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A Story of Fertilizer Use Efficiency in Japanese Rice Cultivation


IFA Beijing SEMINAR
Beijing, 16 September 2013

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Prologue



- Japan learned rice cultivation from China.
- China has the world record of unit yield.
- Today, I want to introduce a story of modern Japanese rice production.
- Now, fertilizer use efficiency of Japanese rice cultivation has been improved however **Japan was a heavy fertilizer user.**



Tsukuba, Japan (2012 Aug)

Today's Topic



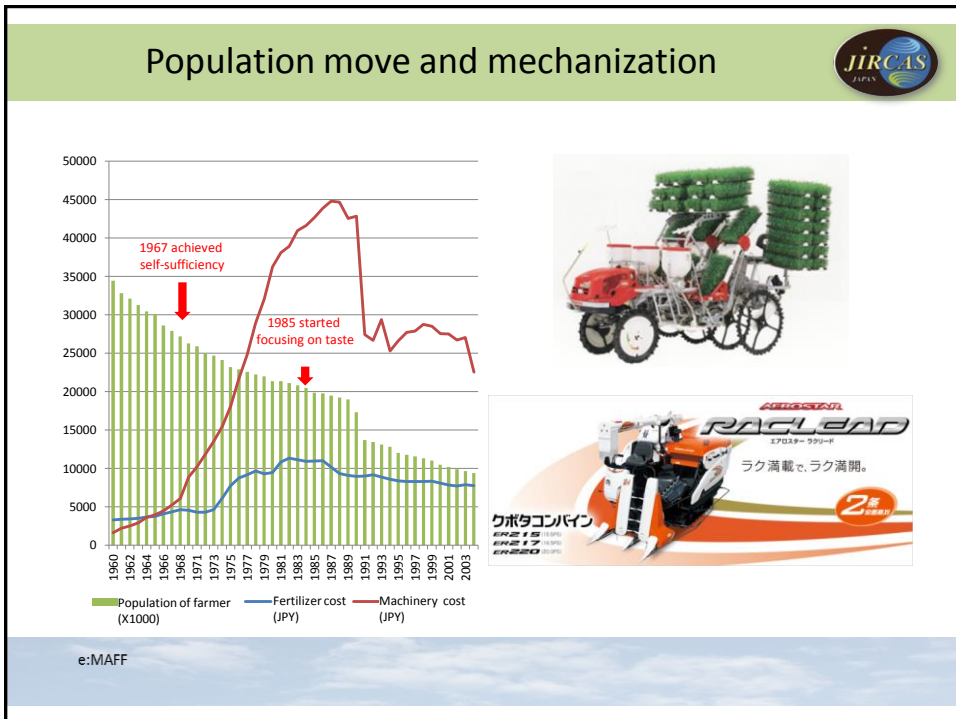
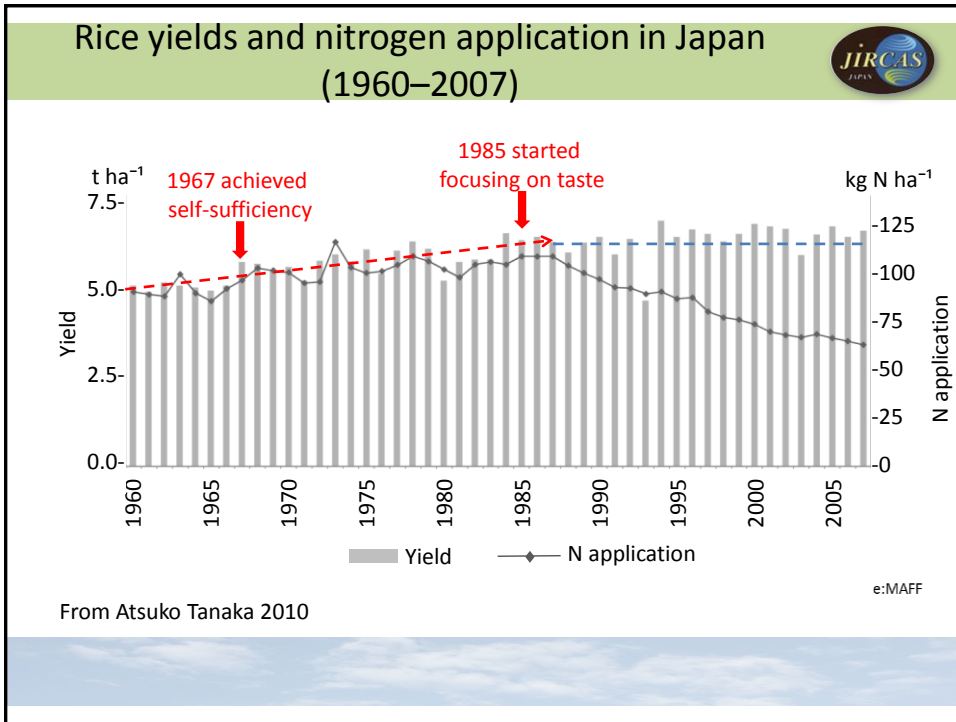
- Change of fertilizer use efficiency in Japan
 - Statistics of Japanese rice production
 - Change of fertilizing methods
- Why Japan could reduce fertilizer?
 - Accumulation of phosphorus and potassium
 - Returning rice straw without composting
 - Studies for the nitrogen use efficiency
- The most advanced farmer's practices



