Greenhouse gas emissions caused from Livestock in Japan

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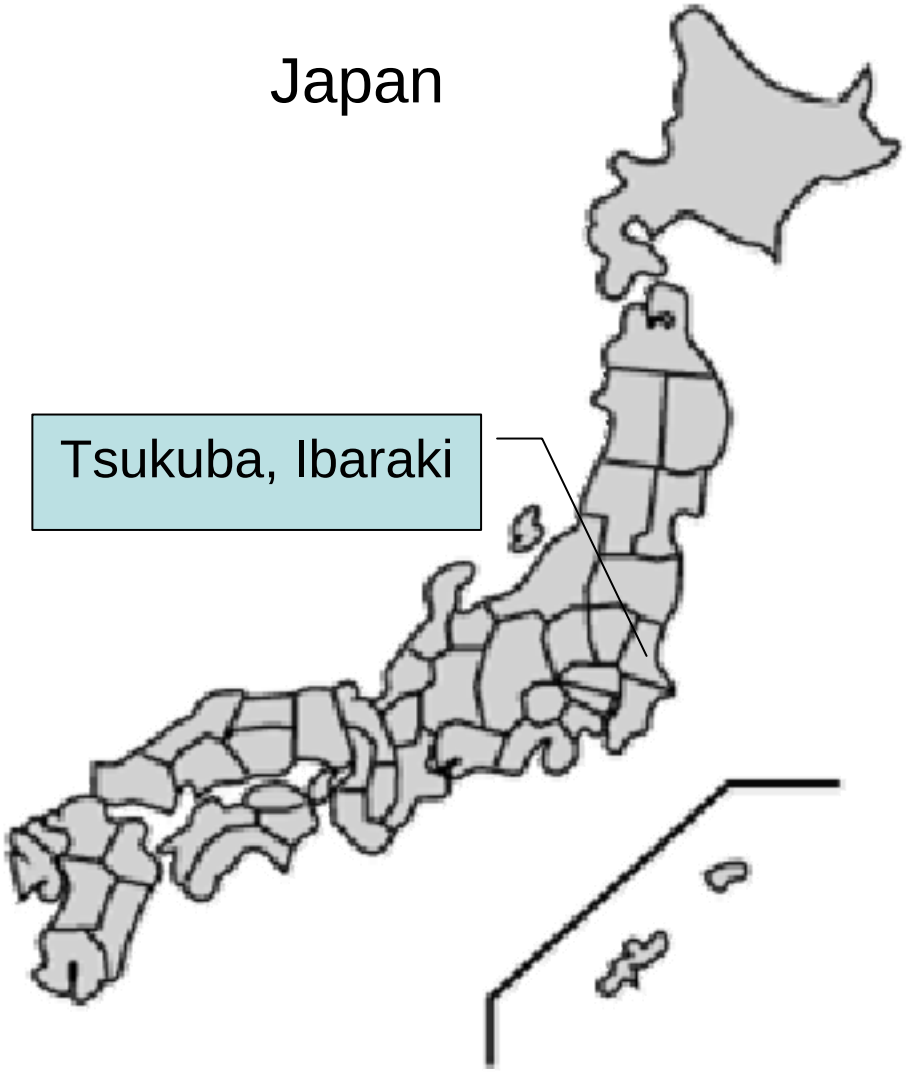
Japan



Tsukuba, Ibaraki

A main building for research

Scenery from the roof

In this presentation…..

1. Animal production in Japan
2. Major source of GHG in this section
3. CH4 caused from ruminant
4. What research are need for next step ?

