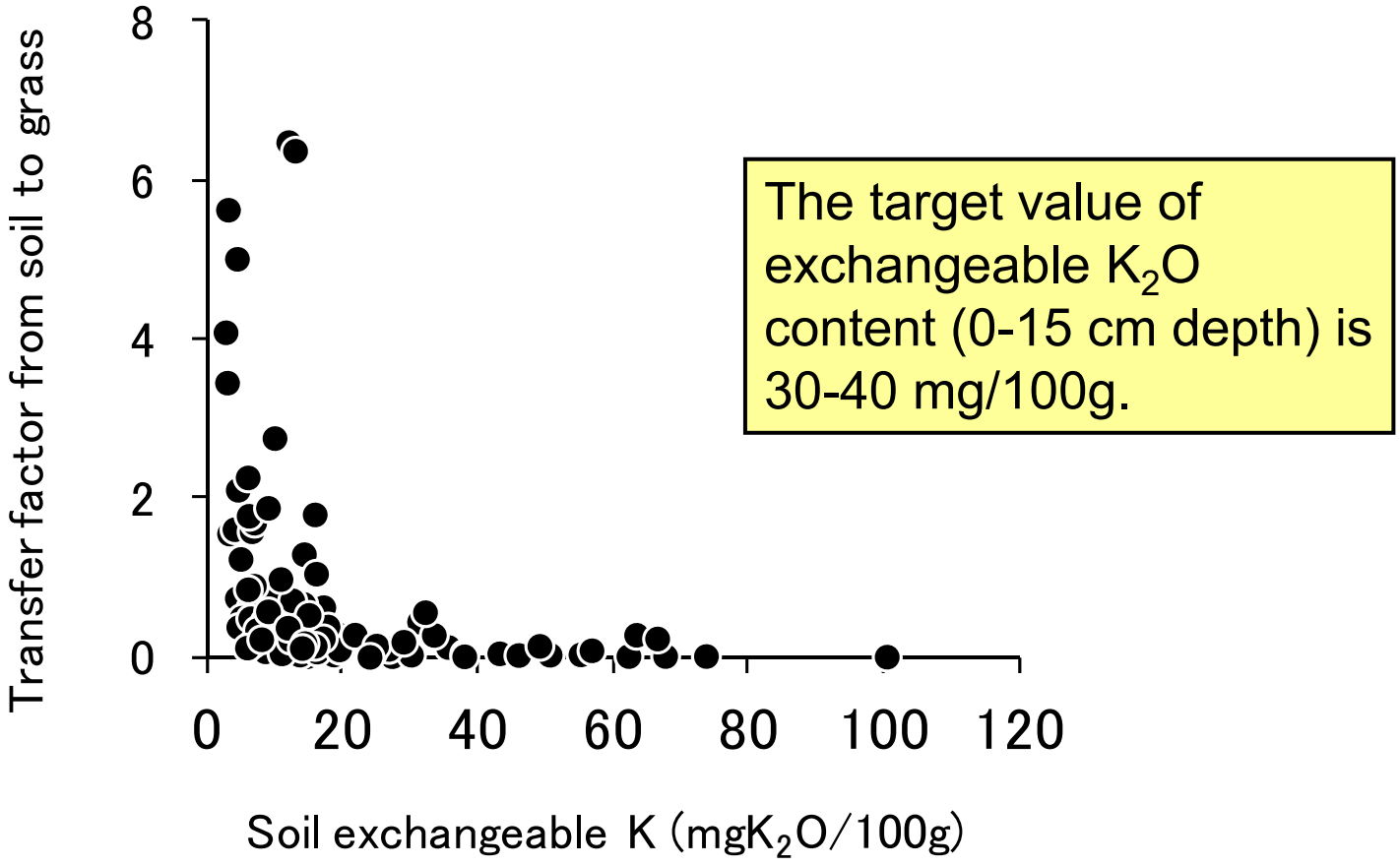
Analysis of soil factors on RCs concentration of grass (2012)

The result of grassland survey in 2012 was reported that 8.1% of renovated grassland produced forage containing radioactive Cs higher than the reference value for feed.



