

Rice Breeding in Japan



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1. Background of rice breeding
2. Rice breeding methods
3. Present rice breeding targets



1. Background of rice breeding

Leading rice varieties in Japan (2015)

	Variety	Ratio (%)
1	Koshihikari	36.1
2	Hitomebore	9.6
3	Hinohikari	9.2
4	Akitakomachi	7.1
5	Nanatsuboshi	3.2
	Top 5 varieties	65.2

1. Background of rice breeding

Number of rice varieties cultivated in Japan (2015)

○ Non-glutinous rice varieties 260

○ Glutinous rice varieties 73

○ Brewing sake rice varieties 105

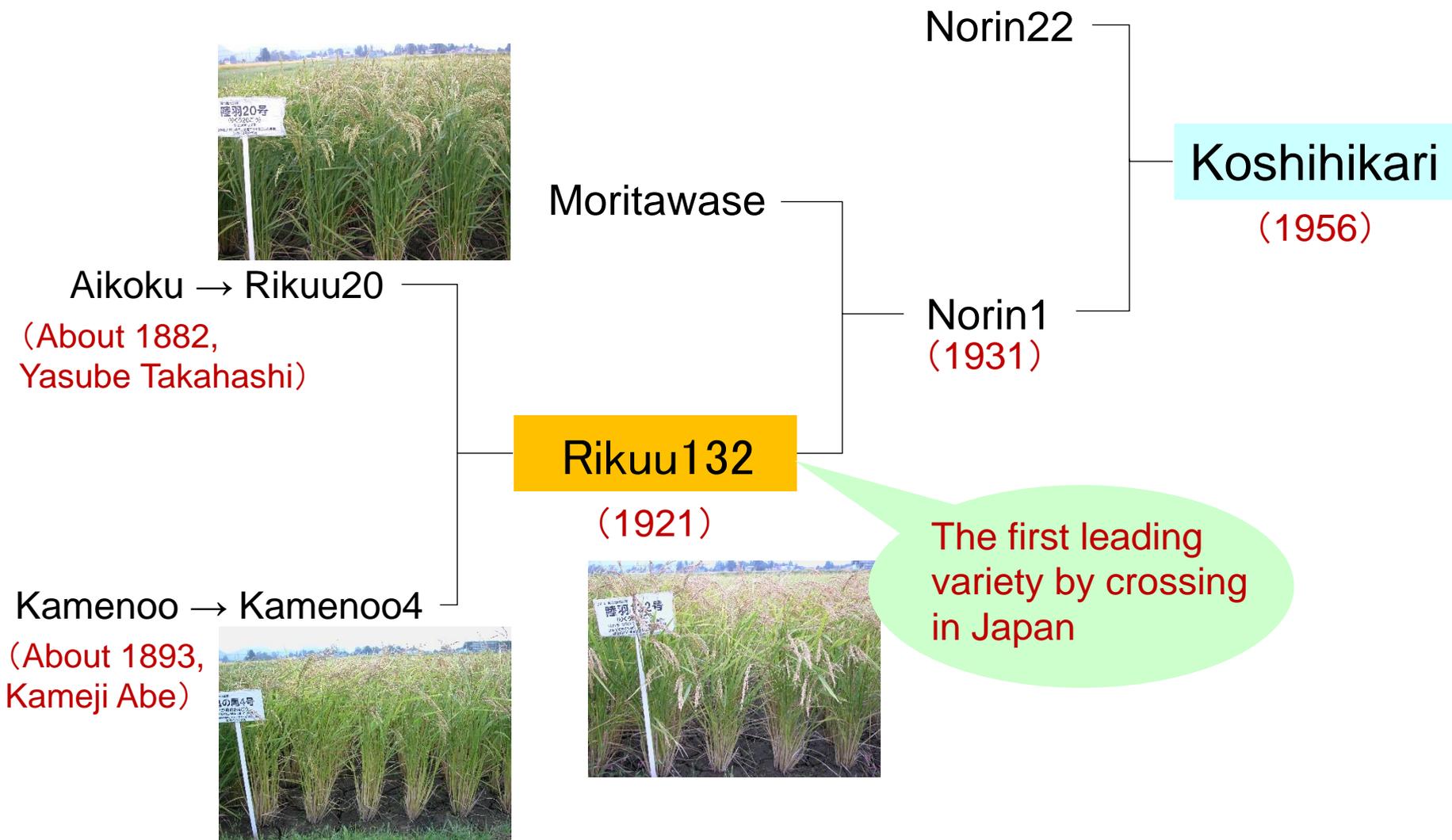
Total 438



Sake (Rice wine)

