

How to prepare and use compost for sustainable agriculture + Topics on Green Manure

Part 1: Why composting is necessary?

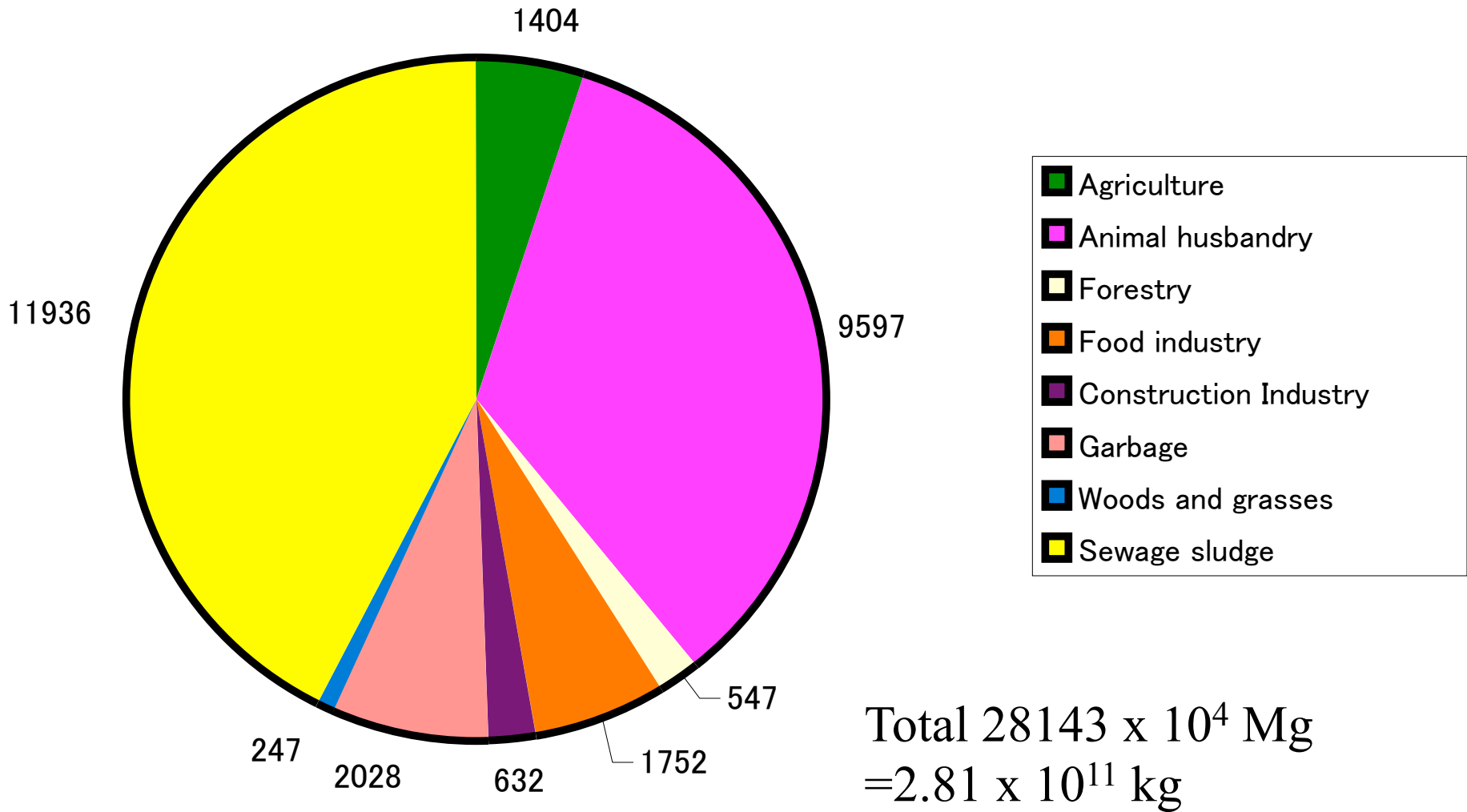
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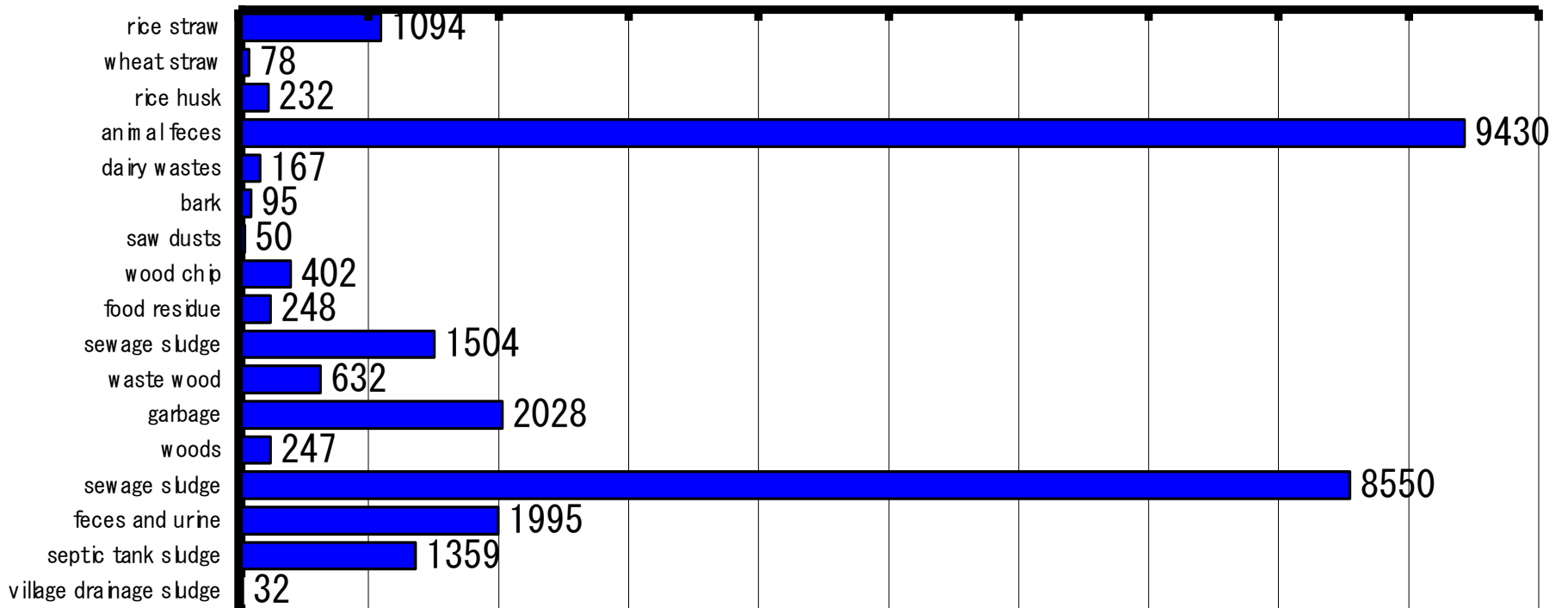
Amounts of biological wastes (10