Main Livestock in Japan

Holstein

Japanese black cattle

Jersey

Japanese Brown cattle

Japanese shorthorn

Minor livestock in Japan

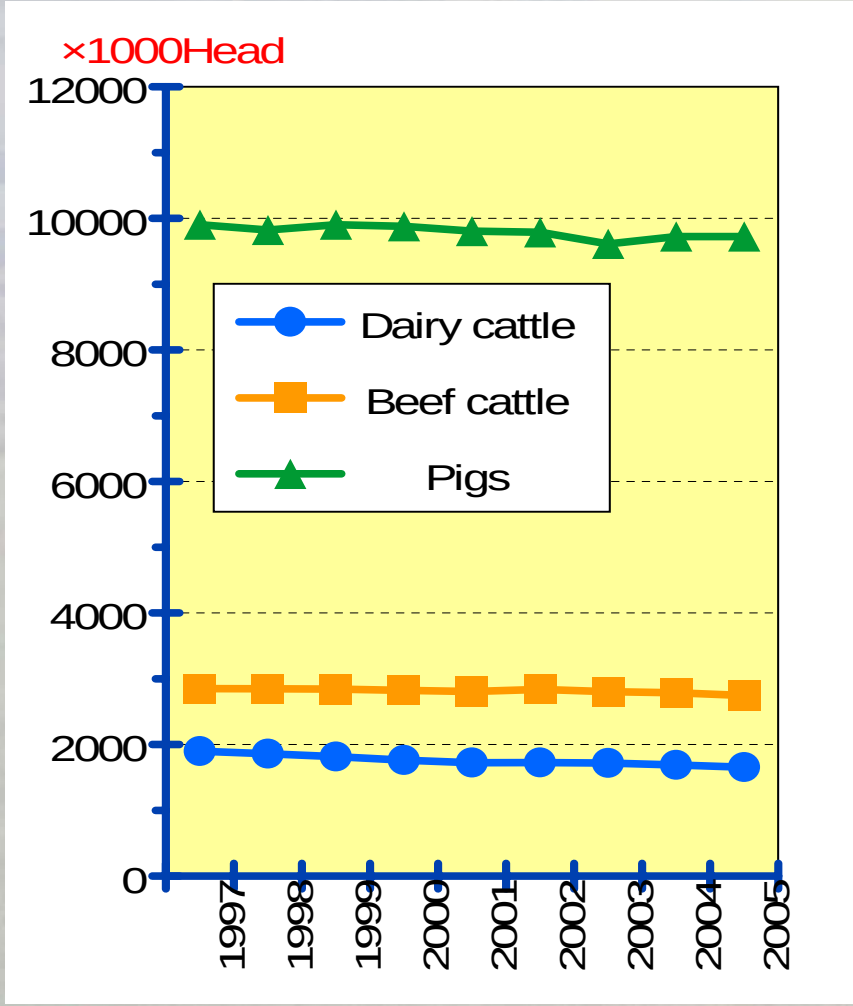
Corridale

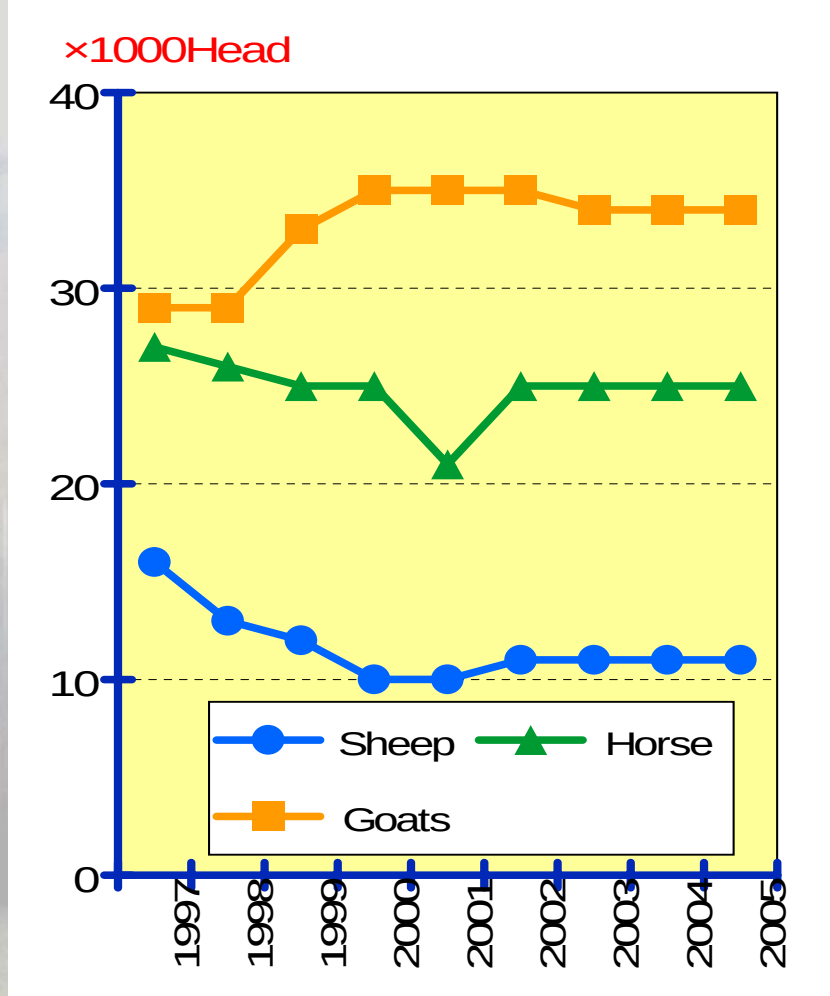
Suffolk

Saanen