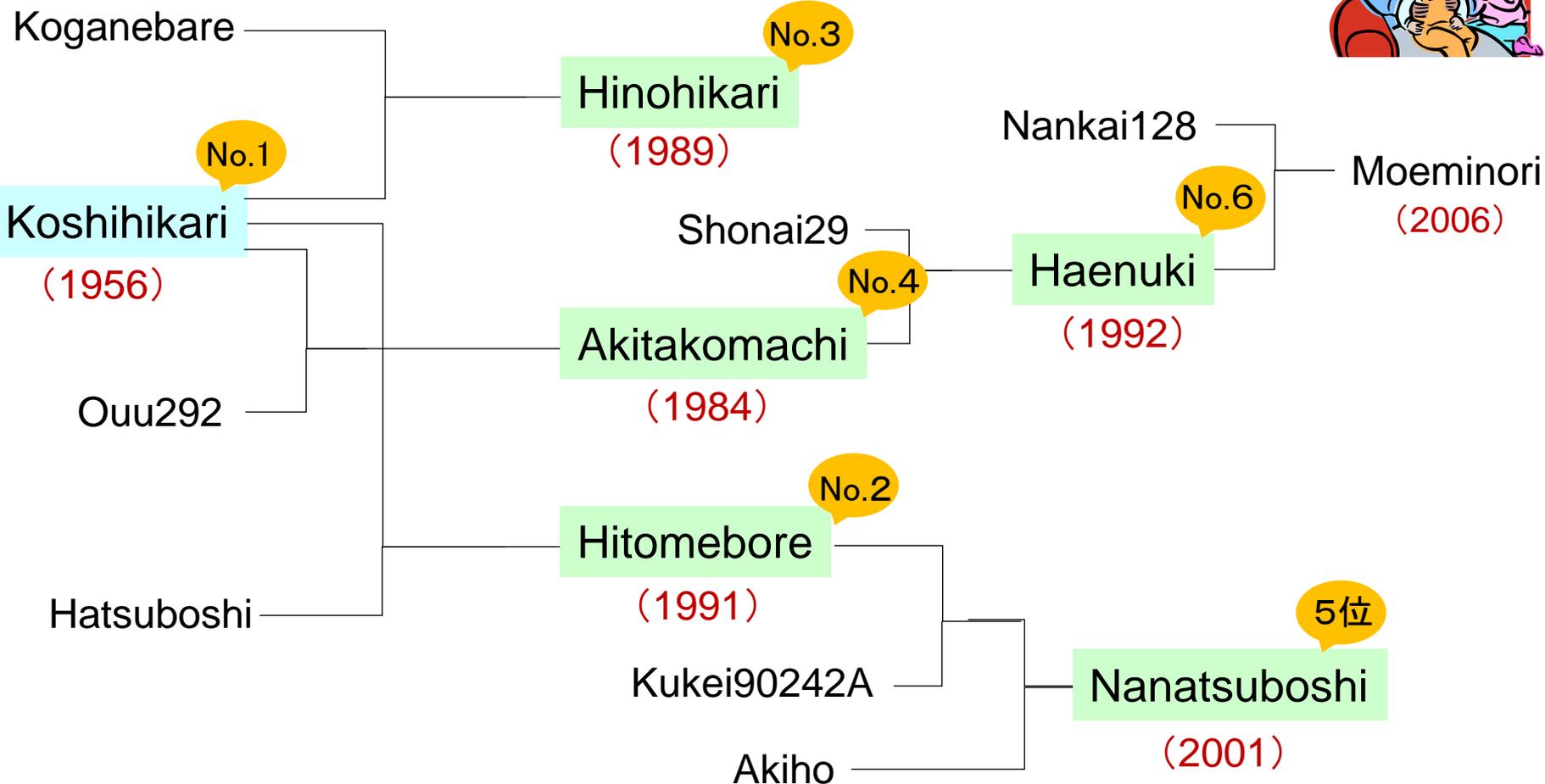
1. Background of rice breeding

The progenitors of Koshihikari



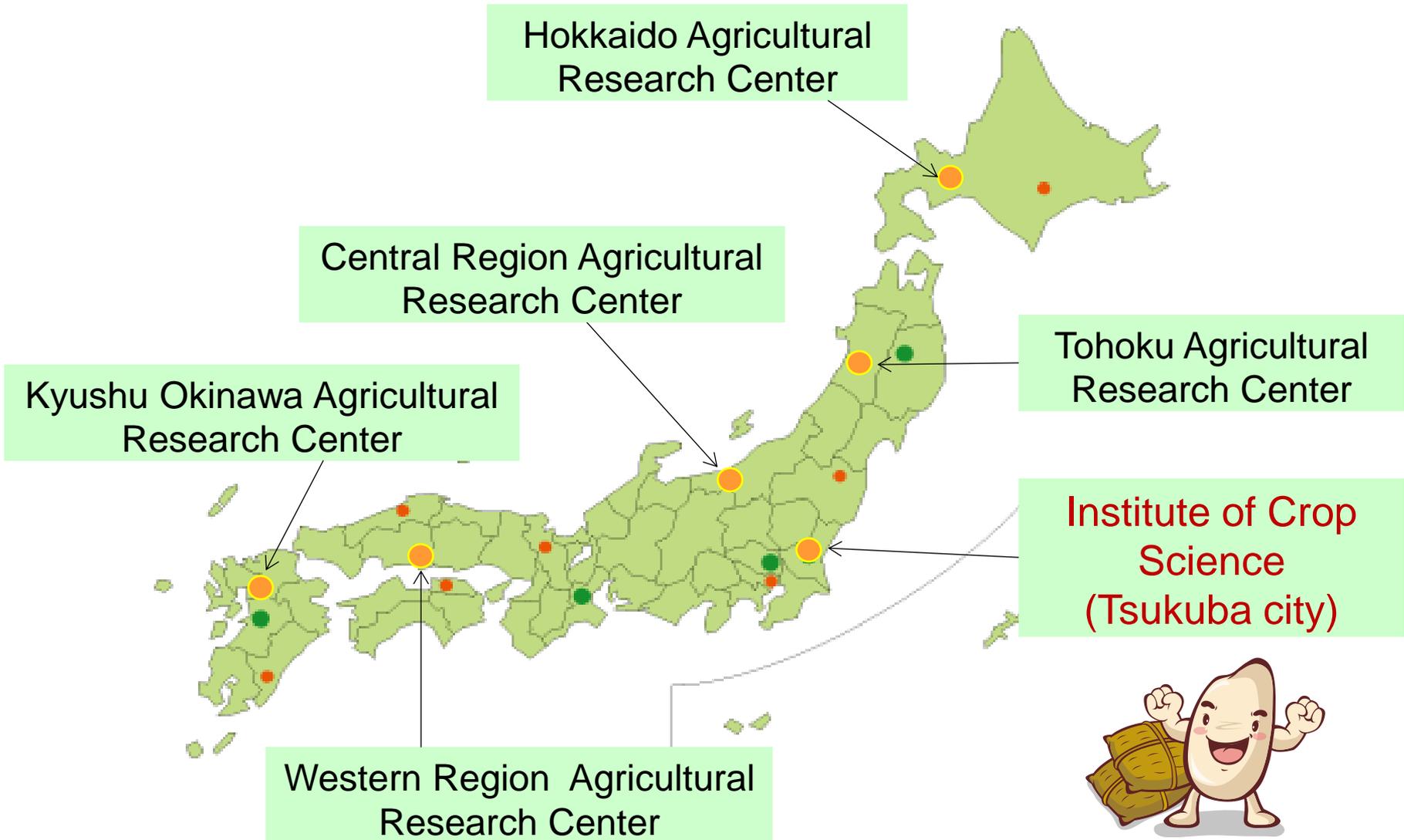
1. Background of rice breeding

The progenies of Koshihikari



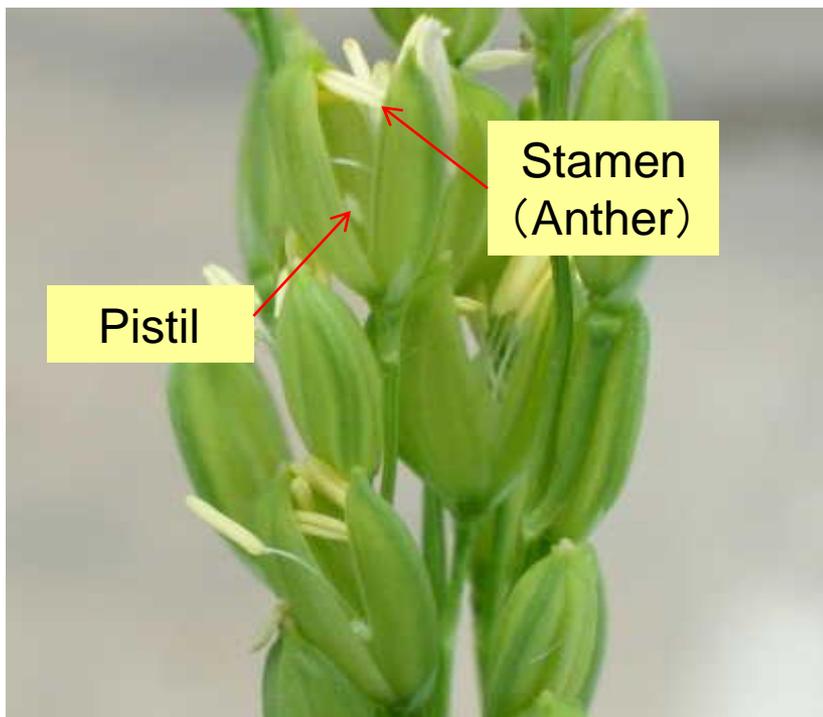
1. Background of rice breeding

Rice breeding stations of NARO



2. Rice breeding methods

1) Crossing method



Flower of rice

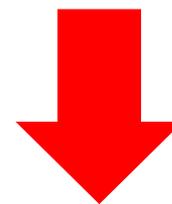
A variety with
good eating
quality and
disease
susceptibility

A variety with
poor eating
quality and
disease
resistance

○ Pistil
× Stamen
(Pollen)

Crossing

× Pistil
○ Stamen
(Pollen)



A new variety with
good eating quality
and disease
resistance



2. Rice breeding methods

1) Crossing method

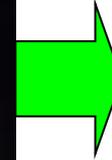


1. Sterilization of female plants -
Hot water **at 43°C for 5-7
minutes**

2. Elimination of spikelets
that fail to open

2. Rice breeding methods

1) Crossing method



3. Cross-pollination with male parents

4. Covering a paraffin bag

2. Rice breeding methods

2) Yield trials



Beds for seedlings



Transplanting – 700 plots of yield trials

2. Rice breeding methods

3) Screening the lines for **blast resistance**



Nursery under upland conditions
(**Leaf blast screening**)



Difference of **leaf blast resistance**

2. Rice breeding methods

3) Screening the lines for **blast resistance**



Difference of **panicle blast resistance**

2. Rice breeding methods

4) Screening the lines for **high temperature tolerance**



Film (30% cut of the day light)