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Change of fertilizer use efficiency in Japan

- Statistics of Japanese rice production
- Change of fertilizing methods



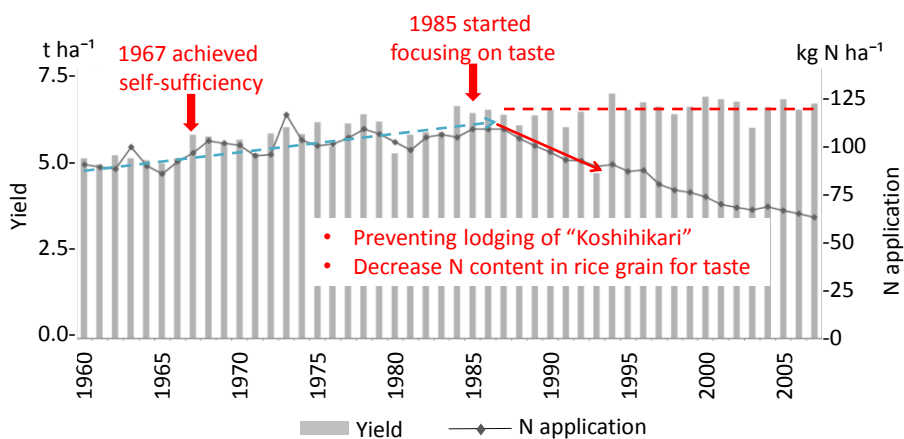
Mechanization Fulfilled Basic Technologies



