

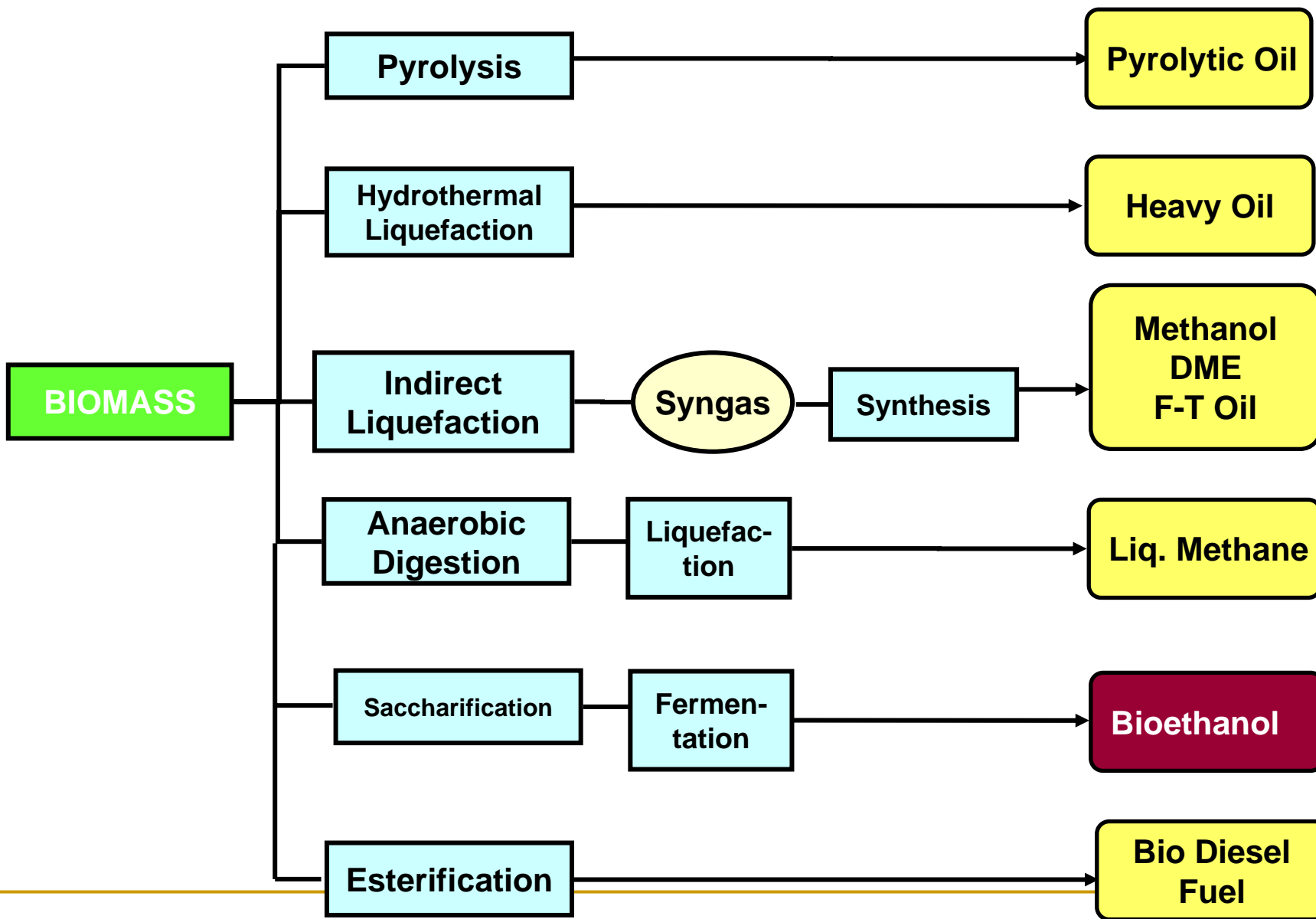
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5th Biomass Asia Workshop  
Baiyun International Convention Center  
Guangzhou, China  
December 4, 2007