RIP: Radiocaesium Interception Potential

Soil exchangeable potassium reduces radioactive Cs transfer to grass

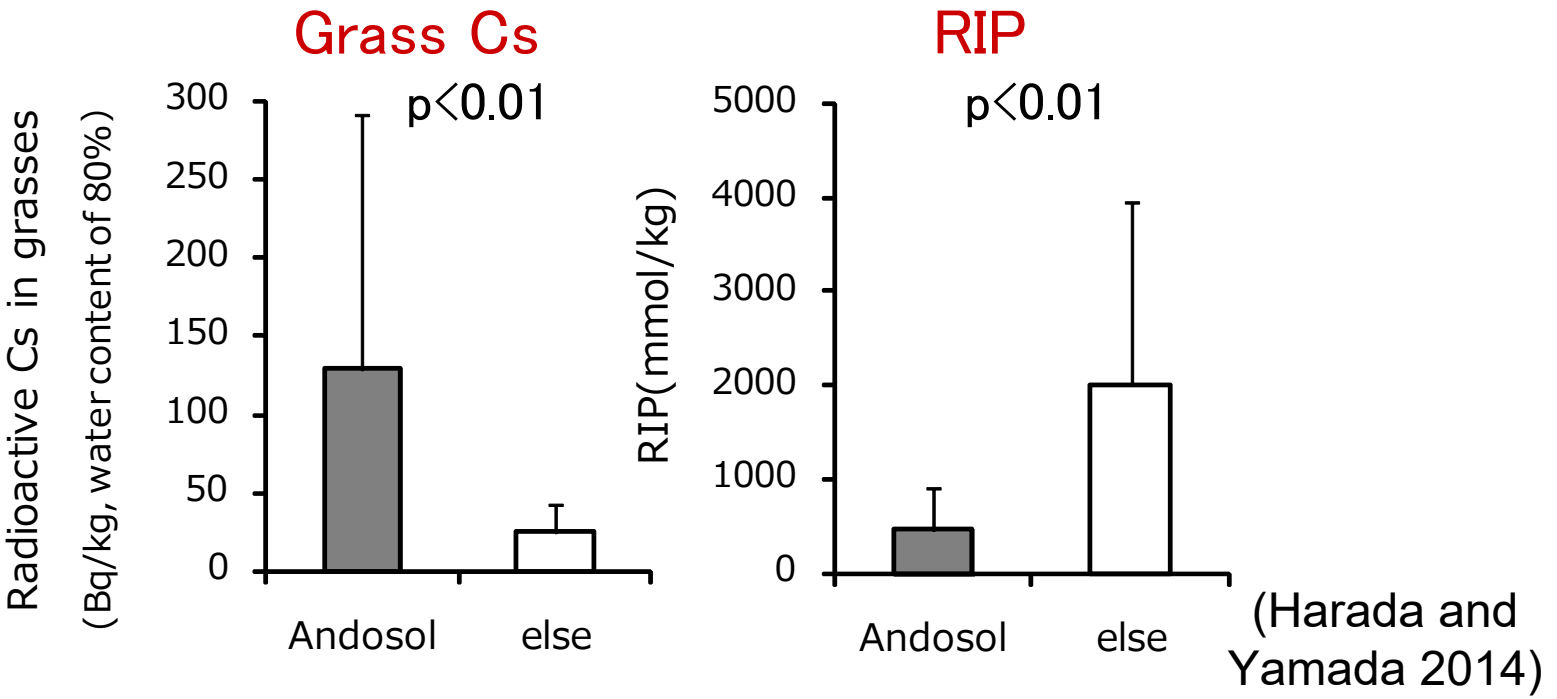


Transfer factor＝radioactive Cs of grass÷radioactive Cs of soil

(Yamada *et al.* 2013)

Andosol (volcanic ash soil) has lower RIP and higher radioactive Cs of grass after renovation

In the survey of 2012 for grasslands where radioactive Cs concentrations of grass after renovation exceeded 100 Bq/kg, andosol showed higher radioactive Cs than the other soil types.