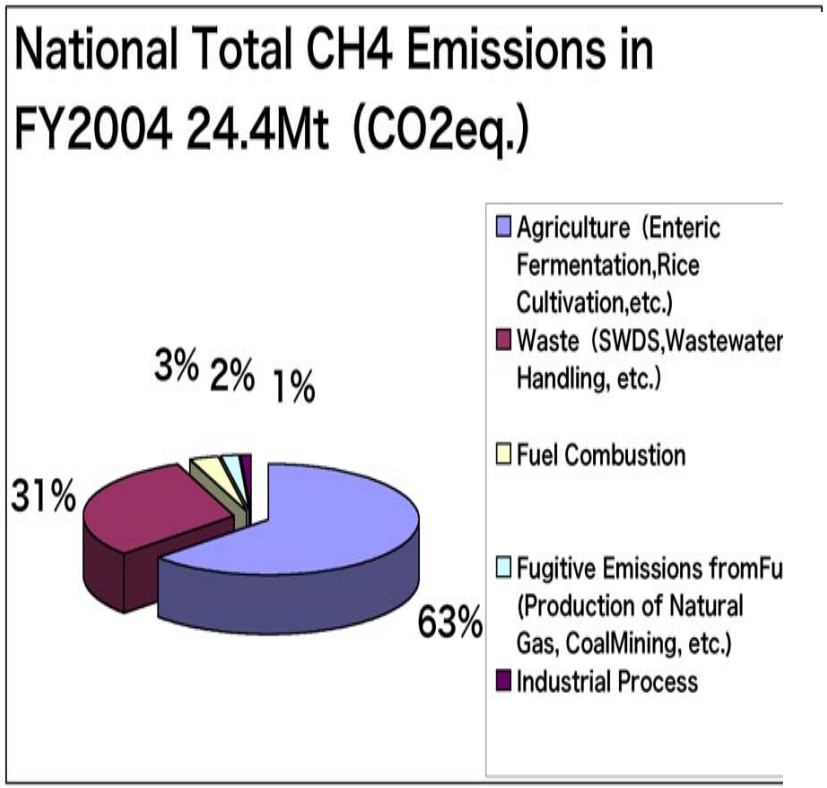
Japanese native goat

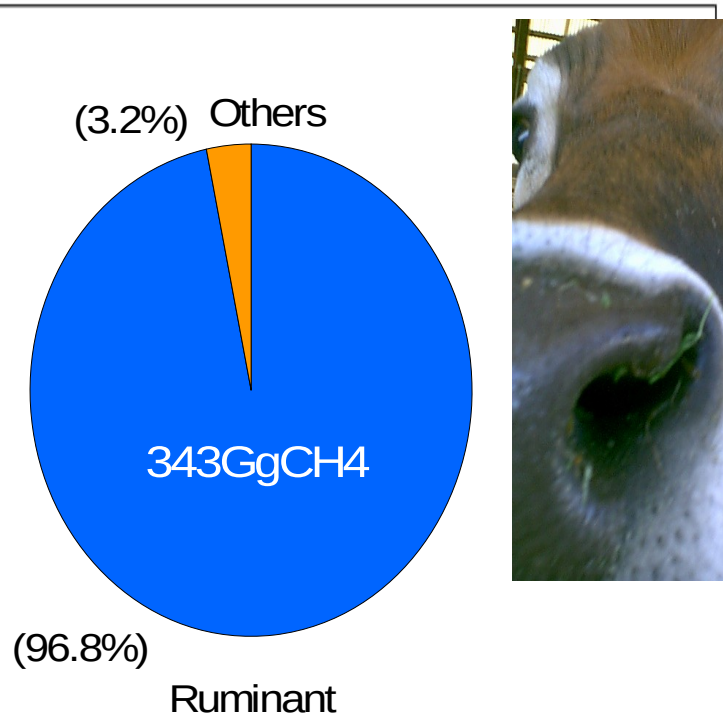
Livestock population in Japan





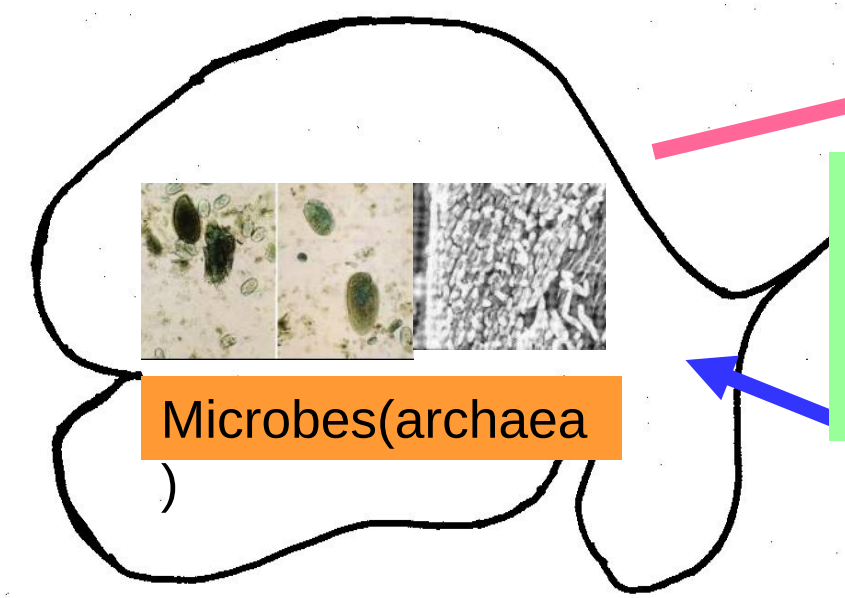
Methane estimated source in Japan (Ministry of the Environment, Japan 2006)