## Research and Development for Sustainable Biomass Utilization in Asian Countries

Shinya Yokoyama  
The University of Tokyo

# LIQUID FUEL FROM BIOMASS



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## POSSIBILITY OF BIOETHANOL FROM RICE IN JAPAN

**RICE: EXCELLENT CROP WITHOUT REPLANT FAILURE  
INCOME FOR FARMERS**

**EFFICIENT UTILIZATION OF REDUCED RICE FIELD**

**DUE TO FALLING BIRTHRATE, POPULATION**

**DECREASE, AND INCREASE IN CROP YIELD**

**LESS HARMFUL TO ENVIRONMENT, NO FORESTRY  
DAMAGE**

**WATER CULTIVATION, PREVENTION OF SOIL OUTFLOW,**

**CONSERVATION OF BIODIVERSITY AND LANDSCAPE**

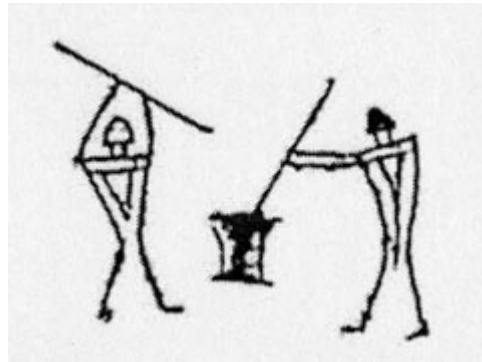
**COLLABORATION WITH ASIAN COUNTRIES**

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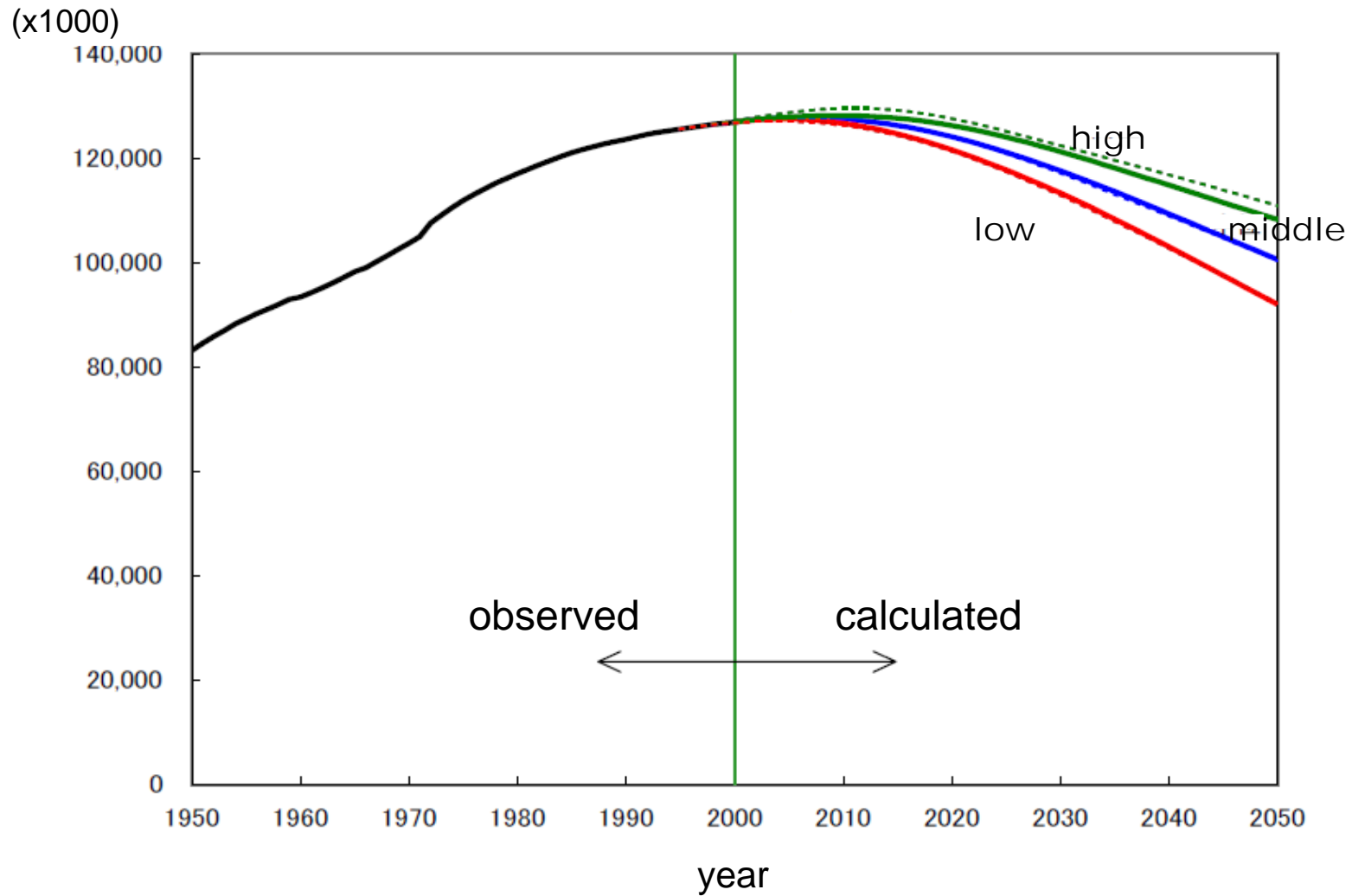
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# THE HISTORY OF RICE FARMING