⁴ Mg)

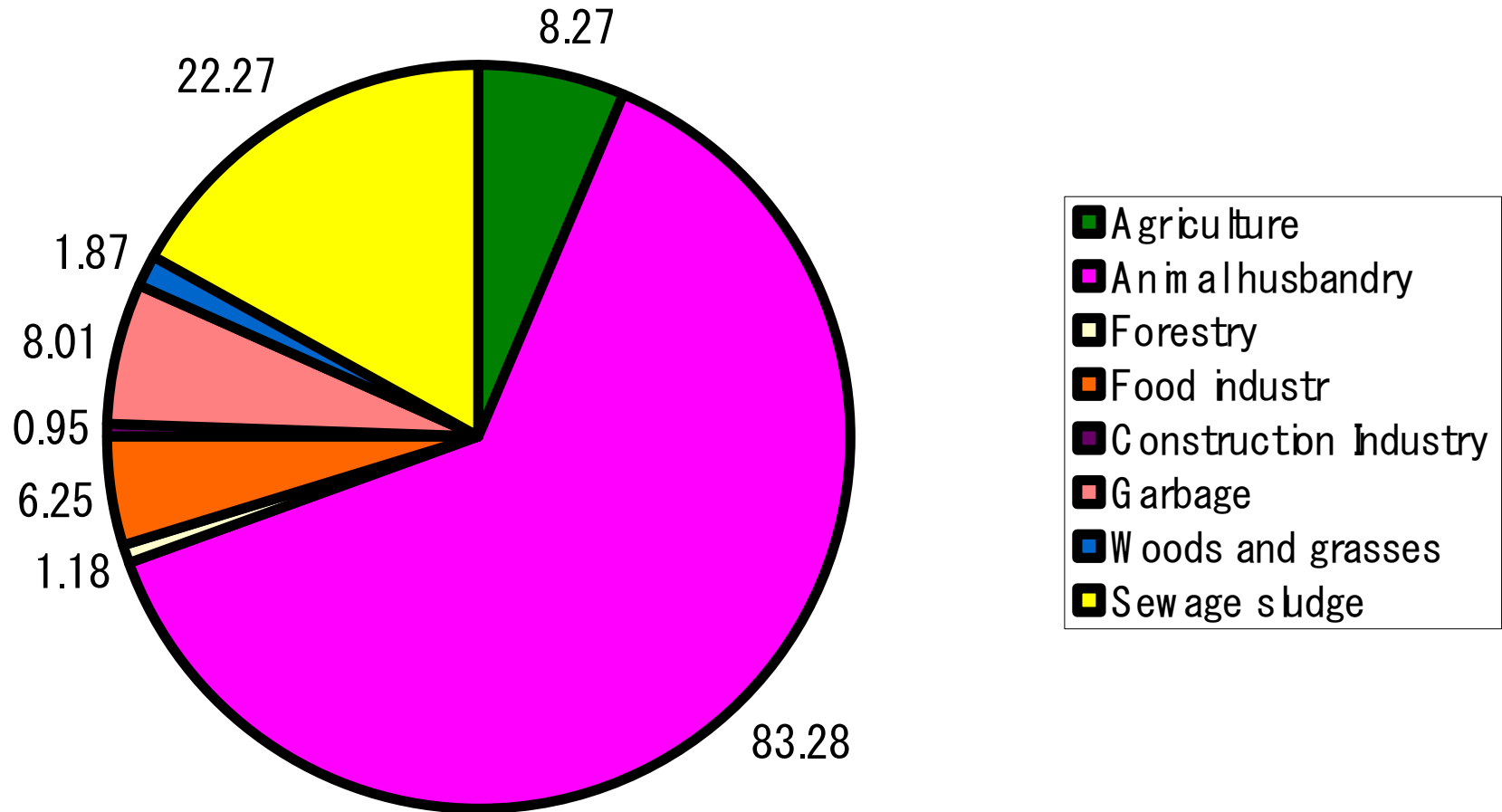


Amounts of biological wastes (10^4 M g)