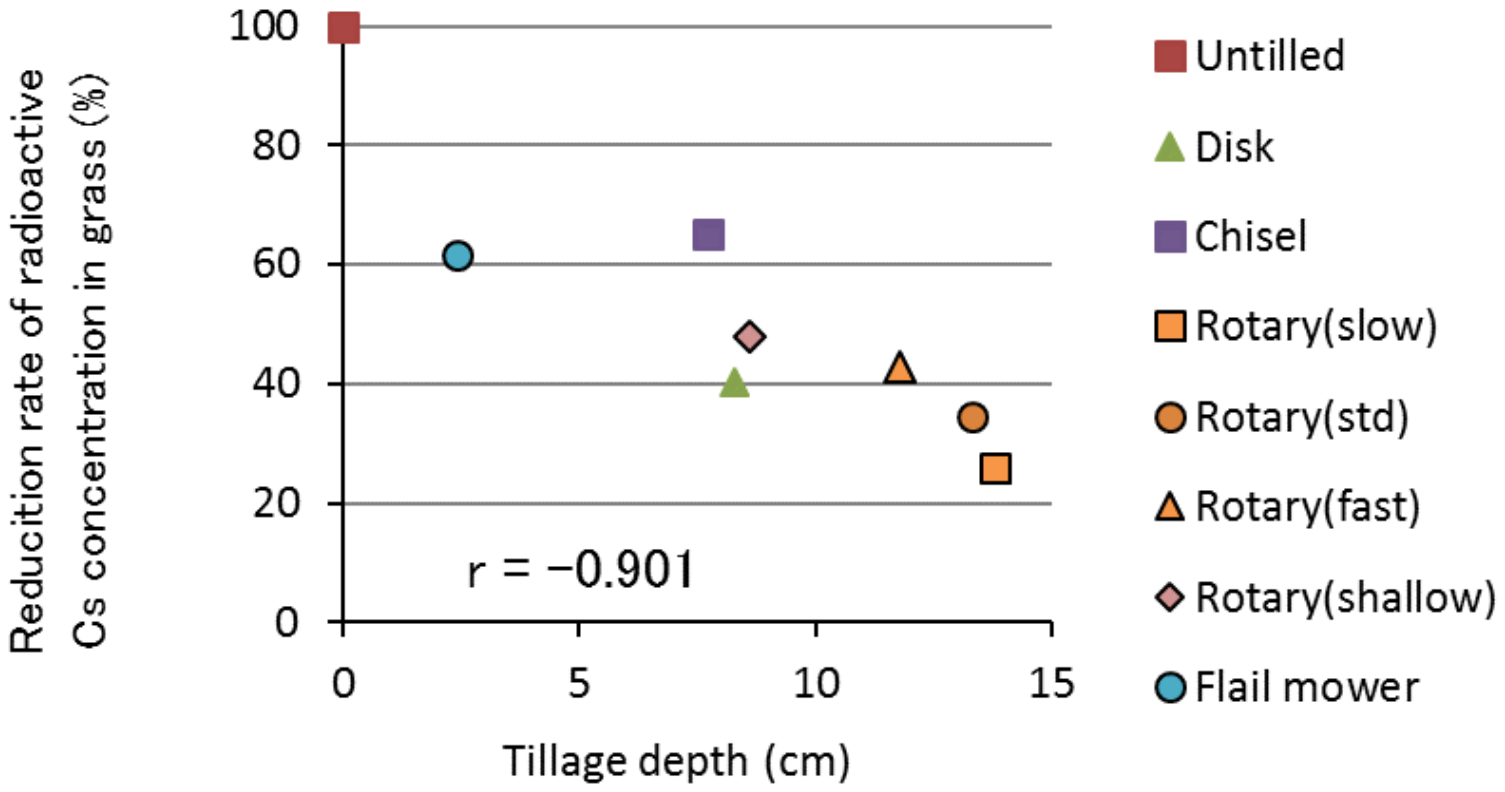


(Harada and Yamada 2014)

Andosol was classified by using the criteria of phosphorus absorbance coefficient > 1500. p <0.01 shows significant difference by U test.