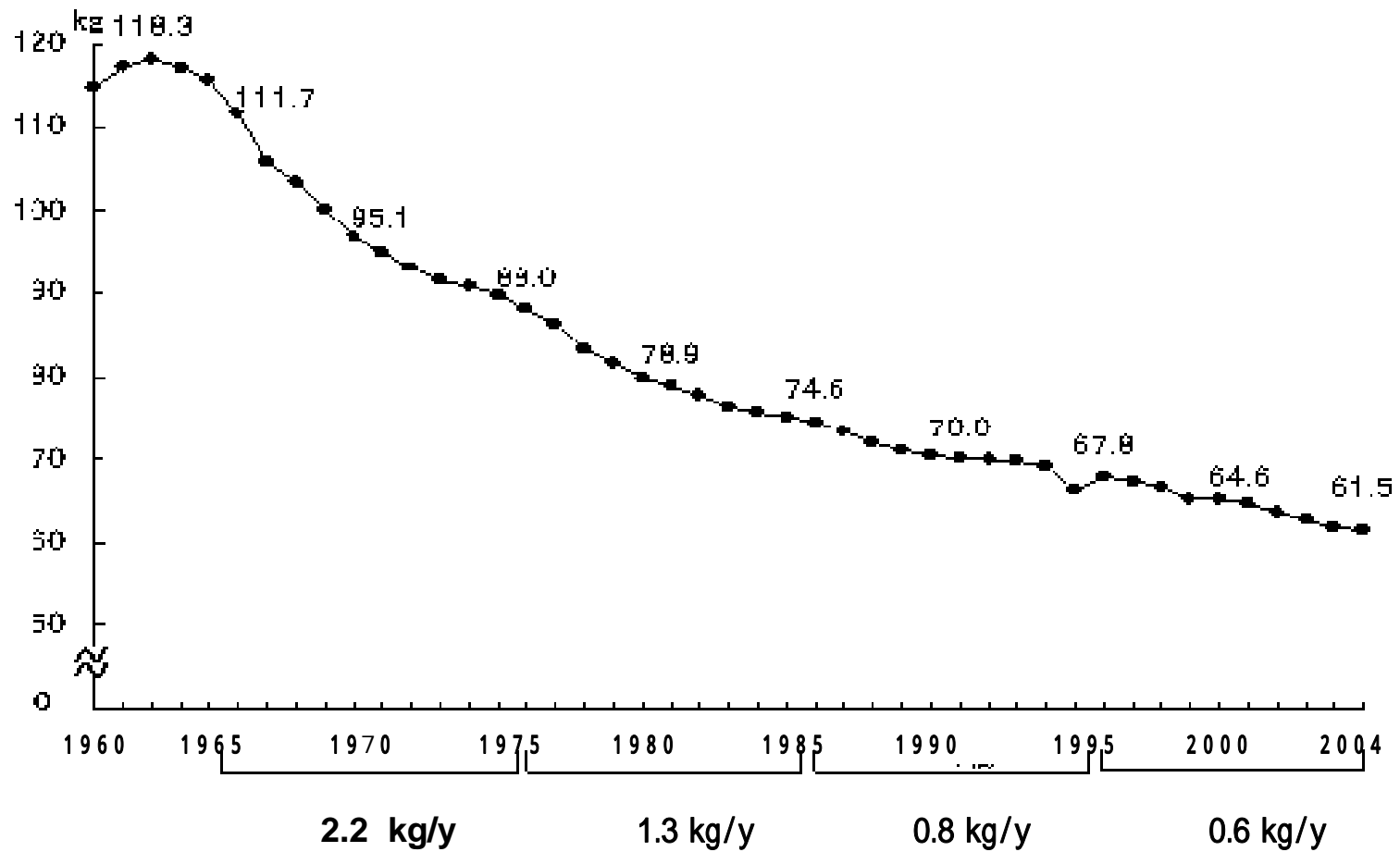
## 2000 YEARS OR LONGER



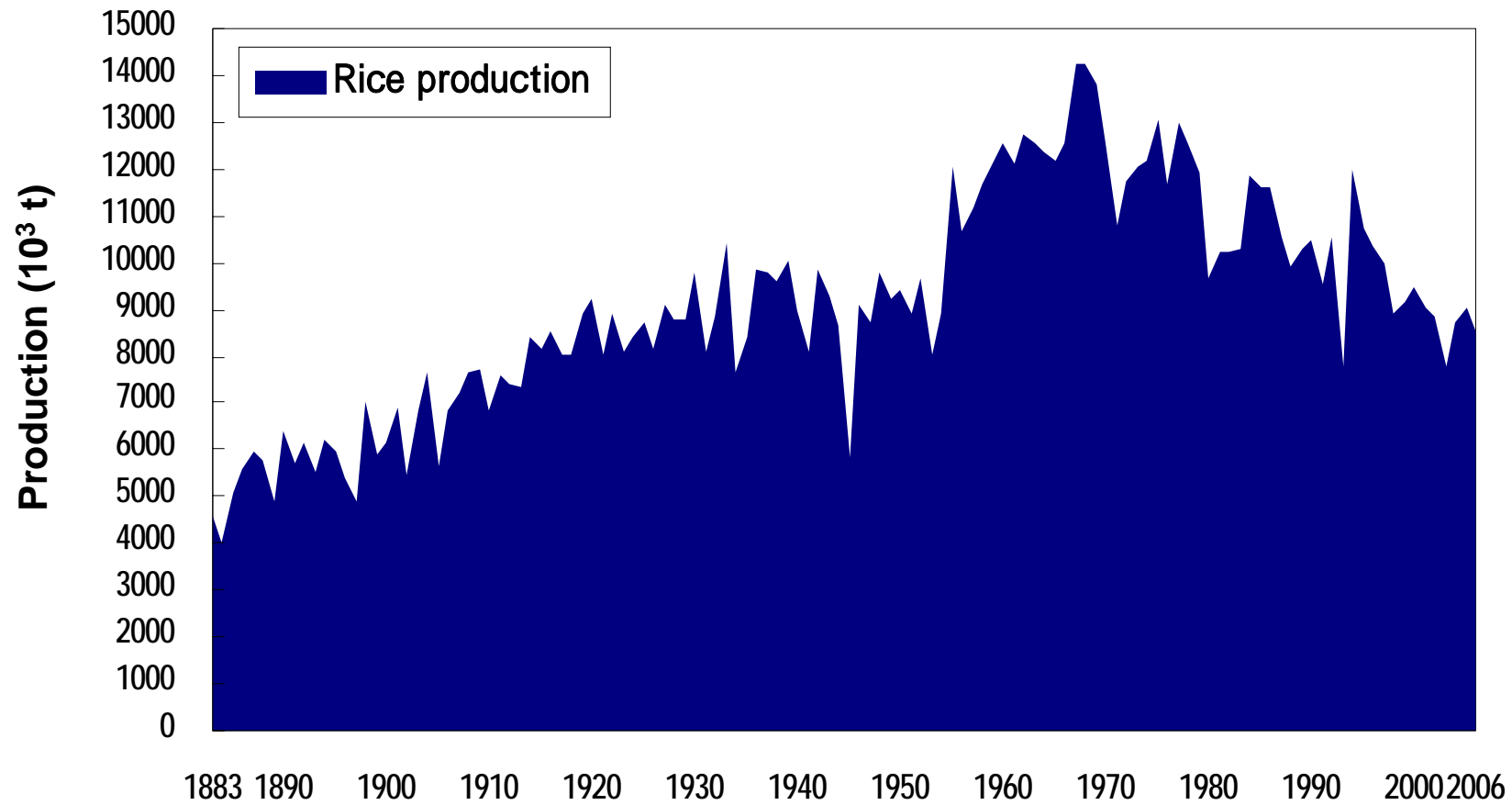
# PROSPECT OF POPULATION IN JAPAN