GHG from Ruminant

- Ruminant(Cattle,sheep,goat) emit methane as a part of their normal digestive processes.

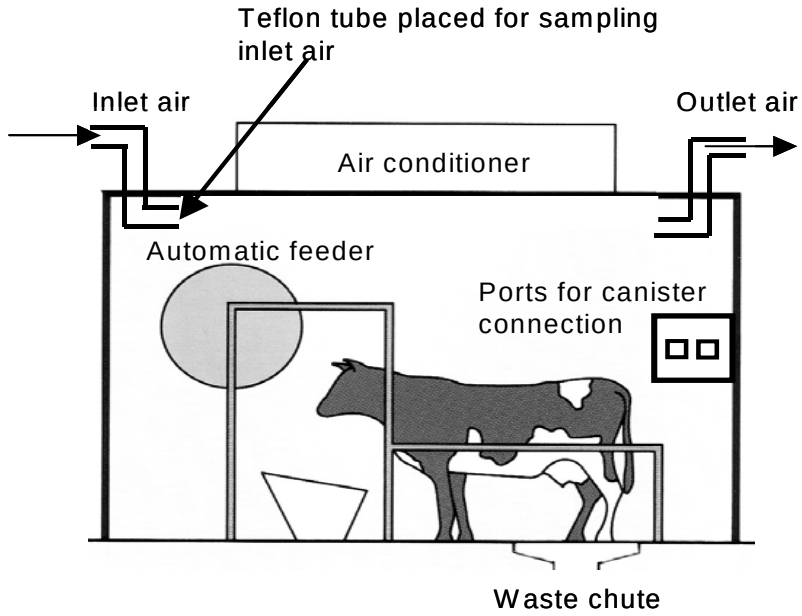


Methane

CH_4 production represents a loss of 3 to 13% of dietary energy.

Feeds

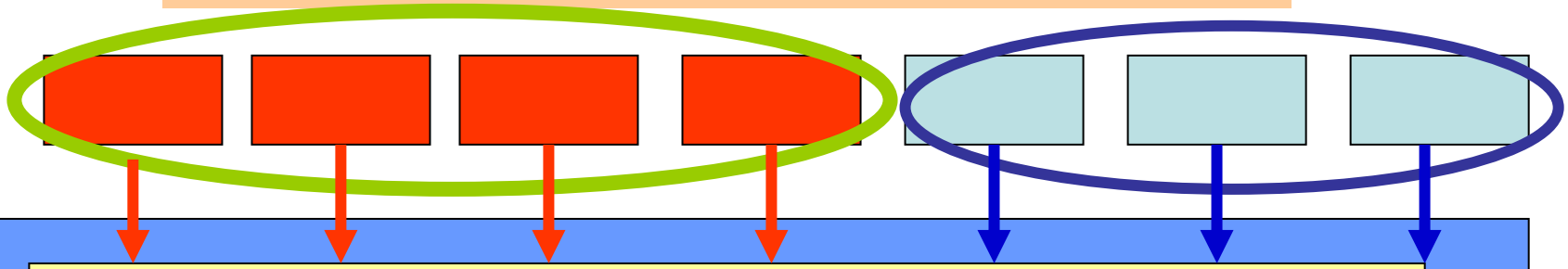
Measurement of methane production from ruminant (Open circuit respiration apparatus)



This apparatus is used to research and analyze energy metabolism and use by gathering and analyzing the gases produced, particularly by respiration and other such operation, by domestic animals