0 1000 2000 3000 4000 5000 6000 7000 8000 9000 10000

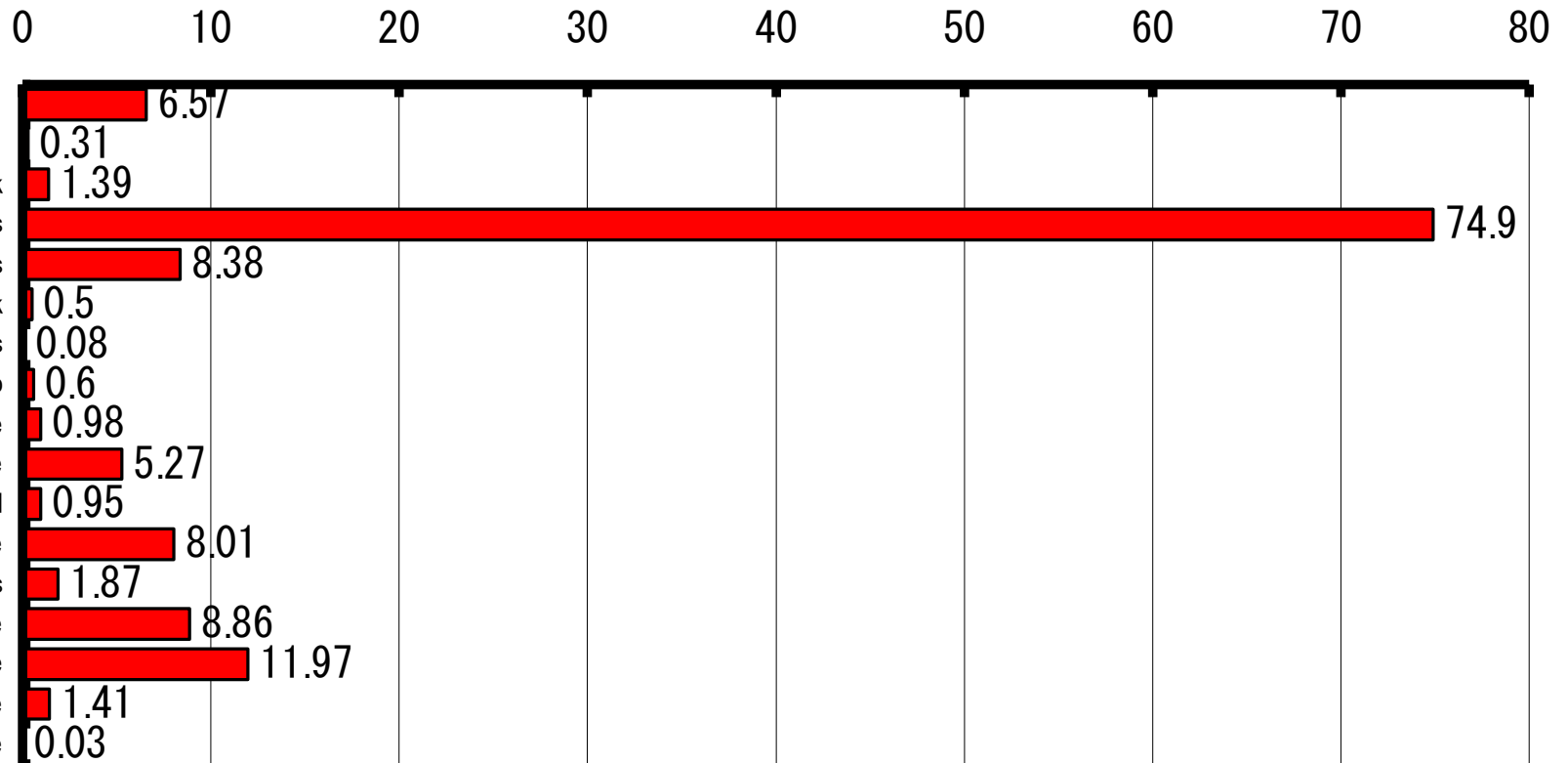


Nitrogen in biological wastes (10^4 Mg)