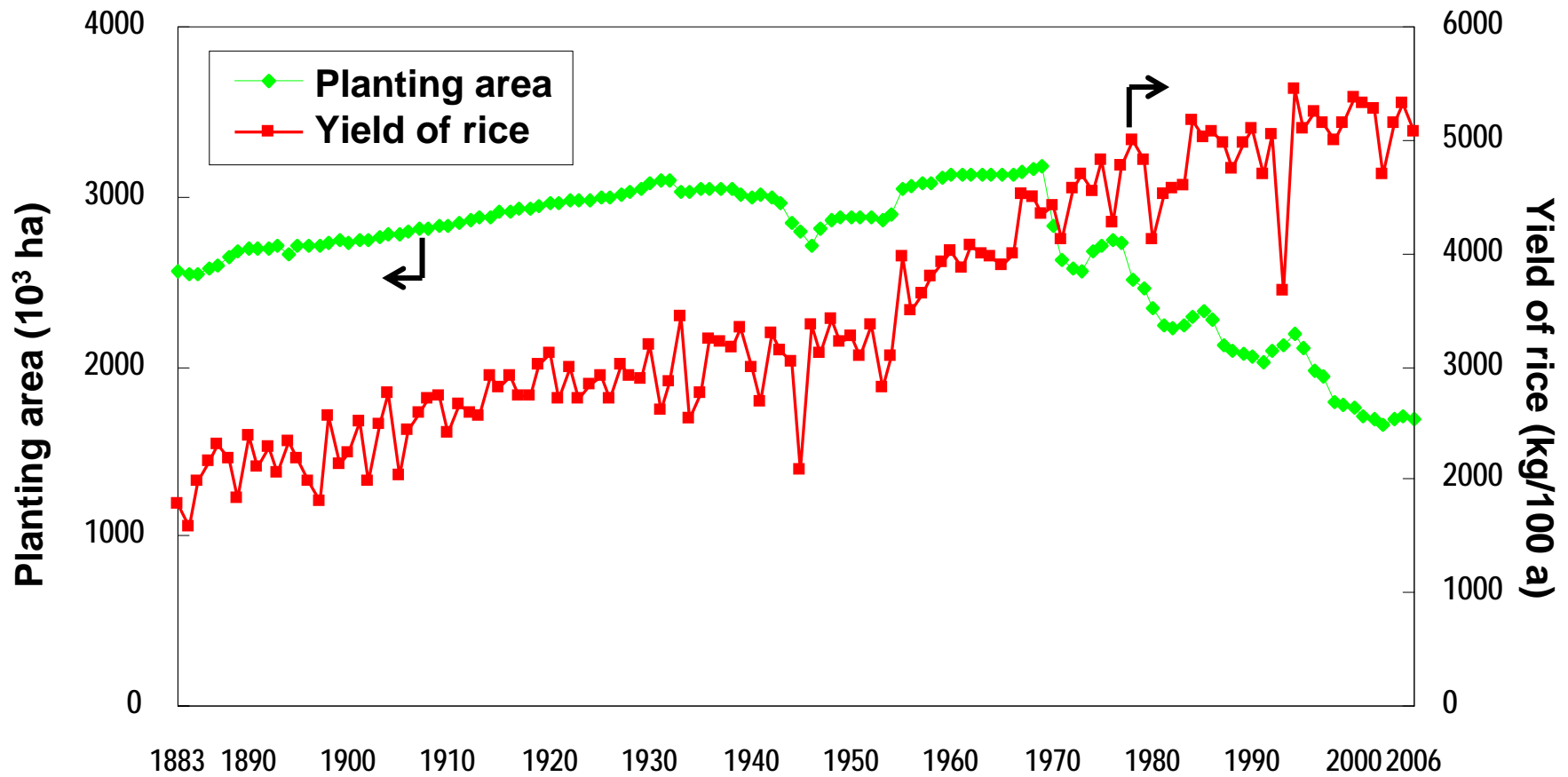
# RICE CONSUMPTION PER CAPITA IN JAPAN



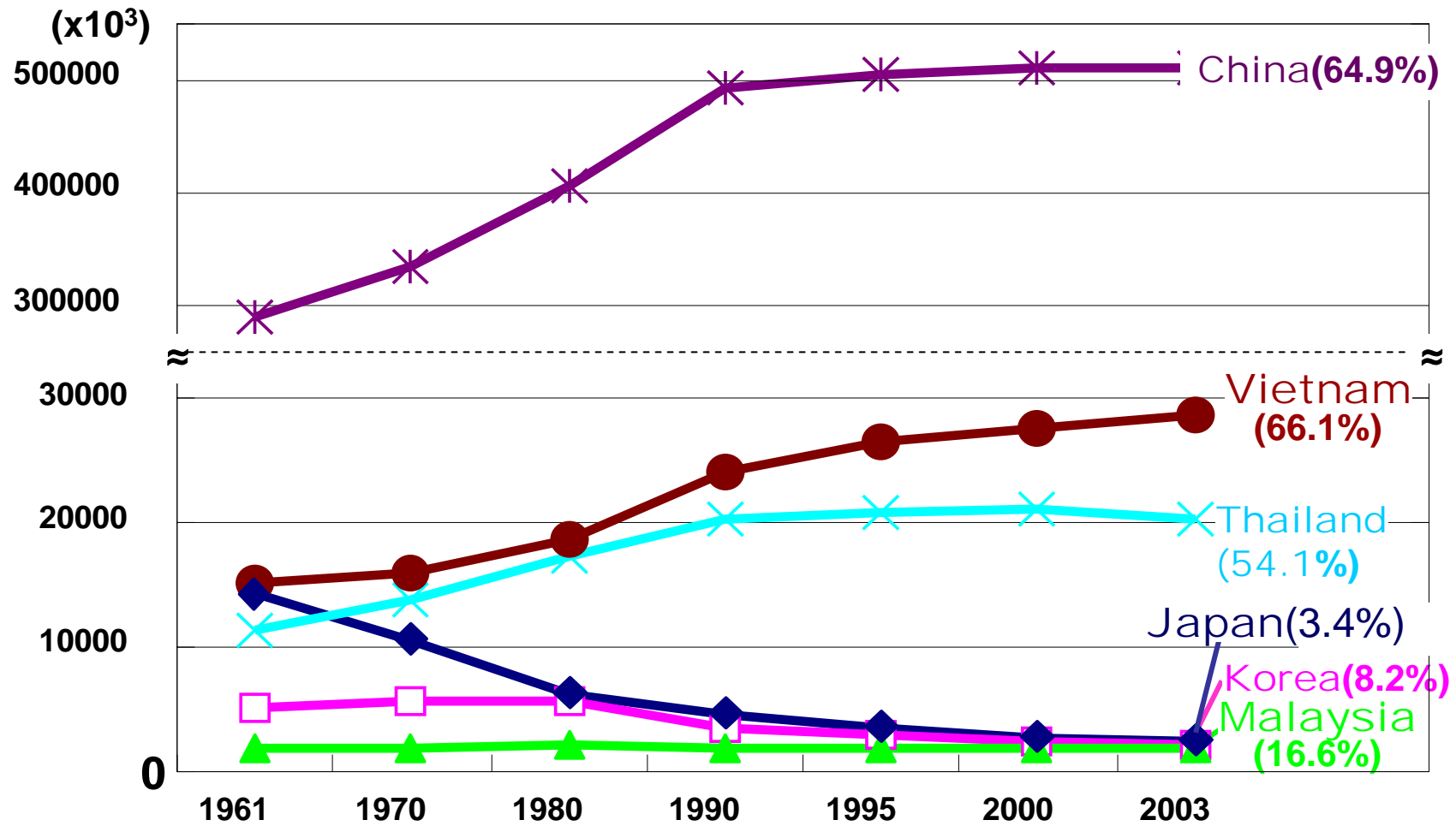
# RICE PRODUCTION IN JAPAN (1883 ~ 2006)