Early planting to treat the plants in the high temperature maturing stage

2. Rice breeding methods

4) Screening the lines for high temperature tolerance



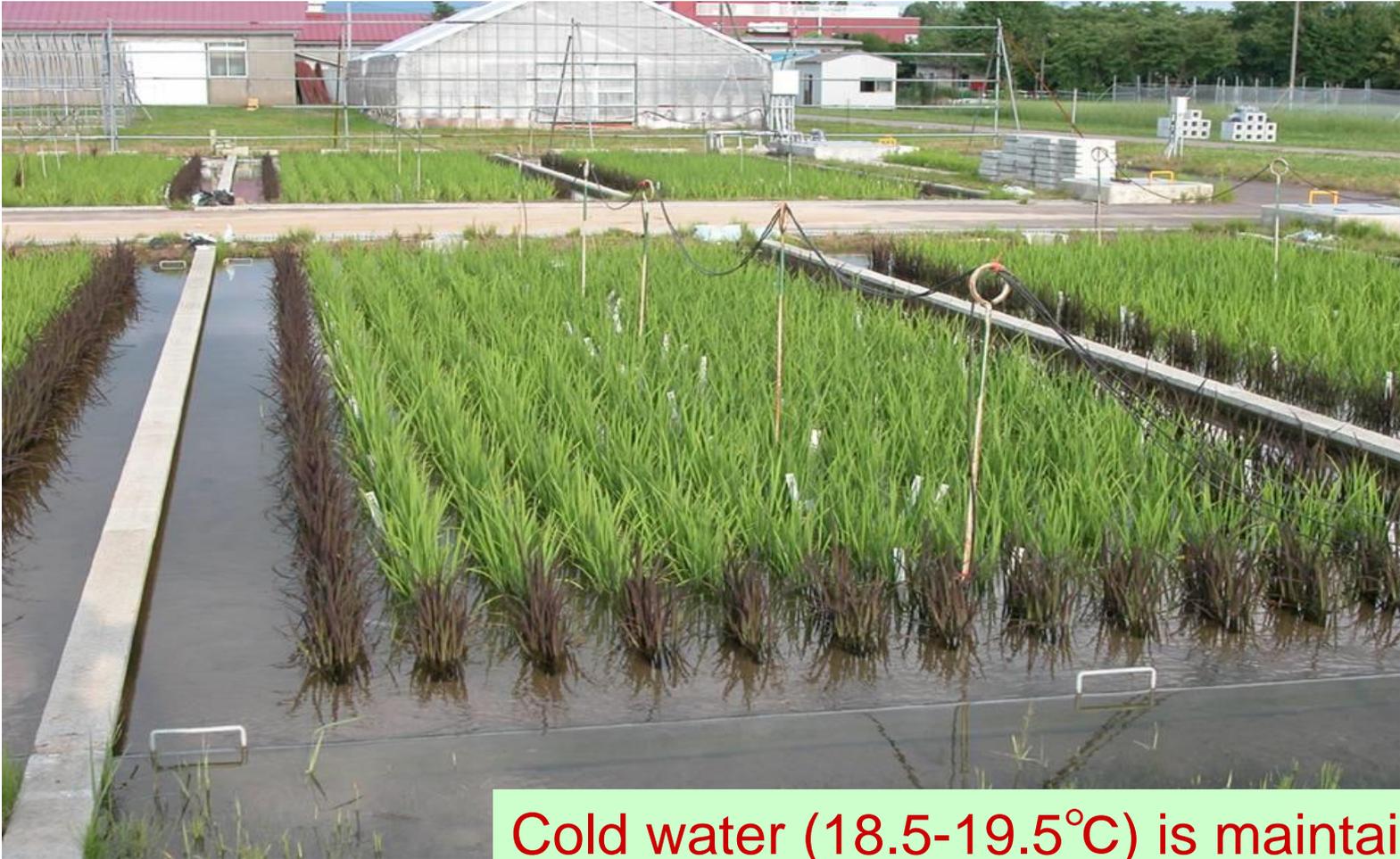
Good grain quality
(Tolerant)

Poor grain quality
(Susceptible)

Difference of high temperature tolerance

2. Rice breeding methods

5) Screening the lines for cool weather tolerance



Cold water (18.5-19.5°C) is maintained at 20 cm depth

2. Rice breeding methods

5) Screening the lines for **cool weather tolerance**



Susceptible



Tolerant

Degree of spikelet sterility → Evaluation of the tolerance

2. Rice breeding methods

6) Screening the lines for eating quality



Evaluation of 3 entries with
2 check varieties (good one
and poor one)

平成15年11月11日 氏名 〇〇〇〇 様

番号	項目	かなり悪い (-3)	悪い (-2)	やや悪い (-1)	基準と同じ	やや良い (+1)	良い (+2)	かなり良い (+3)
1	光沢				○			
	ねばり				○			
	総合			○				
2	光沢					○		
	ねばり			○				
	総合			○				
3	光沢				○			
	ねばり					○		
	総合				○			
4	光沢						○	
	ねばり						○	
	総合						○	
5	光沢							
	ねばり							
	総合							

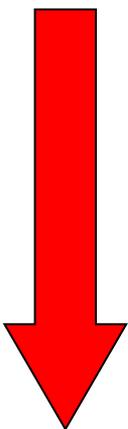
特記事項:

- Physical appearance
- Stickiness
- Over all taste

3. Present rice breeding targets

Consumptions of rice in Japan

118 kg/year in 1962 → **56** kg/year in 2012



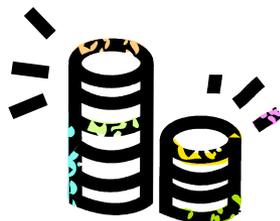
To increase the consumptions of rice ...



Breeding of new varieties for new demand



1) Good taste



2) Low cost



3) Health

3. Present rice breeding targets

1) Varieties with good eating quality

○ Low amylose content grains



Glutinous

Low amylose

Non-glutinous

Amylose	0 %	5-15%	20%
Stickiness	High	Moderate	Low

How to use...