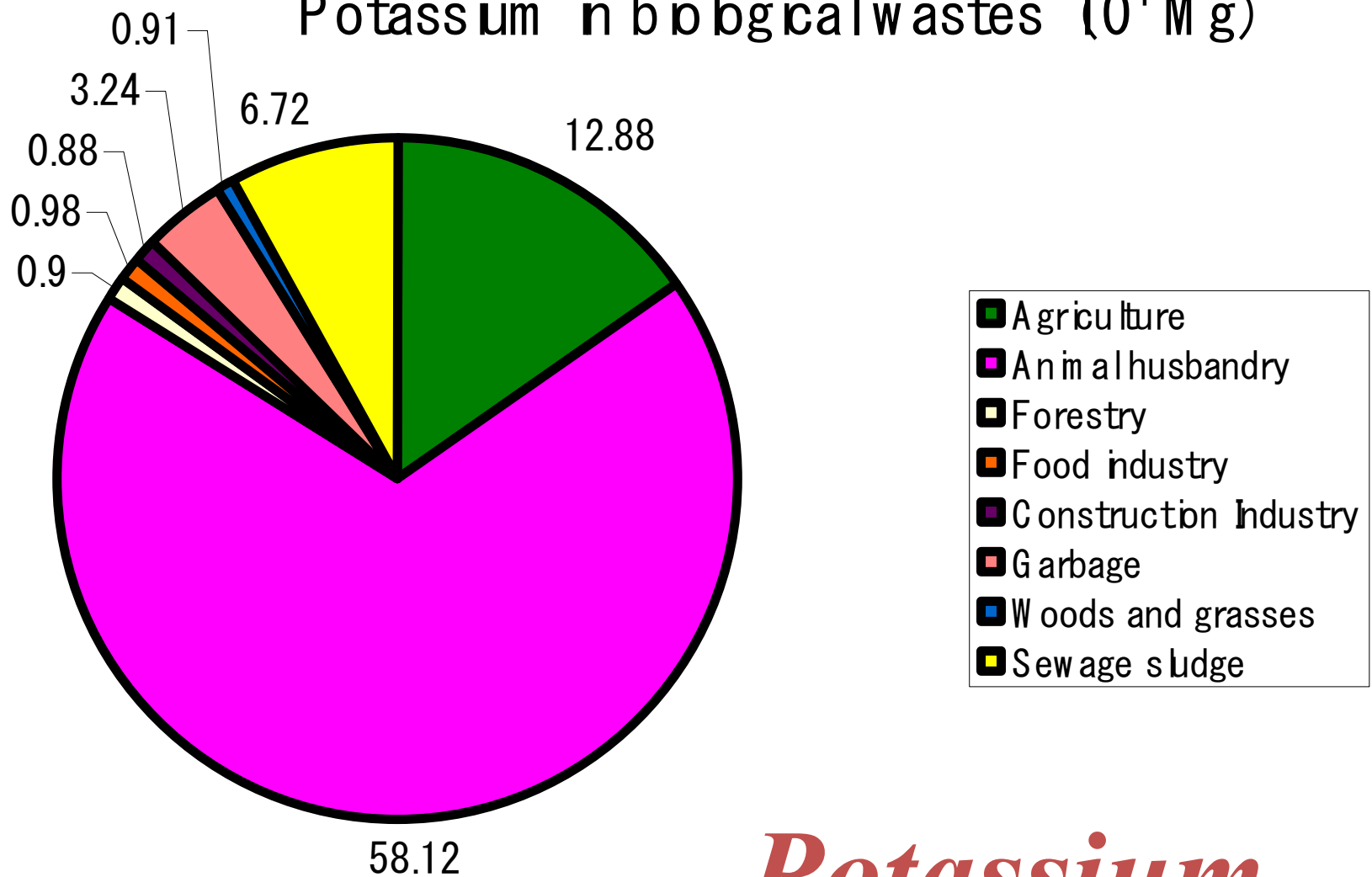


Nitrogen

Nitrogen in biological wastes (10^4 Mg)

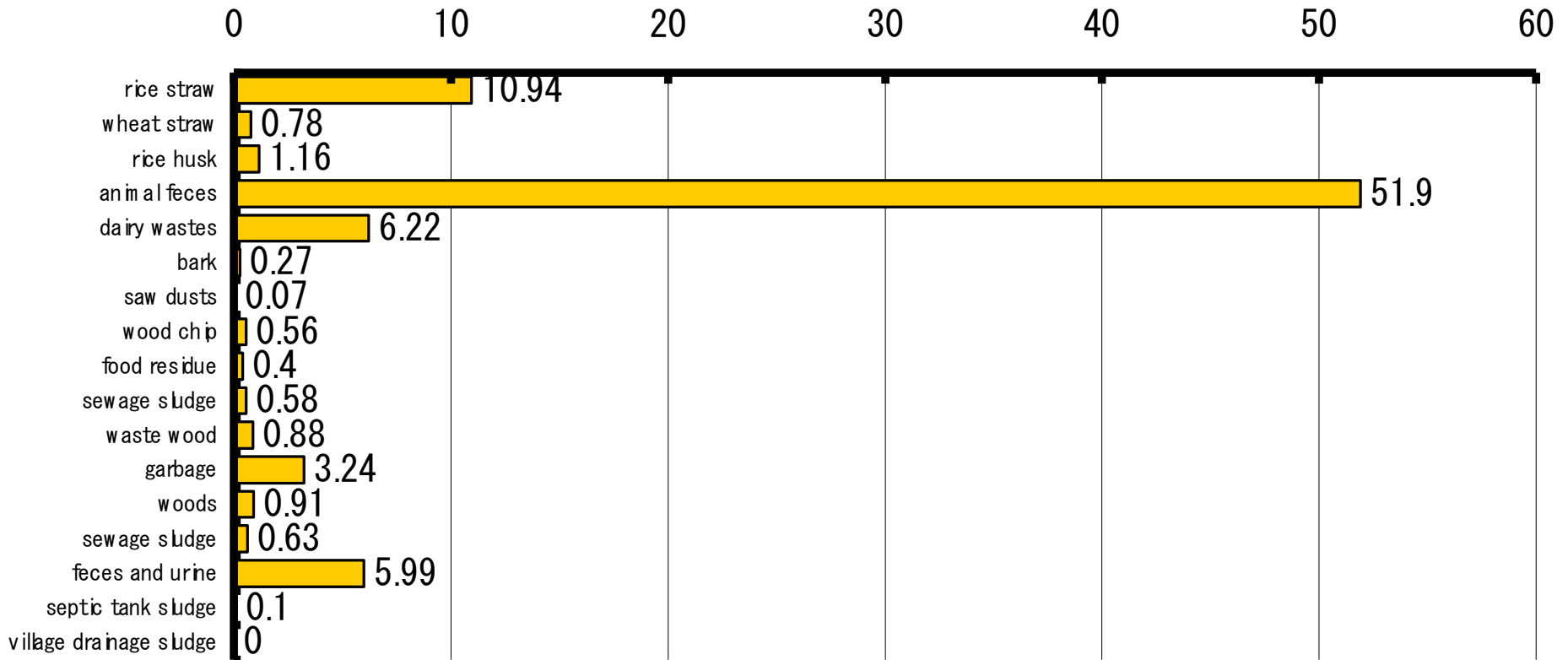


Potassium in biological wastes (10^4 Mg)