- Good Seedling
- Good Leveling
- Shallow Transplanting

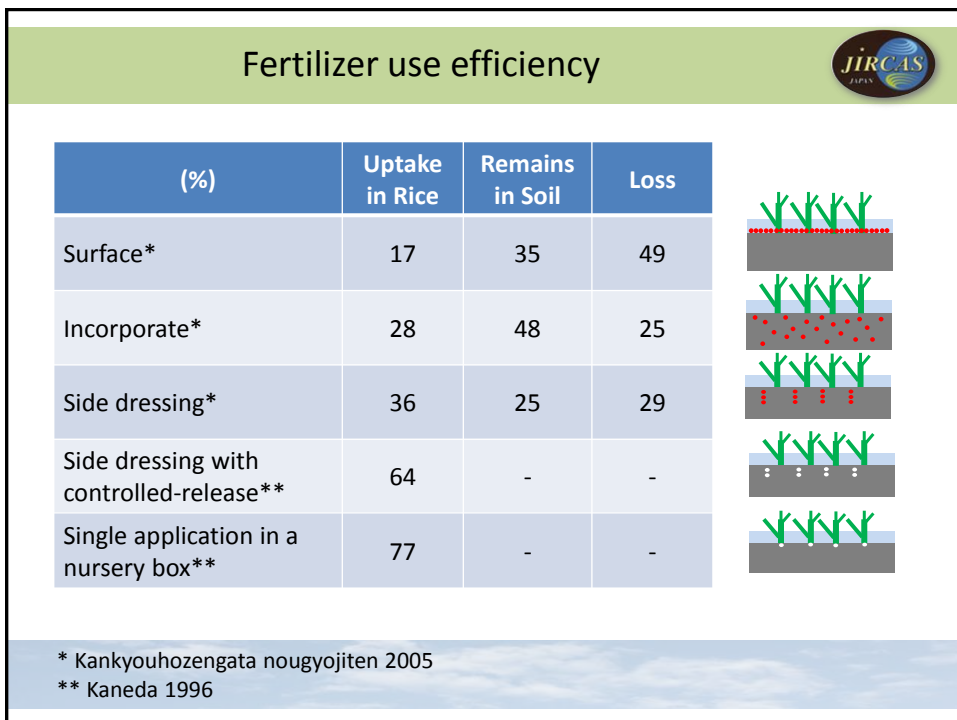
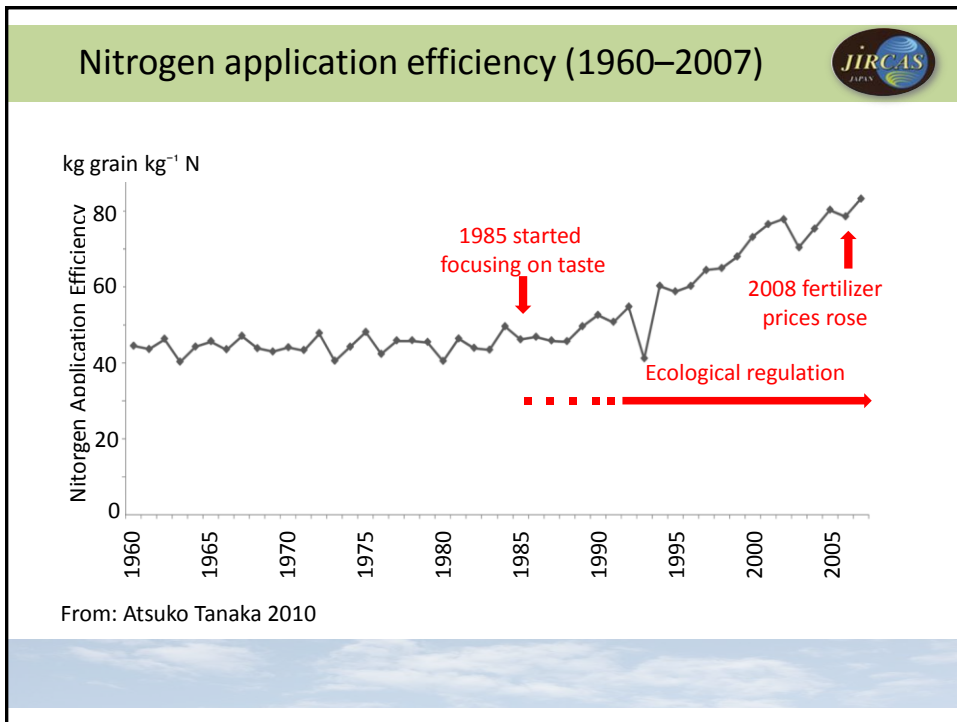


Decrease of N application



From Atsuko Tanaka 2010

e:MAFF



Single application in a nursery box



Method	Fertilizer*	N Kg ha ⁻¹	%	Yield t/ha	Grain grade
Side-dressing fertilizers	LPSS100	80	100	6.9	No.1
Single application in a nursery box	N400-LPS120	48	7.0	No.1	