3. Present rice breeding targets

○ How to use the low amylose content grains

1. Good eating quality in cool rice condition
→ **Suitable for instant food processing**
2. Mixing material for low eating quality rice grains



○ Low amylose content varieties



Milky queen Milky princess Koshihikari

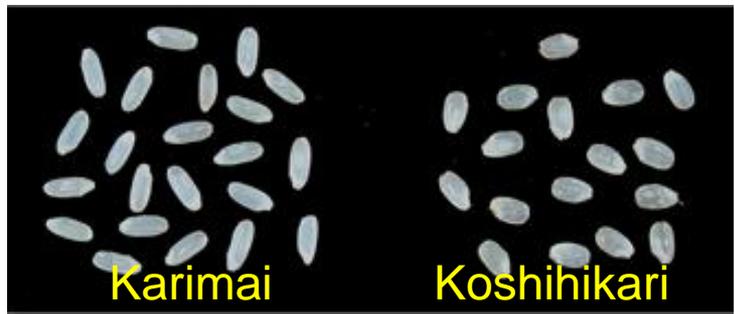
(Non-glutinous)

3. Present rice breeding targets

1) Varieties with good eating quality

○ Varieties for specific cooking

Kareimai



Eminokizuna



3. Present rice breeding targets

2) Varieties for **low cost production**

○ Varieties for **direct seeding**

- Resistance to root lodging
- Seedling establishment



“Moeminori” – Resistance to root lodging

3. Present rice breeding targets

2) Varieties for **low cost production**

- **High yielding** varieties



Akidawara

Koshihikari

“Akidawara” – High-yielding ability and resistance to lodging

3. Present rice breeding targets

2) Varieties for **low cost production**

○ **Blast resistant** varieties

- Cultivation without chemicals or with minimum chemicals
→ **For organic farming**



A highly blast-resistant cultivar “Churahikari”

3. Present rice breeding targets

3) Varieties for health

○ Red or purple grain varieties

- High dietary fiber, tannin, catechin, and anthocyanidin content
- Anti-oxidant activity of the grains



Benigoromo
(nonglutinous)

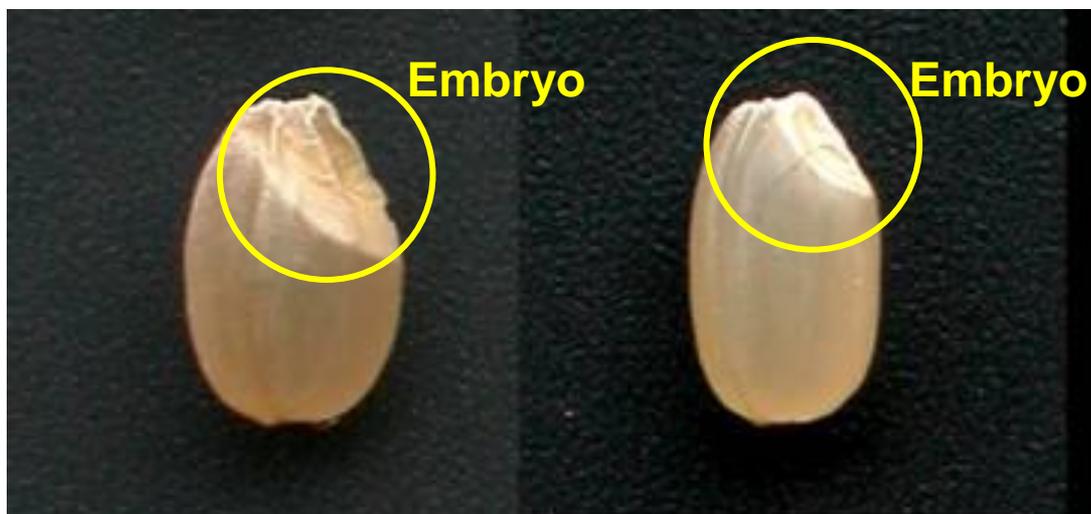
Asamurasaki
(glutinous)

3. Present rice breeding targets

3) Varieties for health

○ Giant embryo varieties

- High Gamma-aminobutyric acid (GABA) content
→ Control of blood pressure



Koiazusa

Akitakomachi



Processed foods with giant embryo grains

3. Present rice breeding targets

Appendix: Varieties for other use



▪ For animal food



▪ For decorative plants



▪ For phytoremediation of polluted fields

Collaboration with Asian countries and Japan

→ **Development of rice breeding**

Thank you very much !