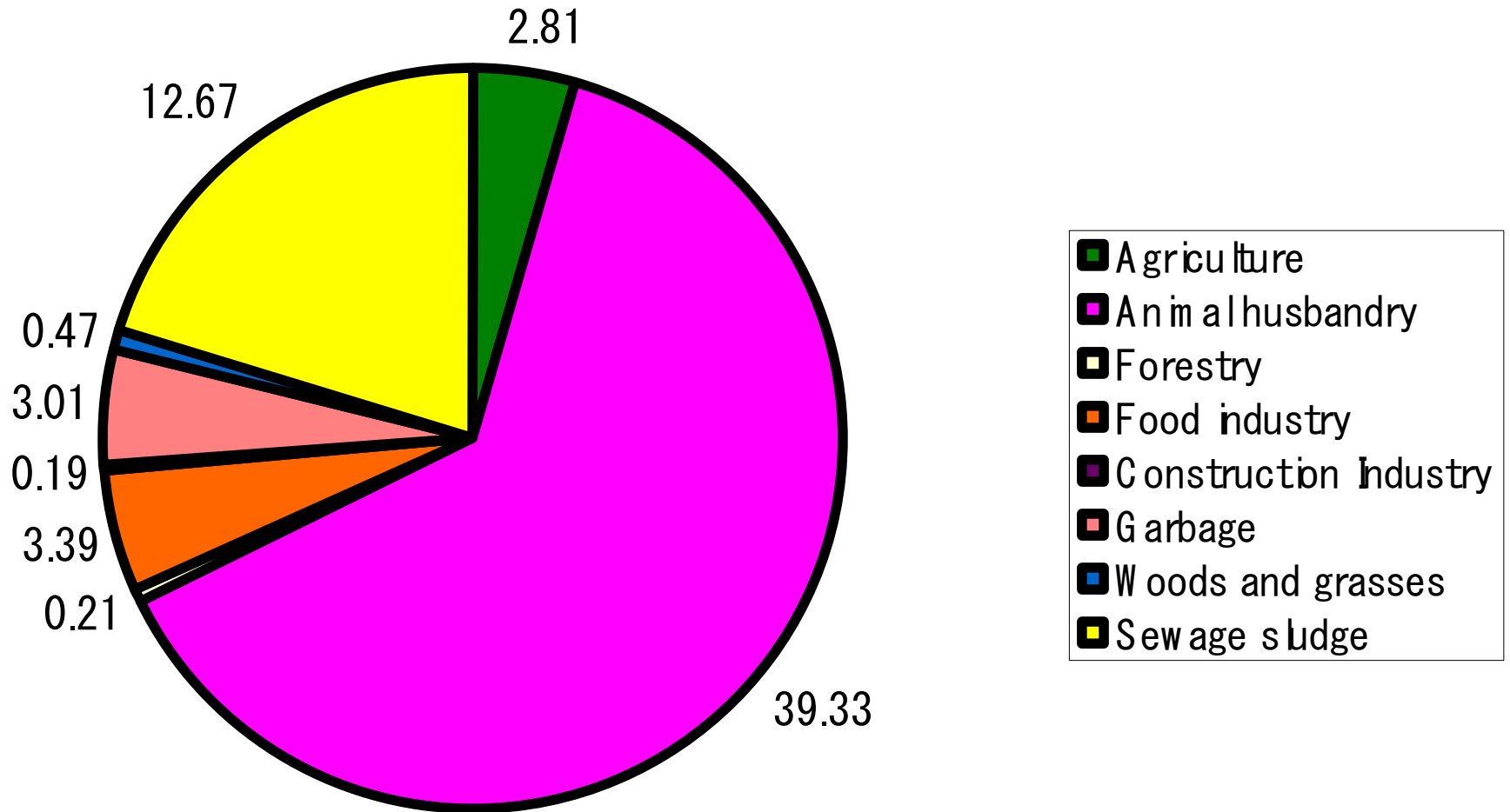


Potassium

Potassium in biological wastes (10^4 Mg)