*controlled-release fertilizers



2010 (Iwate Agriculture Institution)

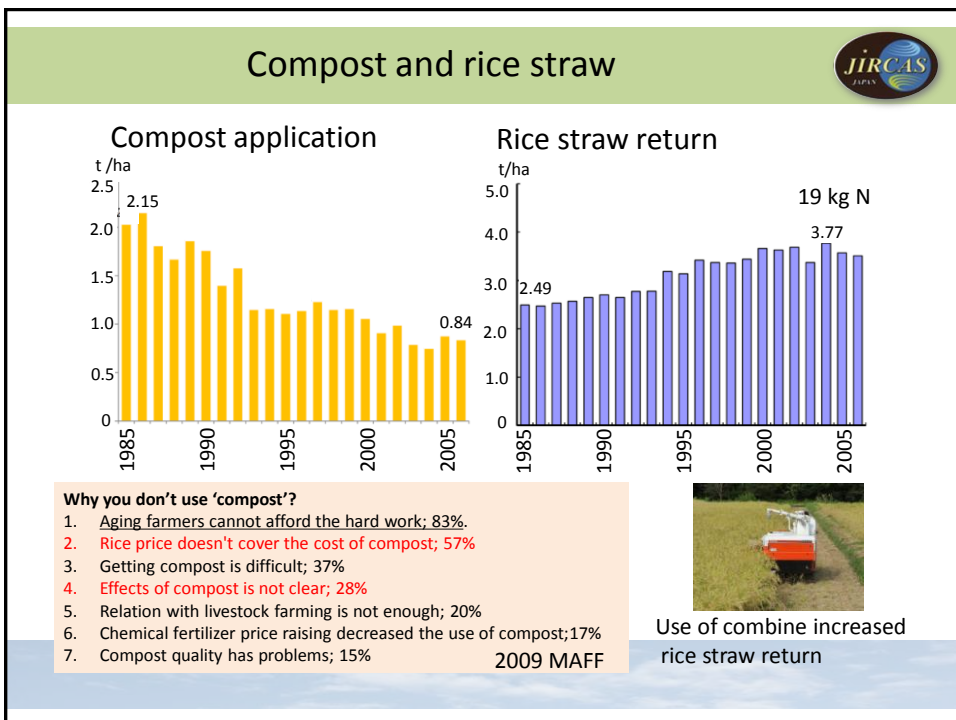
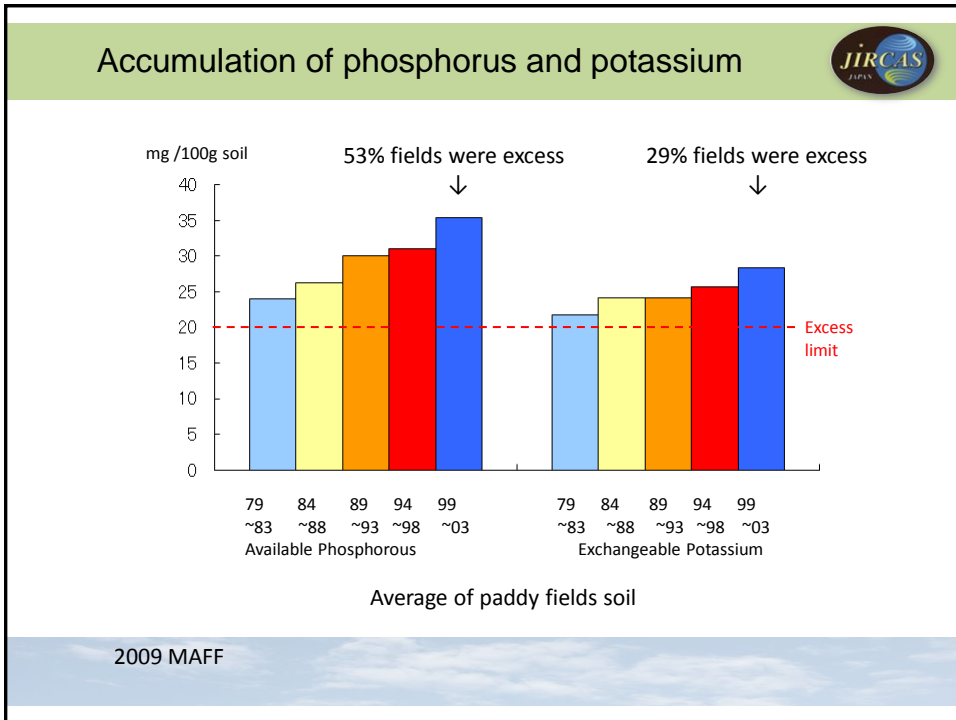