Effect of plowing method on radioactive Cs concentration of grass

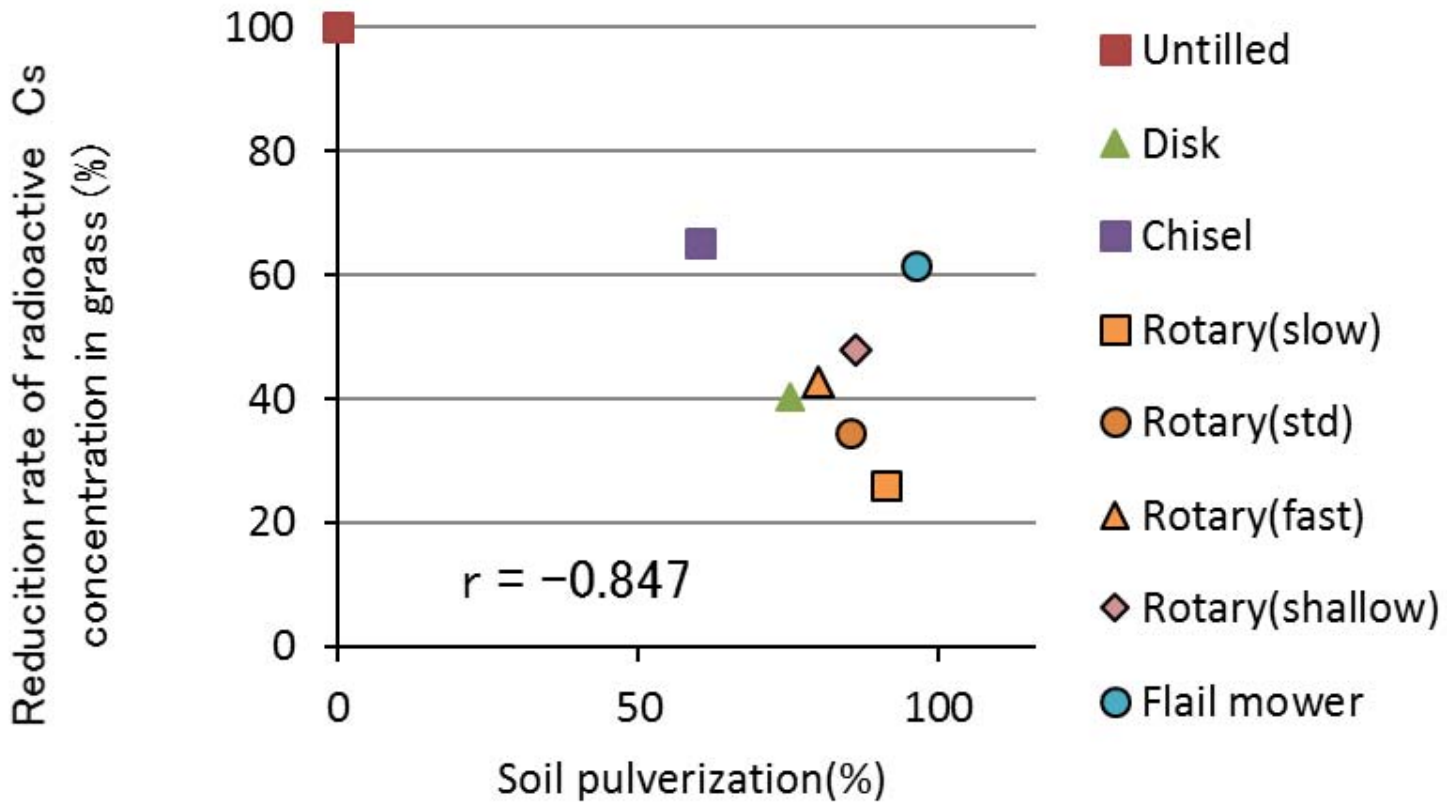
Deep plowing is effective to reduce radioactive Cs of grasses



(Shibuya *et al.* 2014)