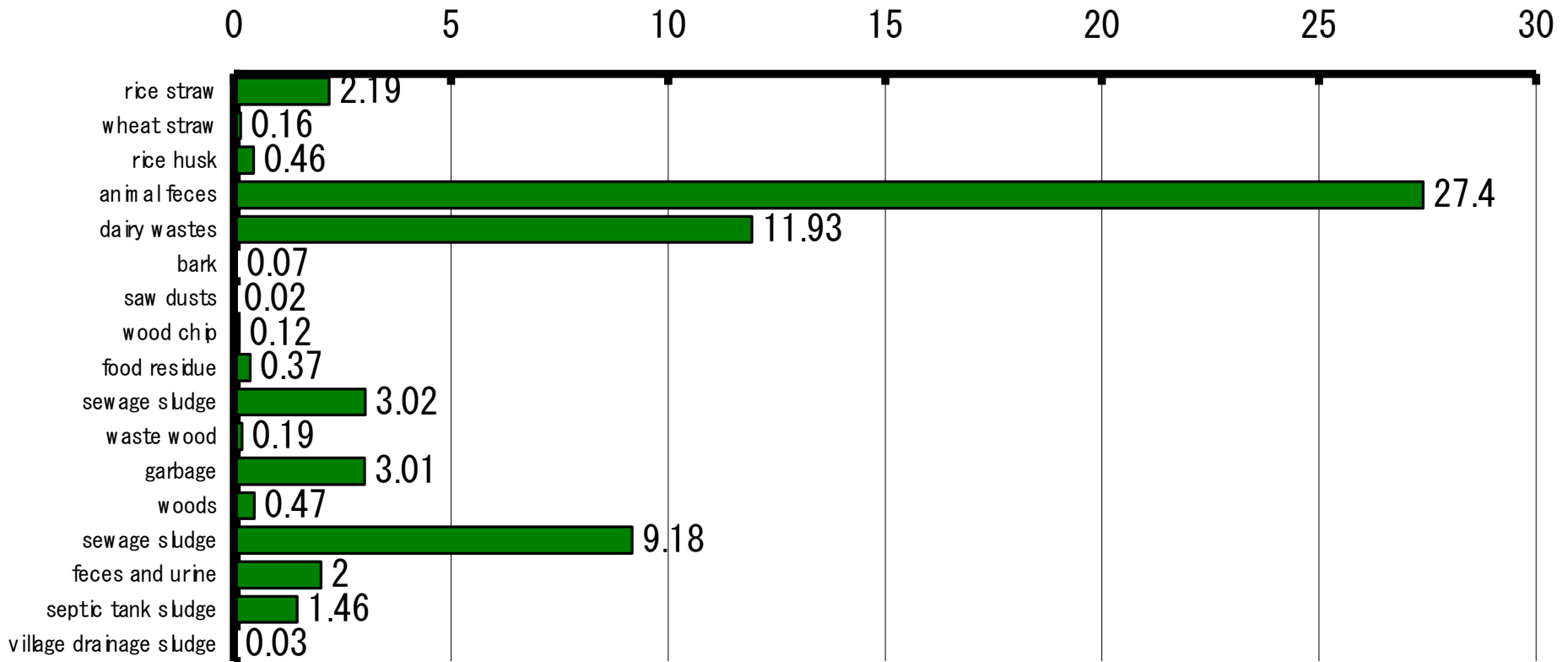


Phosphate in biological wastes (10^4 Mg)



Phosphate

Phosphate in biological wastes (10^4 M g)



Annual amounts of organic industrial wastes in Japan

5×10^8 ton (5 hundred million ton)

5×10^{11} kg

Area of Agricultural Lands in Japan 5×10^6 ha

- 5×10^8 ton of organic waste is equivalent to
- 100 t/ha
- 1.0 t/100m²
- 10 kg/m²

100 t / ha

Can agricultural land in Japan accept this amount of organic wastes?

Carrying capacity

50 t/ha as organic matter

200kg/ha as nitrogen

It seems impossible to accept all the amount to agricultural lands.

Comparison of Animal Feces Excreted in Hokkaido and Other Prefectures in 2000

		Numbers of animals	Amounts of Feces (1000 t)	Amounts of Feces / ha (t)	Amounts of N / ha (kg)
Hokkaido	Milk cow	878,200	13,665	28.3	148.2
	Beef cattle	413,500	3,823		
Other Prefectures	Milk cow	937,800	16,367	116.1	614.6
	Beef cattle	2,428,500	22,476		

Adapted from Shiga (2001)

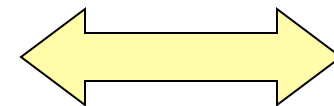
Load of animal feces / unit area in Hokkaido is $\frac{1}{4}$ of that in other prefectures, but it is approaching the carrying capacity of environments.

Carrying capacity of cattle feces in Hokkaido.

	ha	Organic matter applied t/ha	N kg/ha	Carrying capacity for OM (total 10 ⁶ t)	Carrying capacity for Nitrogen (total 10 ³ t)
Paddy field	134,900	15	75	2.02	10.1
Row crop	289,000	20~30	100~150	7.23	36.1
Vegetables	52,286	30~40	150~200	1.83	9.15
Pasture	576,300	50~60	190~228	31.7	120.4
Dent-corn	36,900	55	209	2.03	7.71
Orchards	2,053	20~30	34~50	0.05	0.09
Sum	1091,439			44.9	183.6

Adapted from Shiga (1994)

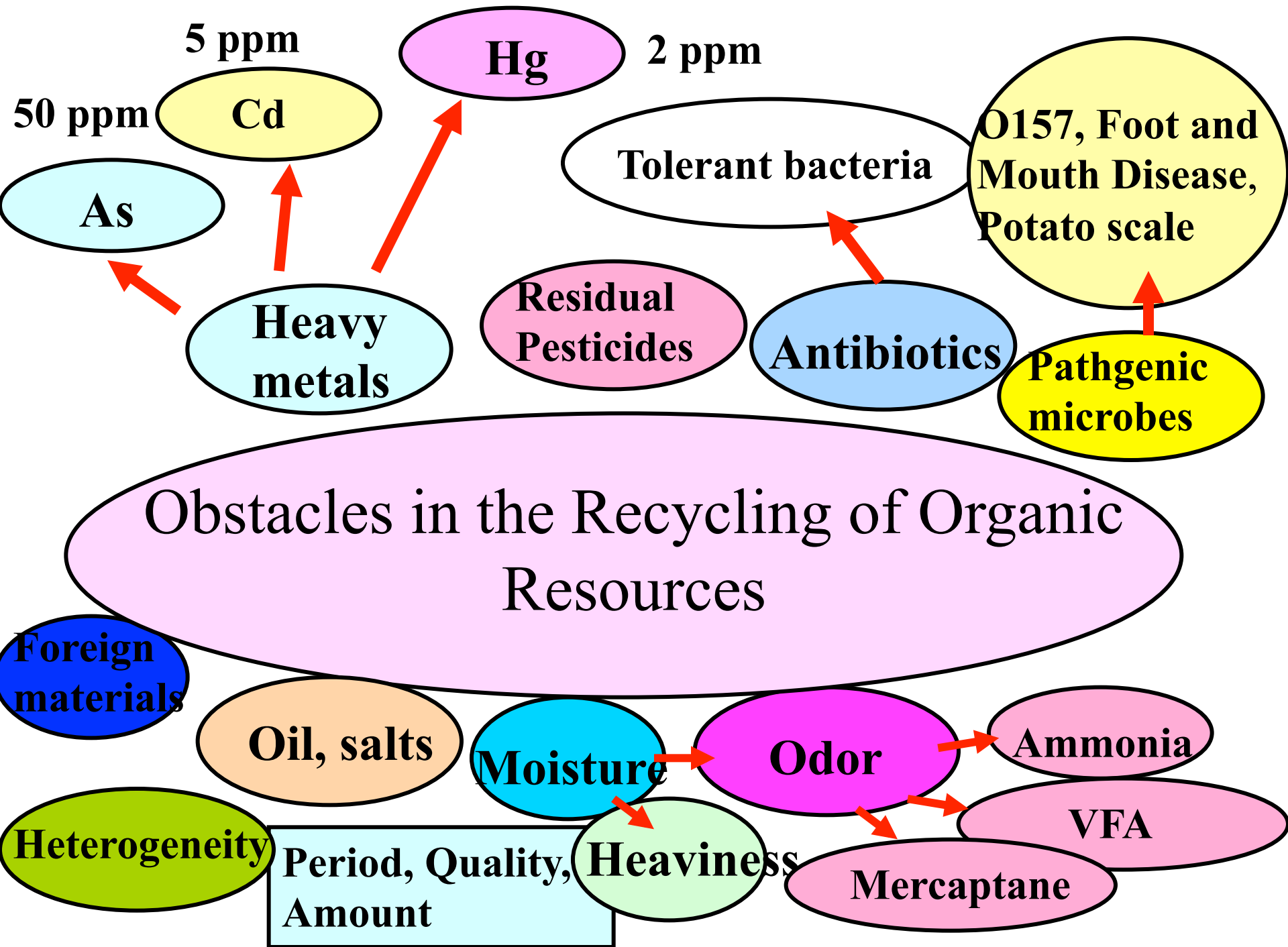
Agricultural land in Hokkaido can carry or require 45 million tons of organic matter.