Method for Estimation Current Methane Emission

Dividing animals into animal group



Collecting dry matter intake（DMI) of each animal group

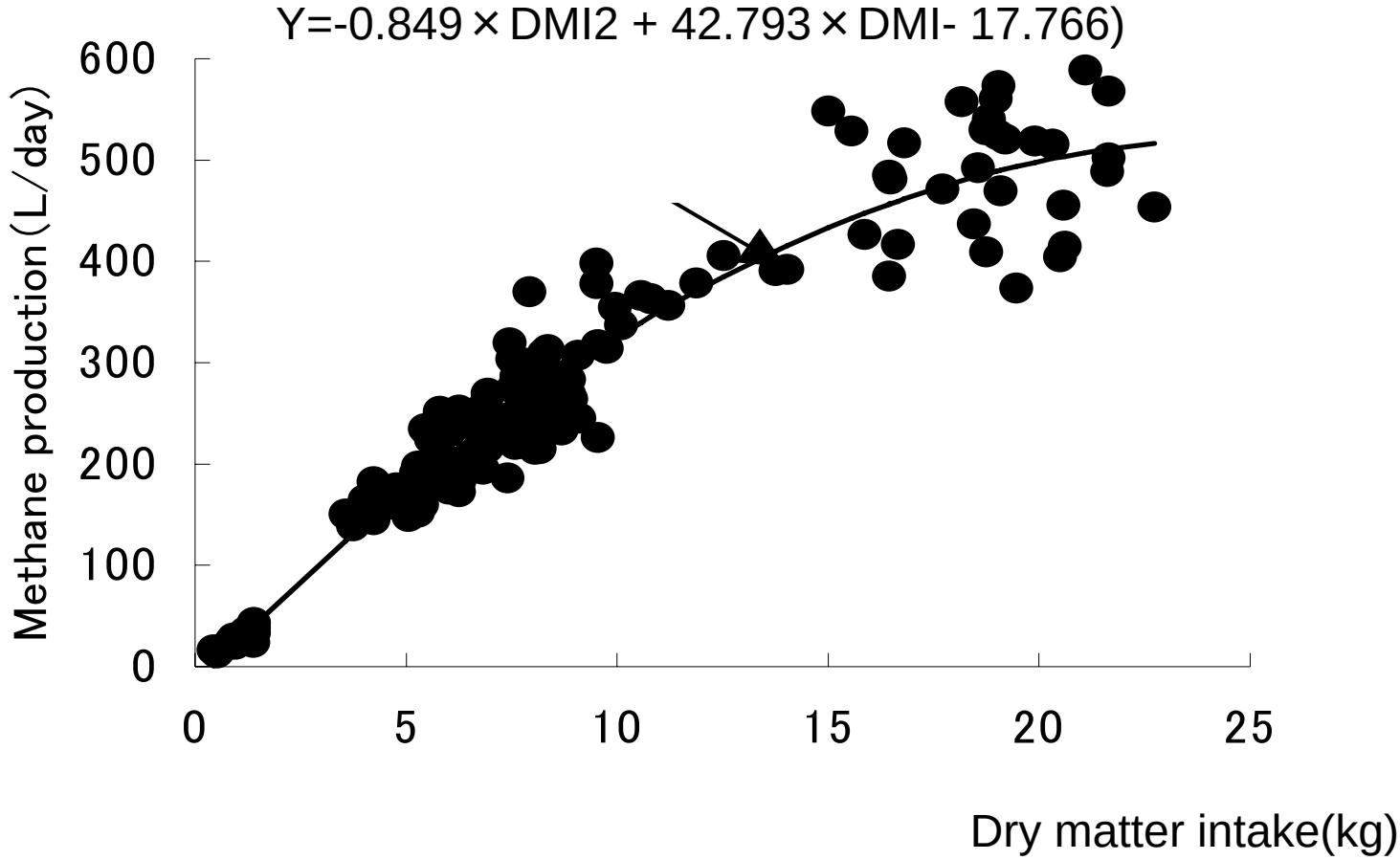
Estimate methane emission by Shibata's equation (Methane production(L/day) = $-0.849 \times DMI^2 + 42.793 \times DMI - 17.766$)