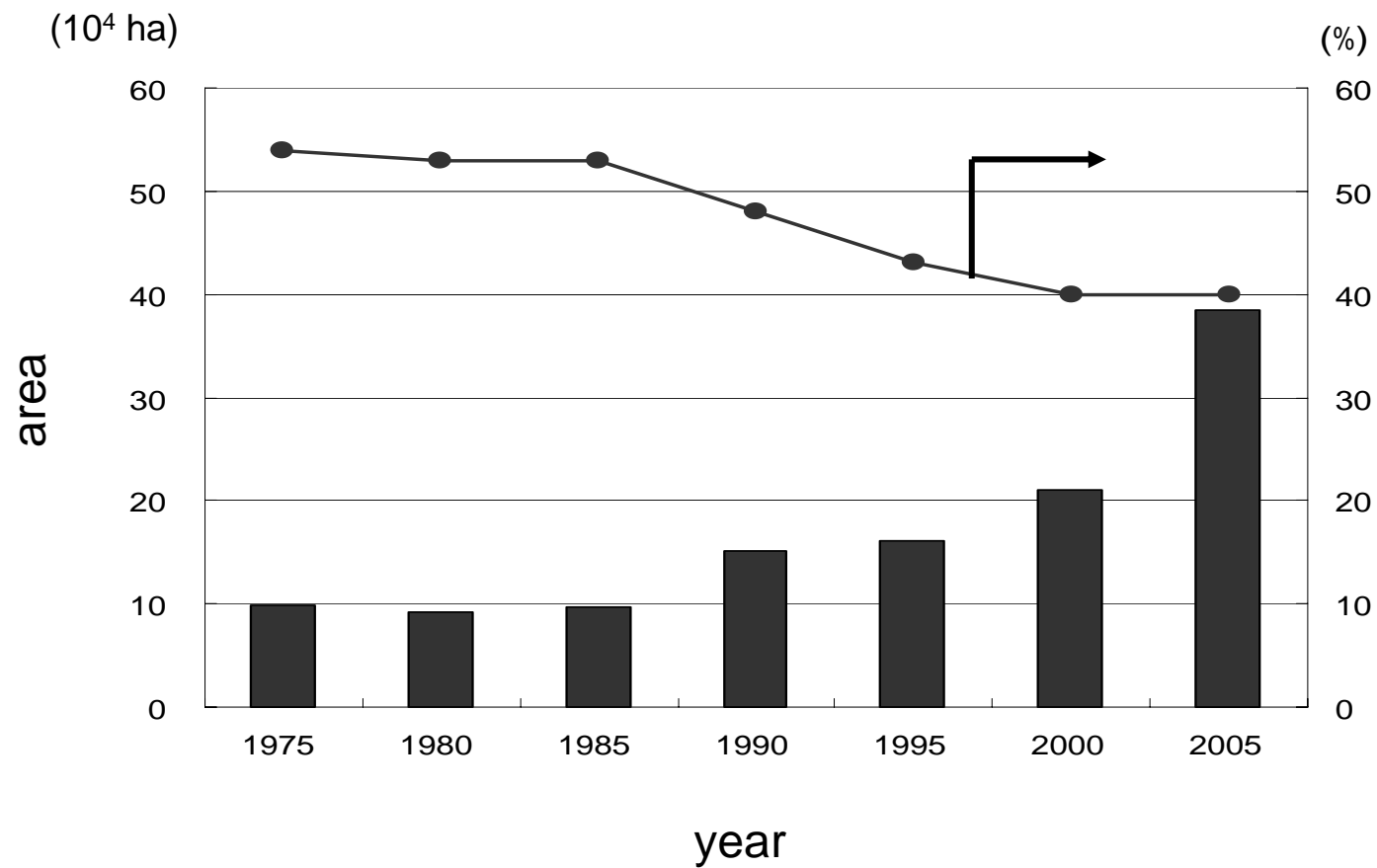
# PLANTING AREA AND YIELD OF RICE (1883 ~ 2006)



# NUMBER OF FARMERS IN ASIA



## REDUCED LAND AREA AND FOOD SELF SUFFICIENCY



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## BIOETHANOL PRODUCTION POTENTIAL FROM RICE IN JAPAN

It is plausible that the rice planting area will decrease due to the population declination with low birth rate, the decrease in rice consumption, and increase in consumption, etc.

If rice is replanted and converted to bioethanol, how much bioethanol can be produced?

About 2.26million kl of bioethanol can be possible on the assumption that 707 liter per hectare can be produced by whole crop utilization .

Difficulties: narrow, mountaneous, isolated, irregular, etc.,

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# CHALLENGES TO BE SOLVED

**COMPETITION WITH FOOD**

**REDUCTION OF PRODUCTION COST**

**DEVELOPMENT OF HIGH YIELD RICE**

**ADVANCED TECHNOLOGY OF SACCHARIFICATION AND FERMENTATION**

## POTENTIAL OF BIOETHANOL PRODUCTION FROM SUGAR CANE IN THAILAND (2050)

		present	2050
<b>population (x10<sup>4</sup>)</b>		<b>6300</b>	<b>6200</b>
<b>rice consumption (kg/capita/a)</b>		<b>160</b>	<b>80</b>
<b>net export (x10<sup>4</sup> t)</b>		<b>999</b>	<b>999</b>
<b>rice</b>	<b>planting area (10<sup>4</sup>ha)</b>	<b>1020</b>	<b>591</b>
	<b>yield (t/ha)</b>	<b>2.7</b>	<b>3.5</b>
	<b>production(10<sup>4</sup> t)</b>	<b>2724</b>	<b>2043</b>
<b>corn</b>	<b>planting area (10<sup>4</sup>ha)</b>	<b>108</b>	<b>90</b>
	<b>yield (t/ha)</b>	<b>3.9</b>	<b>7.3</b>
	<b>production(10<sup>4</sup>t)</b>	<b>418</b>	<b>658</b>
<b>sugar cane</b>	<b>planting area (10<sup>4</sup>ha)</b>		<b>454</b>
	<b>yield (t/ha)</b>	<b>56.5</b>	<b>78.9</b>
	<b>production(10<sup>4</sup>t)</b>		<b>35843</b>
<b>ethanol(10<sup>4</sup> kl)</b>			<b>3630</b>