Cattle feces produced in Hokkaido is 17.5 million tons.

Cattle feces are lacking, valuable resources.

Technology for converting biological wastes to effective organic fertilizer / compost is required.



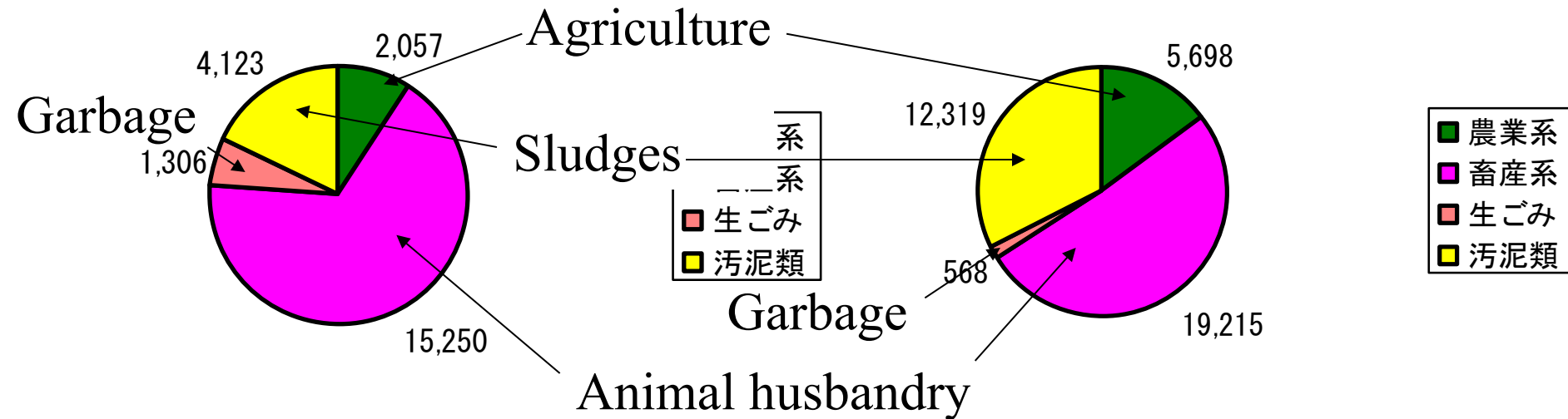
Heavy metal contents in composts (ppm in average)

Items	Sewage sludge compst	Manure Compost
Cadmium Cd	2.79	0.82
Arsenic As	4.55	2.22
Mercury Hg	1.37	0.11
Copper Cu	184	28
Zinc Zn	1109	82

Emergenced Amounts of Cd & As originating from biological wastes

Cd (kg/year)

As (kg/year)