Collecting population data

Multiplying the population by estimate methane emission for each animal group

Summing emissions across animal group

Prediction of methane emission from enteric fermentation in Japan



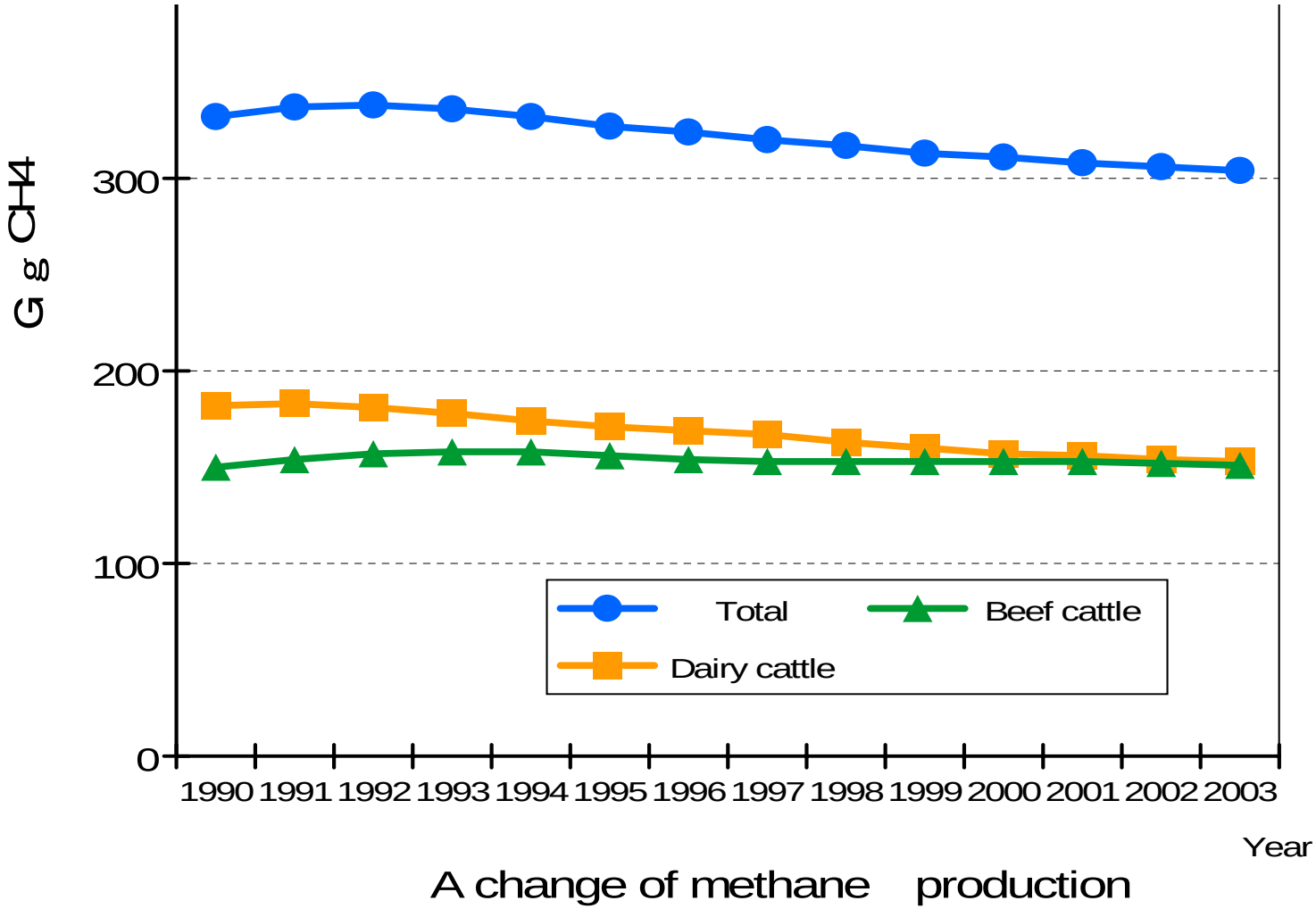
Average dry matter intake of cattle

		Dry matter intake(kg/day)
Dairy cow	Lactating	20.6
	Dry	8.5
	Growing	
	< 2 years old(except 5.6 months old)	7.5
	5.6 months old	3.7
Beef cow	Reproductive cattle	
	(> 1year old)	7.1
	(< 1 year old:except 5.6 months old)	6.7
	(5.6 months old)	4.4
	Fattening cattle(Japanese block)	
	(steer: >1 year old)	8.4
	(< 1 year old:except 5.6 months old)	6.8
	(5.6 months old)	4.3
	(heifer: > 1year old)	6.4
	(< 1 year old:except 5.6 months old)	6.1
	(5.6 months old)	4.1
	Dairy bull cattle for fattening	
	(except 5.6 months old)	8.7
	(5.6 months old)	5.3

(Ministry of the Environment, Japan 2006).

CH_4 emissions from enteric fermentation ($kgCH_4$/year/head)

		1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Dairy cow	Lactating	136	136	136	134	133	132	132	132	13	128	127	126	125	123	120
	Dry	24	24	24	23	23	22	21	20	20	19	19	18	18	18	17
	Growing															
	<2 years old(except 5,6 months old	31	31	31	30	30	29	28	27	27	26	25	25	25	26	28
	5,6 months old	32.7	2	2	2	2	2	2	2	1	1	1	1	1	1	1
Beef cow	Reproductive cattle															
	(>1year old)	40	41	41	41	40	39	38	38	38	38	39	39	38	38	38
	(<1 year old except 5,6 months old)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	(5,6 months old)	0.2	0.2	0.32	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
	Fattening cattle(Japanese block)															
	(steer: >1 year old)	27	28	29	30	30	30	29	29	28	28	29	29	29	28	28
	(<1 year old except 5,6 months old)	8	8	8	8	8	8	8	8	7	7	7	7	7	7	7
	(5,6 months old)	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	(heifer; >1year old)	10	11	12	13	13	14	14	14	14	14	14	14	14	14	16
	(<1 year old except 5,6 months old)	4	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	(5,6 months old)	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	Dairy bull cattle for fattening															
	(except 5,6 months old)	60	61	62	62	62	61	62	63	64	64	64	63	63	61	60
	(5,6 months old)	4	4	4	4	4	4	4	4	4	5	5	4	4	4	4