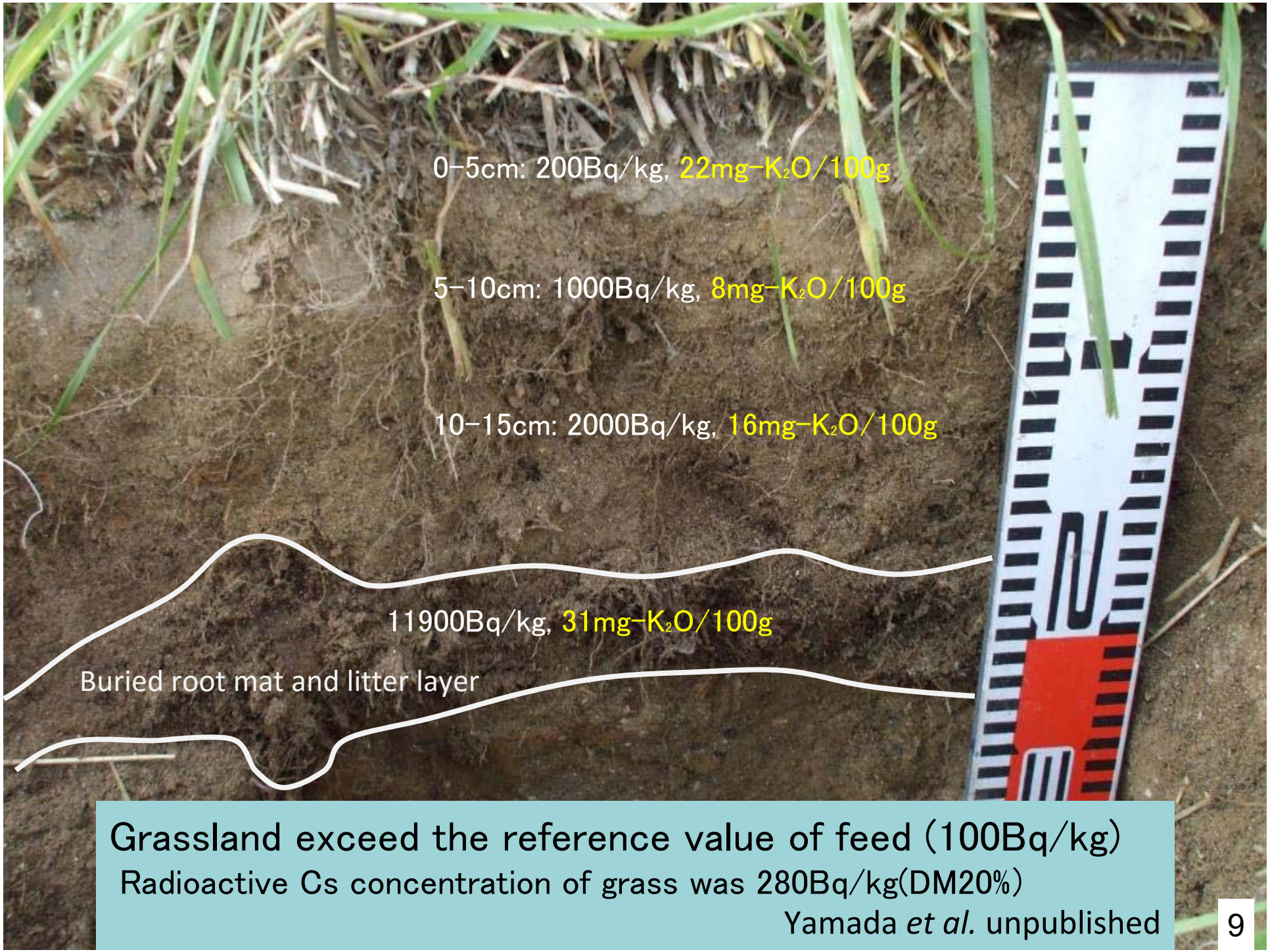
Effect of plowing method on radioactive Cs concentration of grass

Fine clod breaking is effective to reduce radioactive Cs of grasses



Soil pulverization :percentage by weight of soil particles passing through a sieve of 2cm mesh

(Shibuya *et al.* 2014)



Grassland exceed the reference value of feed (100Bq/kg)