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## POTENTIAL OF BIOETHANOL PRODUCTION ON EXCESS LAND

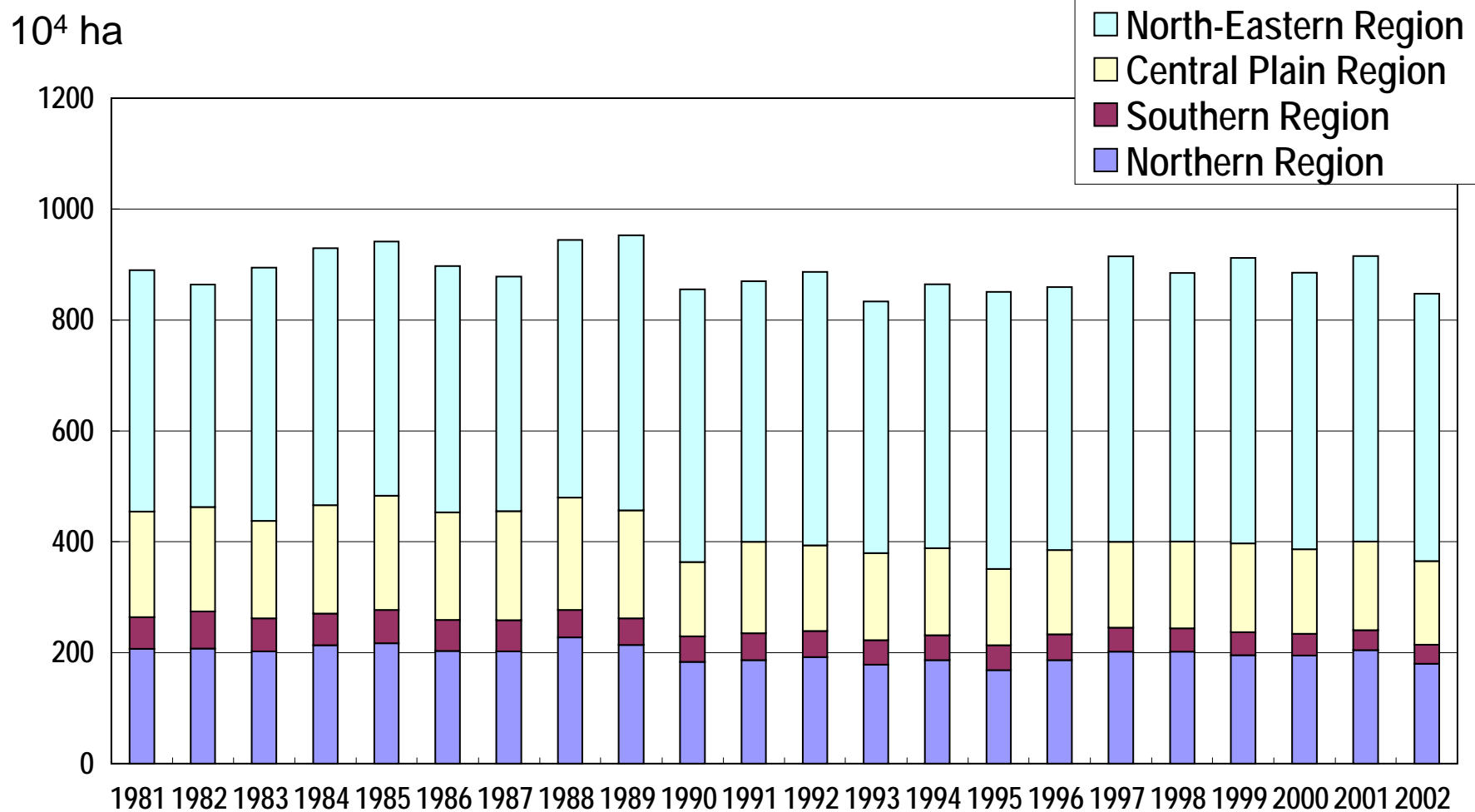
EXCESS LAND WILL BE USED FOR BIOETHANOL PRODUCTION

(Rice for food is kept and the excess rice is used for bioethanol)

RICE PRODUCTION YIELD IS ASSUMED TO BE IMPROVED BY IRRIGATION, FERTILIZER INPUT, AND ADOPTION OF HIGH YIELD RICE SPECIES.

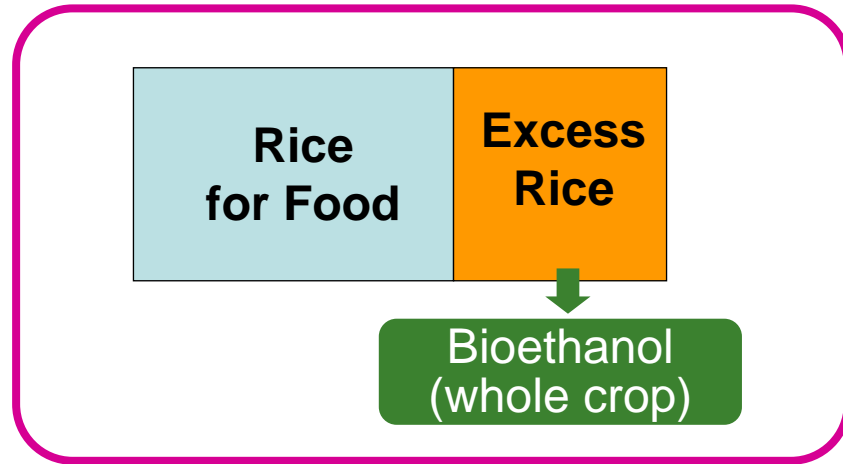
- \* **25% of rice planting area (9 million ha) is irrigated. Irrigated area can be increased to 50% by irrigating North-Eastern region by 4 times. If so, yield can be improved by 60%. (1.6t/ha to 2.6 t/h)**
  - \* **According to the experience in Japan, rice yield can be improved by 60% by fertilizer input. (3.2 t/ha to 5t/ha)**
  - \* **High yield rice can gain the production by 70%.**
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# RICE PLANTING AREA REGION BY REGION