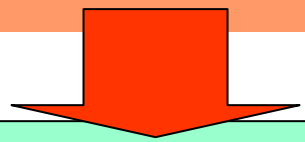
A change of methane production

Factors affecting methane emission from ruminant

- Feed intake level
- Digestibility of feeds
- Feed processing
- Addition of lipid(unsaturated fatty acid) ,and so on

"Methane emission is influenced by many factors"

To take an accurate measurement of methane in various condition



It is need to develop simple measurement techniques of quantity of methane emission

A trial of simple measurement technique of quantity of methane emission

Open circuit respiration chamber

Sulfur hexafluoride tracer technique(SF6)

In vitro gas production technique

Rusitec(Semi-continuous system similar to rumen)

The research that we have to do

1.It is important to develop the technology needed to estimate CH4 emission accurately from ruminant and practically method to reduce the amounts of CH4.

2. Evaluation and a prediction of global warming impact on animal production.

3. We have to develop the feeding technology of livestock for warming.

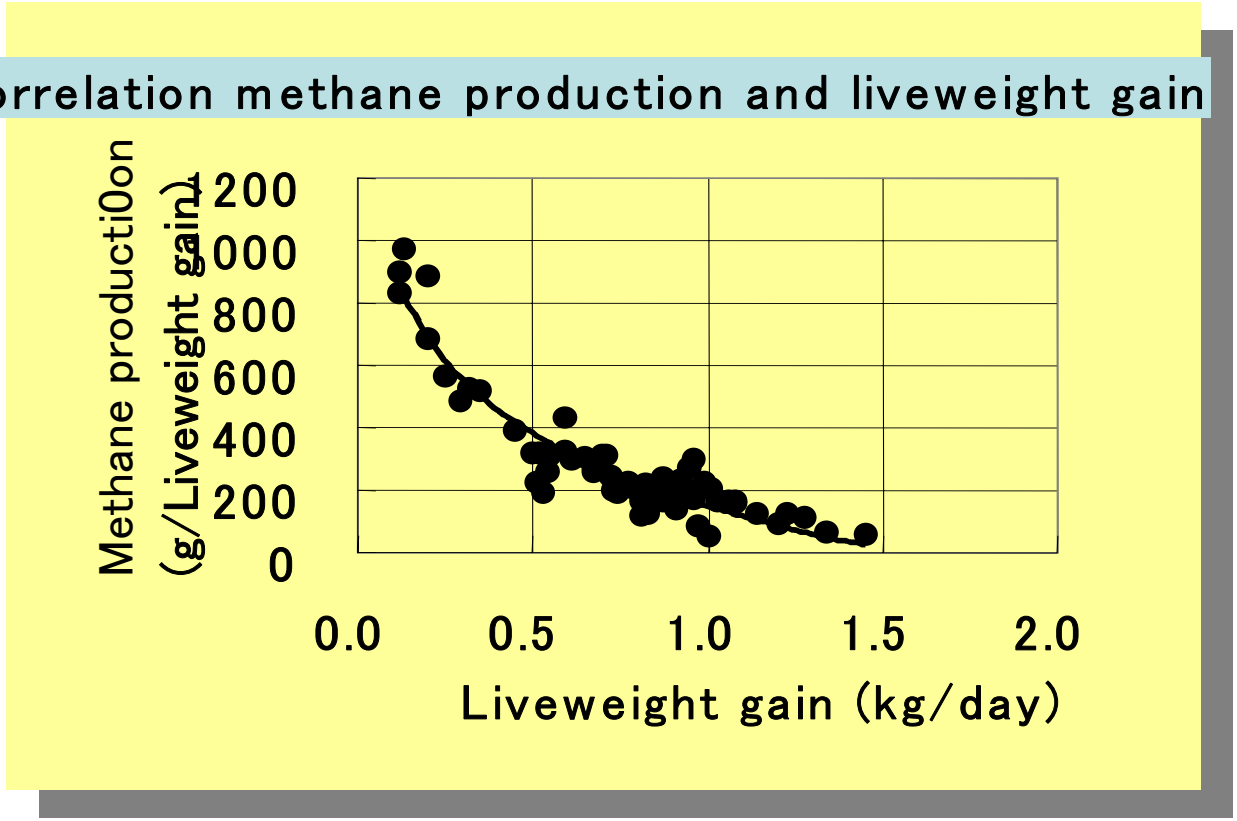
Future study

In vitro gas production technique(Menke's method) appears to have the capacity to determine the CH_4 production potential of ruminant diets. Further studies are needed to evaluate *in vitro* technique to reflect the treatment difference among the feed.