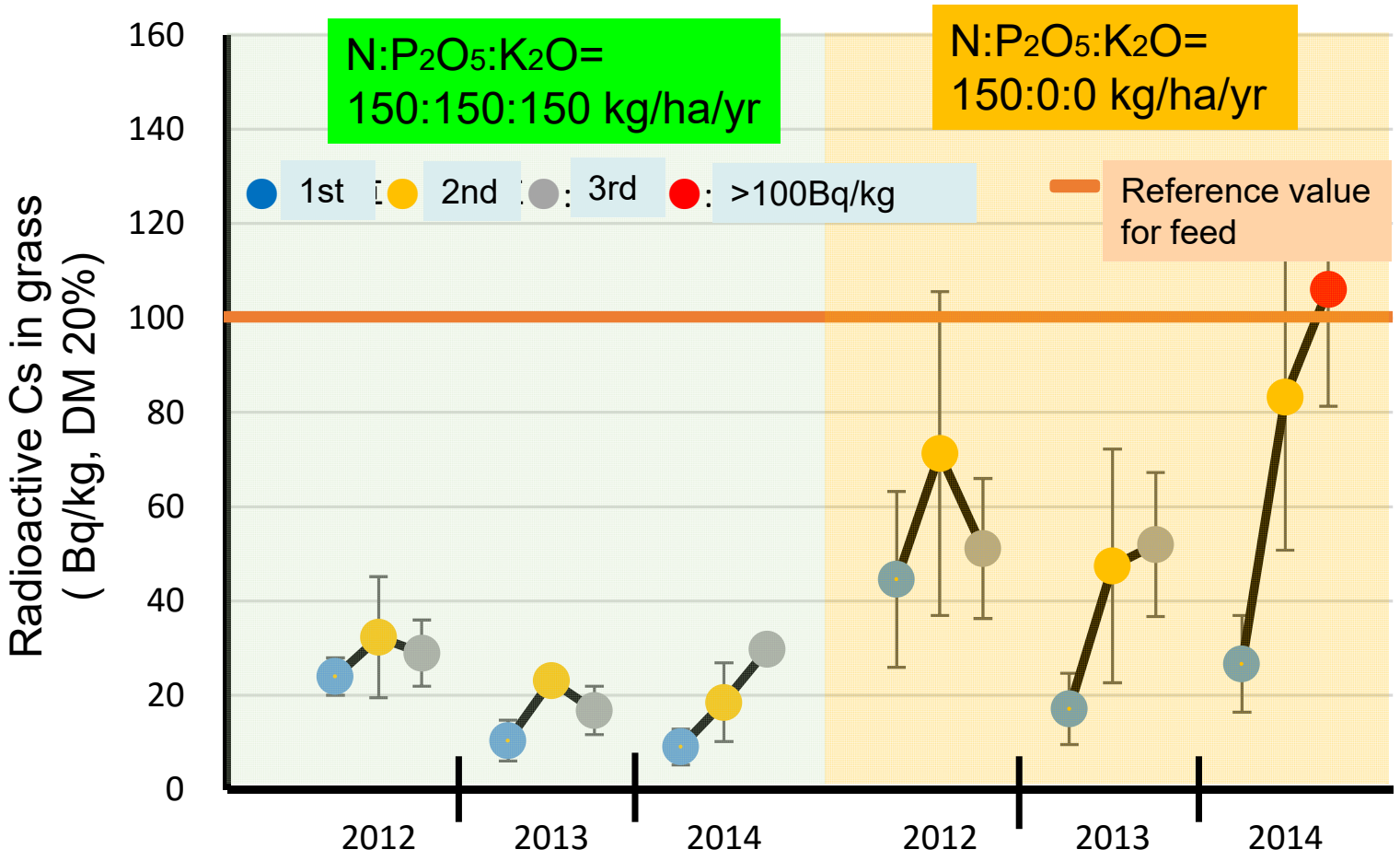
Radioactive Cs concentration of grass was 280Bq/kg(DM20%)