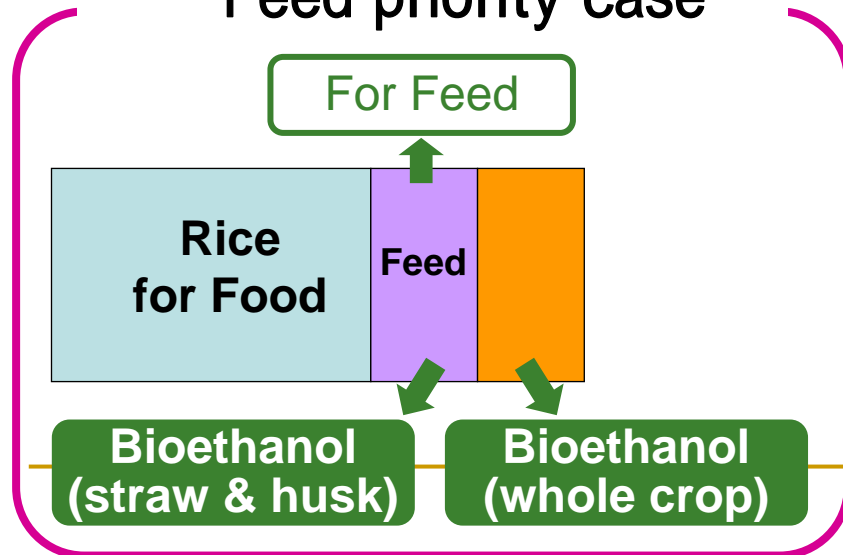


# CASES

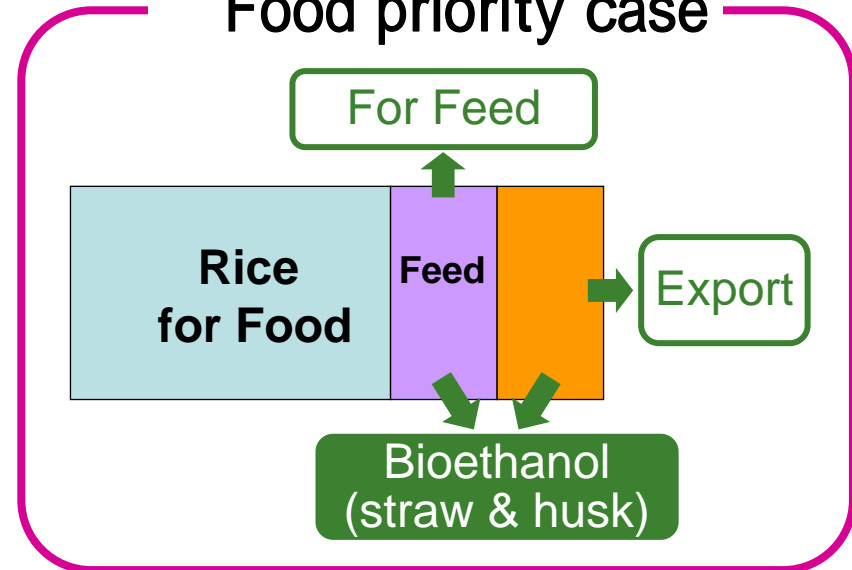
## Bioethanol priority case



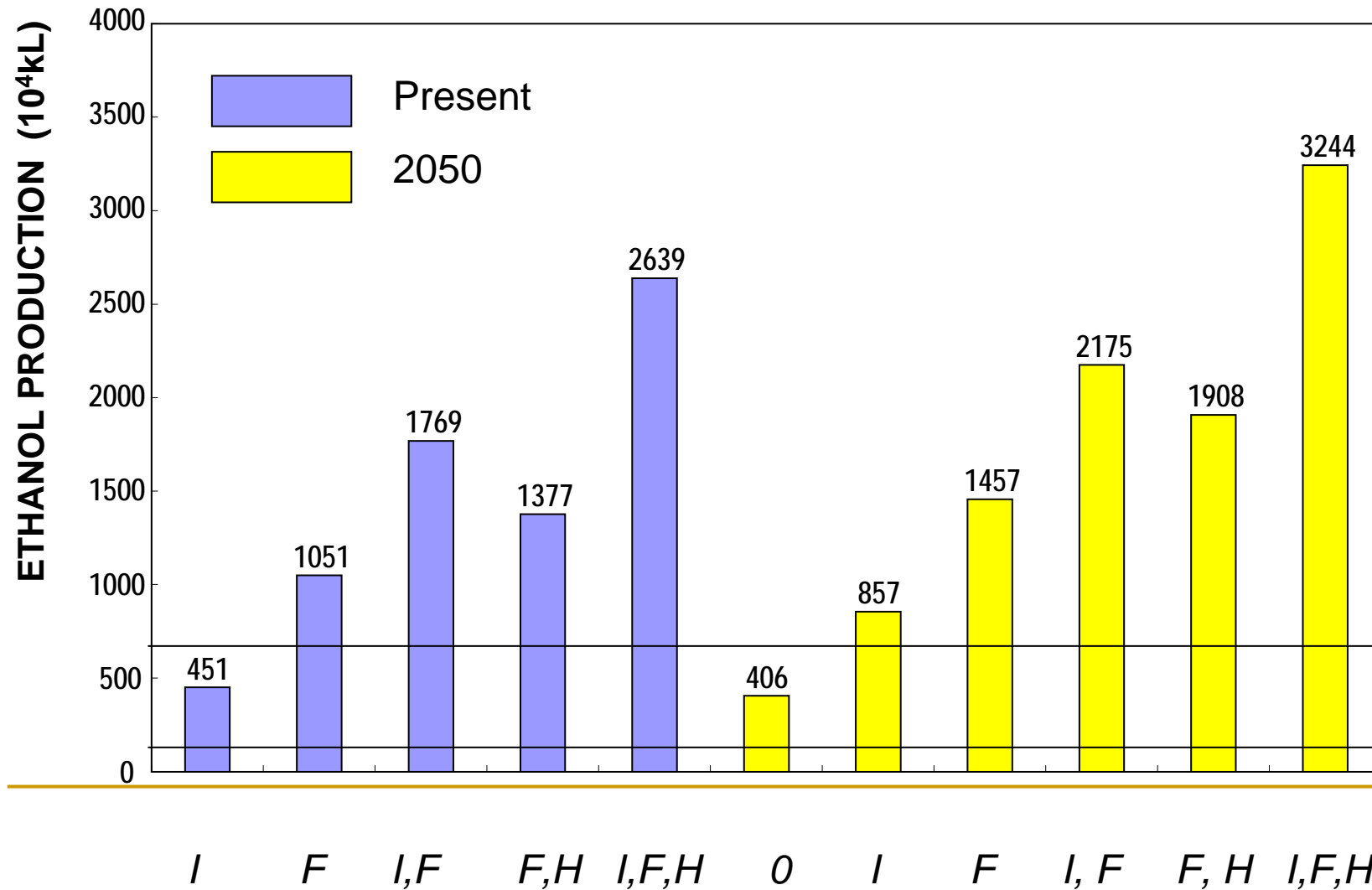
## Feed priority case



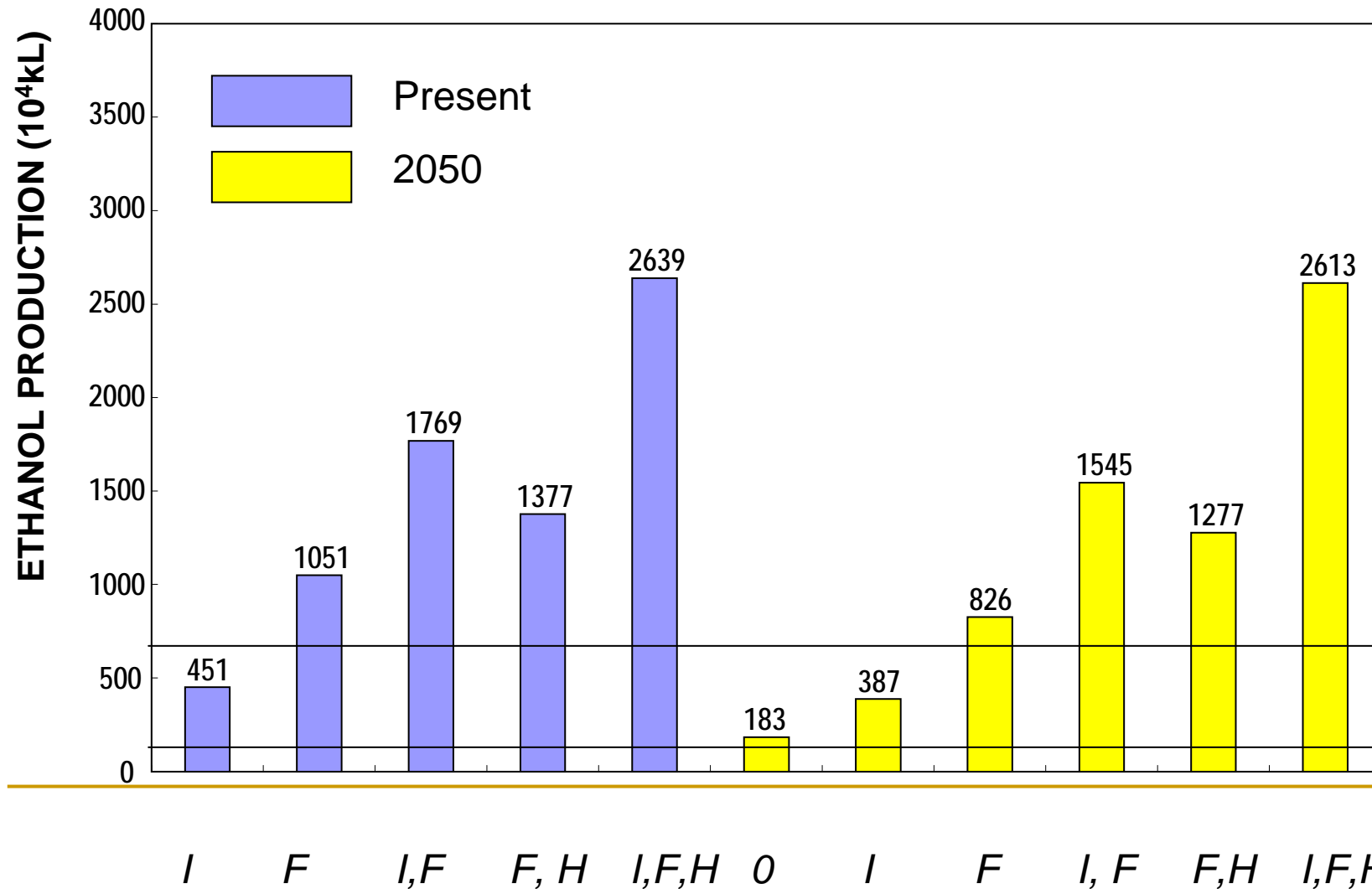
## Food priority case



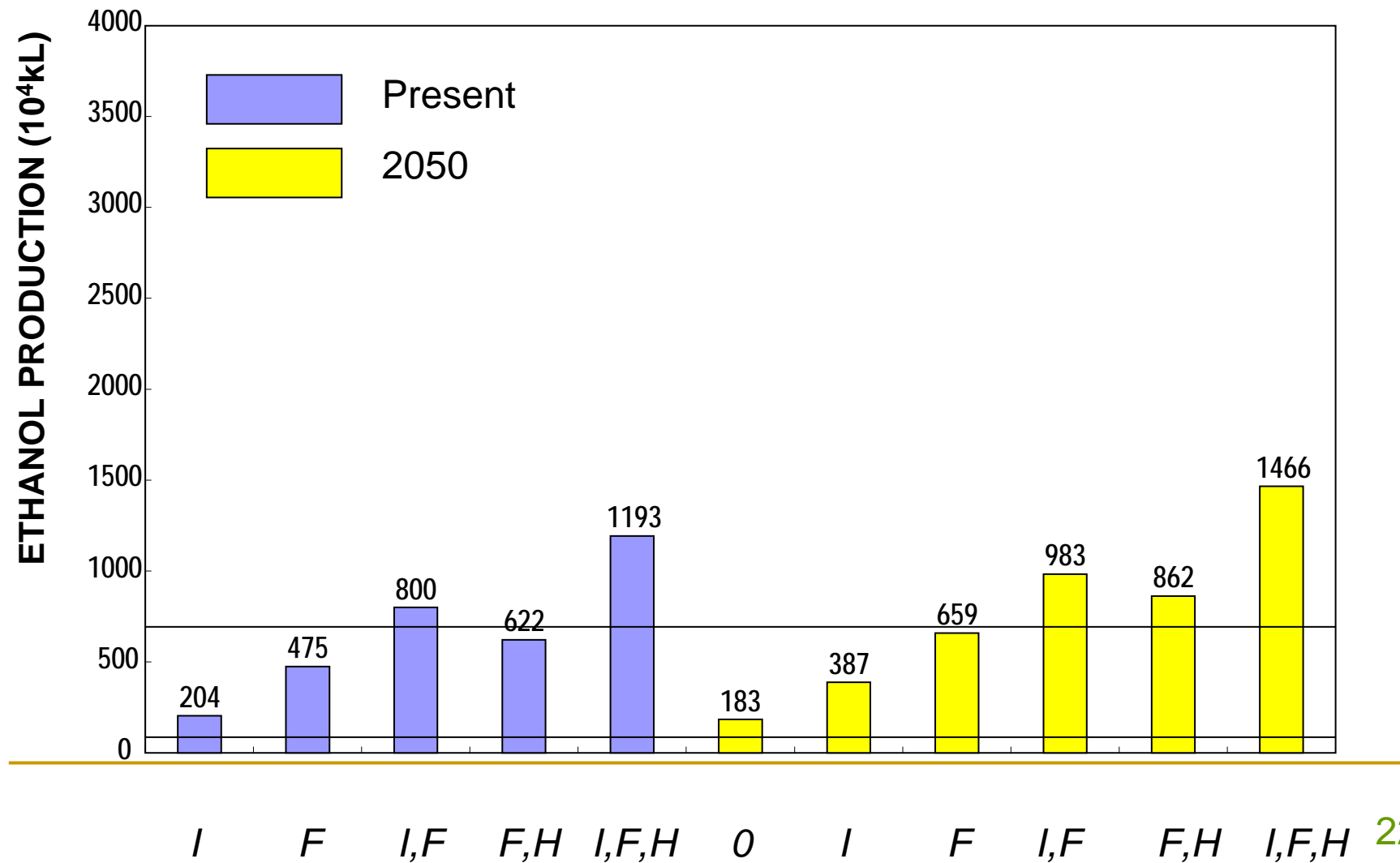
# BIOETHANOL PRIORIY CASE



# FEED PRIORITY CASE



# FOOD PRIORITY CASE



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# BIOETHANOL POTENTIAL

- \* **Target of bioethanol introduction by Thai Government is 1.10 million kl by 2011.**
- \* **1.10 million kl is possible by any scenario.**
- \* **If Japan tries to introduce E10, 6 million kl of bioethanol is necessary. In case that 7.1 million kl is necessary, this amount will be provided by the following scenarios.**
  - (1) In bioethanol and feed priority cases, this amount can be available by fertilizer input.**
  - (2) In food priority case, this amount can be available by irrigation and fertilizer input.**
  - (3) Except food priority case, 20 million kl of bioethanol can be produced by irrigation, fertilizer input, and high yield rice adoption.**

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Thank You Very Much

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