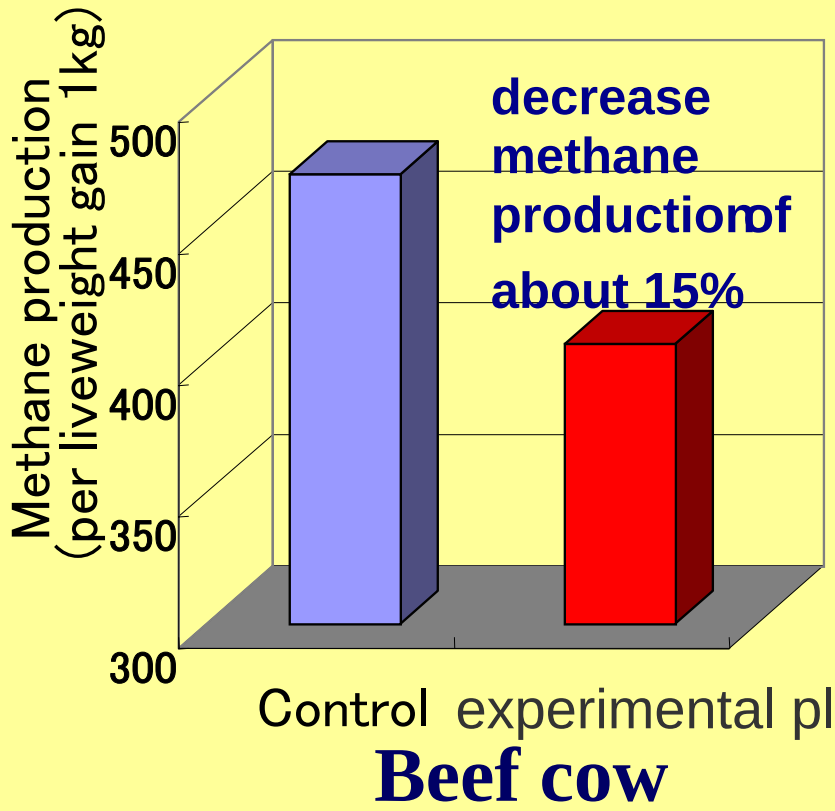
We found that condensed tannin(CT) compounds reduced the methane emissions from goat. Therefore, It is need to study about methane reduction using cattle

Factors affecting methane emission from ruminant

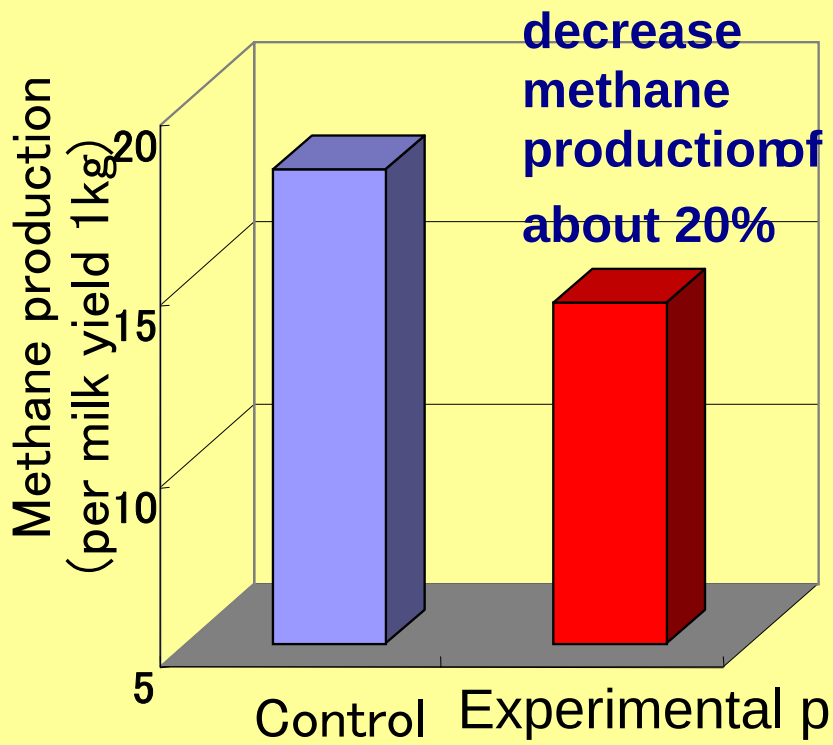
Improving animal productivity decreases methane emissions per unit of product.



Methane reduction by calcium fatty acid



Beef cow



Dairy cow

Emission Reduction

- Unsaturated fatty acids
- Fat rich by-products
- Ionophore
- Removing ciliate protozoa from rumen