Yamada *et al.* unpublished

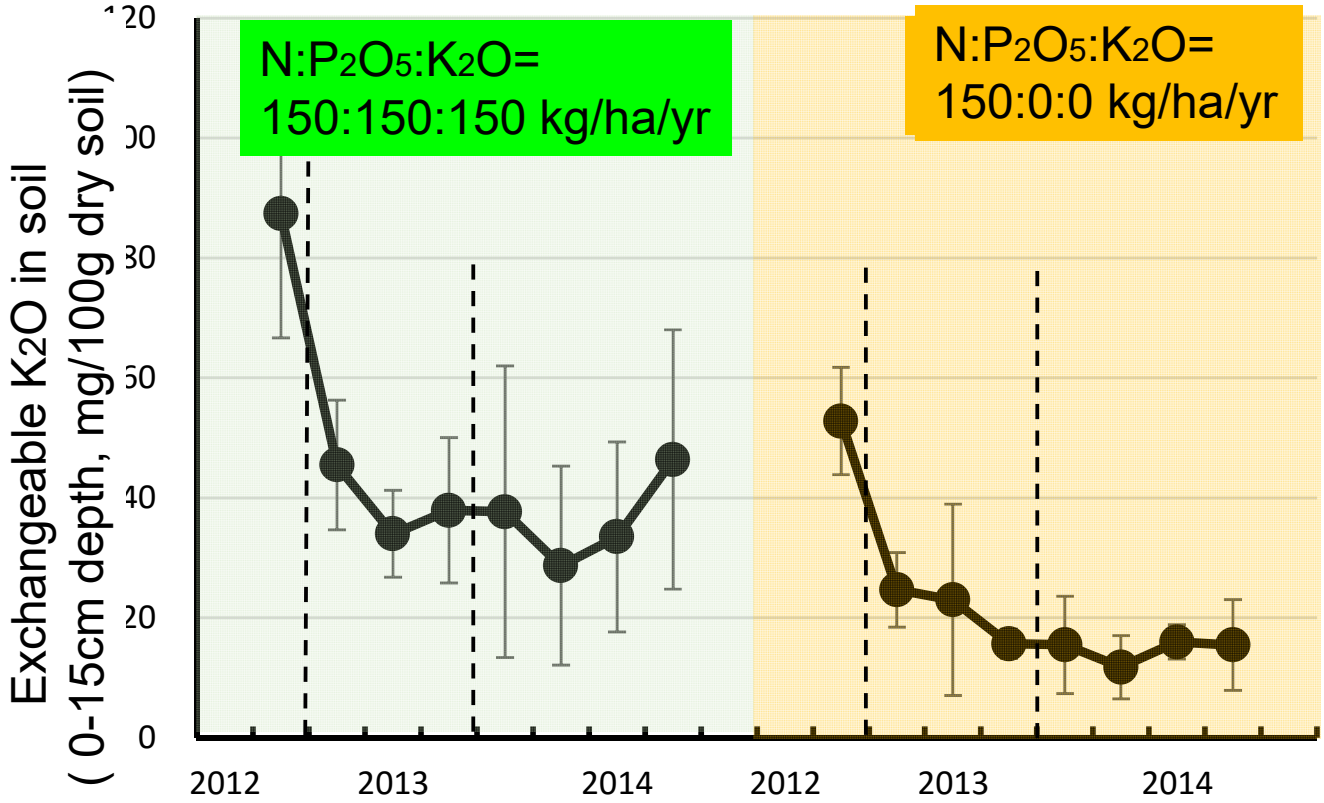
Results of the survey of grass on decontaminated (renovated) grassland

Survey Year	Total	Reported samples (Number, %)		
		～50Bq/kg	～100Bq/kg	100Bq/kg～
2012	1,893 (100%)	1,578 (83.4%)	161 (8.5%)	154 (8.1%)
2013	18,158 (100%)	17,081 (94.1%)	725 (4.0%)	352 (1.9%)
2014	10,319 (100%)	9,999 (96.9%)	230 (2.3%)	90 (0.9%)
2015	10,999 (100%)	10,678 (97.1)	230 (1.6%)	115 (1.3%)

An application of only nitrogen fertilizer on meadow caused a decrease of soil exchangeable K_2O content and an increase of radioactive Cs concentration of forage



(Shibuya et al. 2015)



$N:P_2O_5:K_2O$ (kg/ha/yr)	Grass production (DM t/ha/yr)			K_2O output (kg/ha/yr)			K_2O balance (kg/ha/yr)		
	2012	2013	2014	2012	2013	2014	2012*	2013	2014
150:150:150	8.9	10	11.2	280	370	360	-30	-220	-210
150:00:00	8.2	9.8	9.8	260	280	240	-160	-280	-240

*:K_2O input in 2012 includes the amount applied in the grassland renovation in 2011.

Renovation of steep slope grasslands by using radio-controlled tractor

Cutting pre-vegetation

Fertilization

Seeding

Rotary tilling

Soil packing

Newly developed rotary

Growth situation (after 2 months)

Thank you for your attention