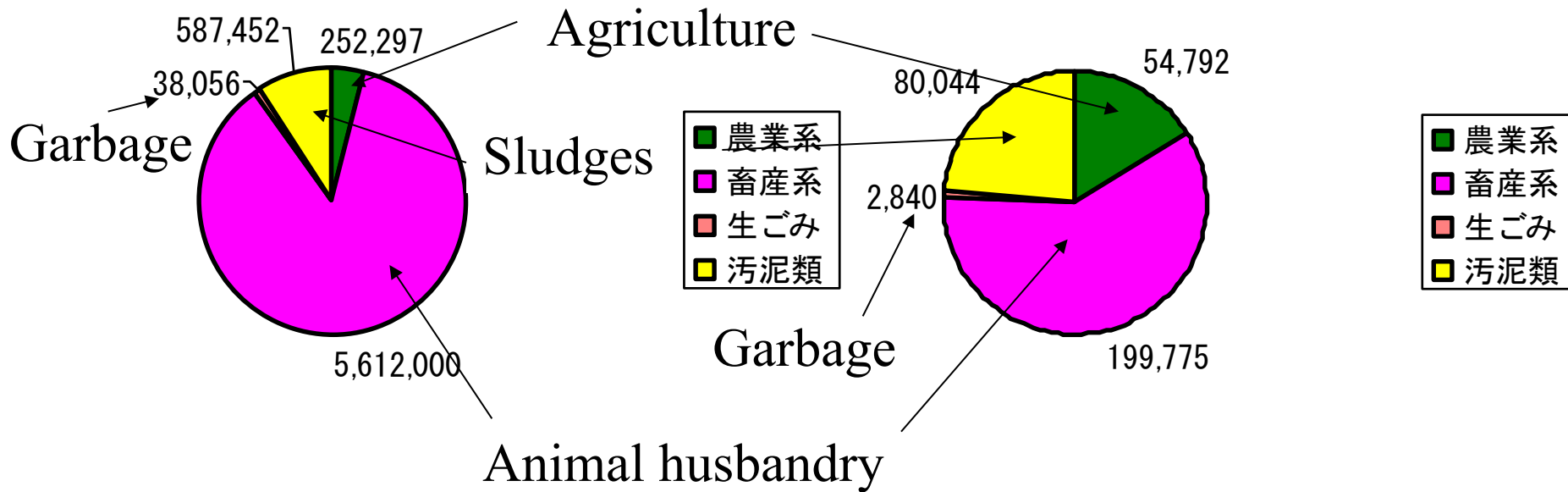


Loads of heavy metals were larger in the order of
Animal >> Sludge > Agriculture > Garbage

Emergenced Amounts of Cu & Pb originating from biological wastes

Cu (kg/year)

Pb (kg/year)



**Loads of heavy metals were larger in the order of
Animal >> Sludge > Agriculture > Garbage**

Antibiotics tolerant bacteria in animal manure



Amounts of antibiotics used

- As a human medicine 520 tons (1998)
- As an animal medicine 1060 tons (2001)
- As food additives 230 tons (2001)
- **Used in larger amounts for animals**



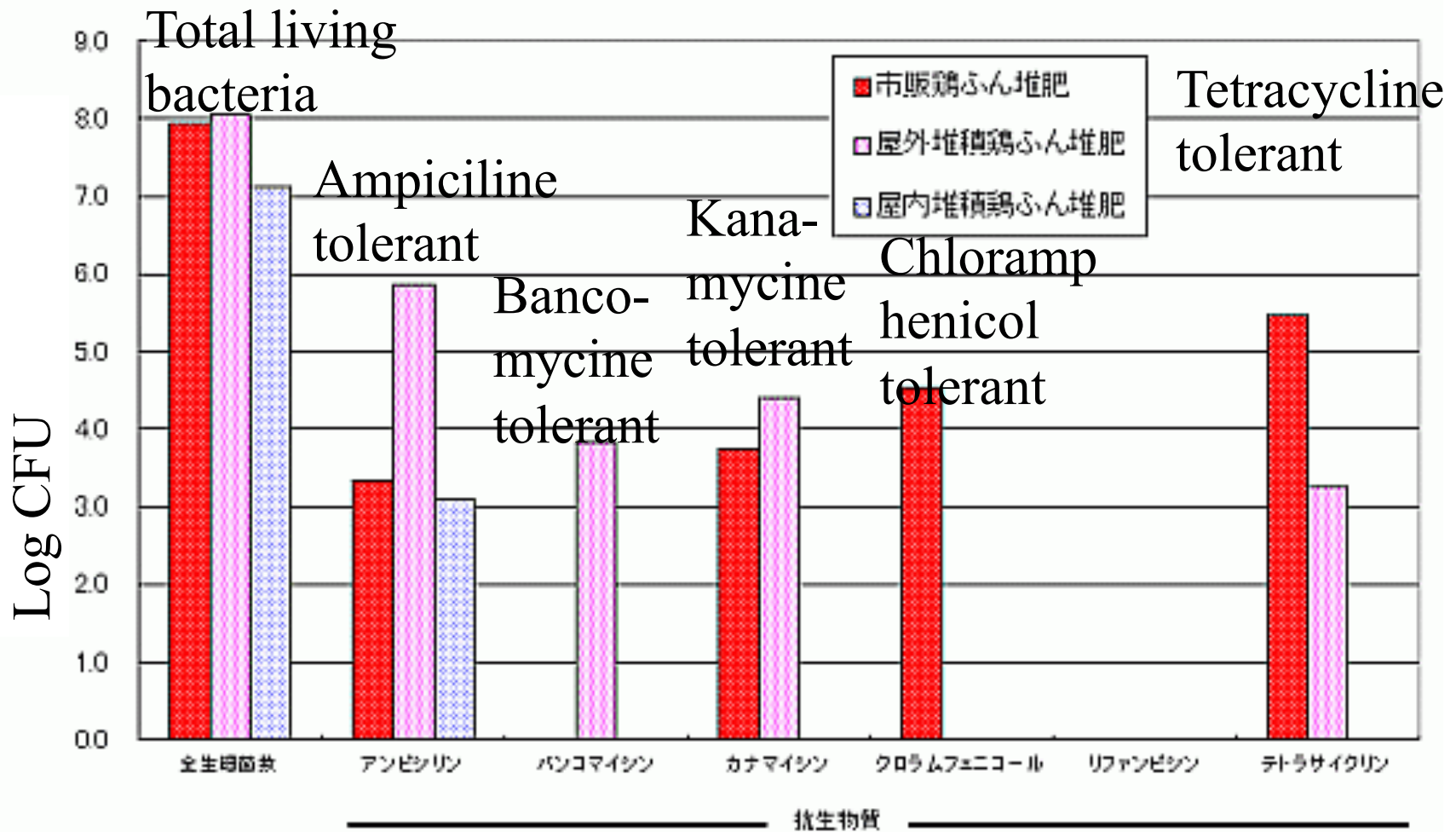


図1 鶏ふん堆肥中の抗生物質耐性細菌数 (Kobashi et al. 2005 から作図)
 (屋外および屋内堆積鶏ふん堆肥は異なる経営体のもの)

Numbers of antibiotics tolerant bacteria in animal manure