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Why Japan could reduce fertilizer?

- Accumulation of phosphorus and potassium
- Returning rice straw without composting
- Studies for the nitrogen use efficiency

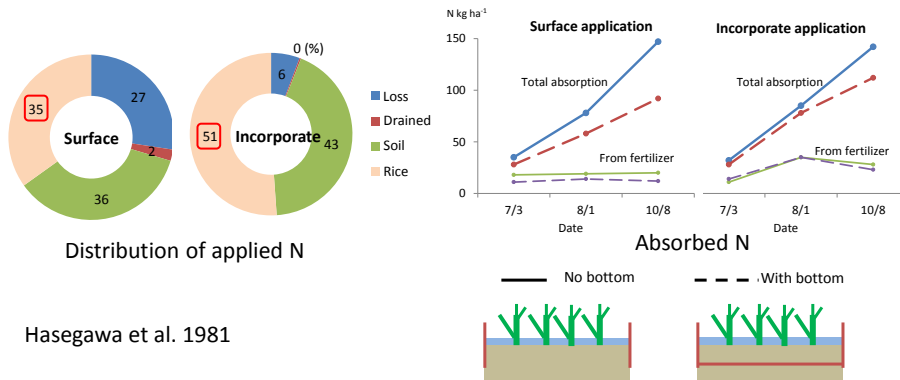
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Fertilizing method and the efficiency



- Surface vs Incorporate = **35%** vs **51%**
- However the total absorbed nitrogen is same!
- The effect of nitrogen is very short




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The most advanced farmer's **practices**

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Nitrogen proportion of rice

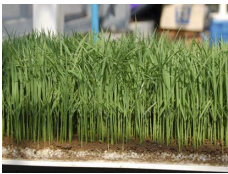


	Dry Weight t ha ⁻¹	N Content %	N uptake Kg ha ⁻¹
Straw	7	0.5	35
Paddy	8(6.4)**	1.0	80
Total	15	0.77	115


* Japanese Society of Soil science and plant nutrition, 1984
 ** () as grain

In 1984, Japanese average yield was 6 t
 → 110 kg N was applied

Single application in a nursery box yield is 7 t
 → 48 kg N is applied




Epilogue (Next stage with eco agriculture)



The practices of Keiji Ohotsuki, one of the most advanced farmer.

Seedling decides 90% of the yield

- 1 plant per hill
- Adjusting the machine planted seedling by hand
- 20 cm depth ponding until harvesting
- Oedogonium provides nutrition for rice (?)



Photos by Taichi Yamamoto 2012

Conclusion



- Fertilizer use efficiency was improved from 40 to 80 kg grain per kg nitrogen application in Japan.
- Japanese compost application decreased, on the other hand, rice straw return increased.
- Improvement of nitrogen use efficiency is not change the total nitrogen absorption of rice.
- The most advanced technology (I recommend) is 'single application in a nursery box. (145 kg grain per kg nitrogen application)'.
- Some farmer achieved higher nitrogen use efficiency, therefore further studies are needed.