

Nutrient management in crop production system in China



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Fusuo et al.; IPI International Symposium on Fertilization; Optimizing the utilization of water and nutrients; Beijing, September 20-24, 2005

Outline

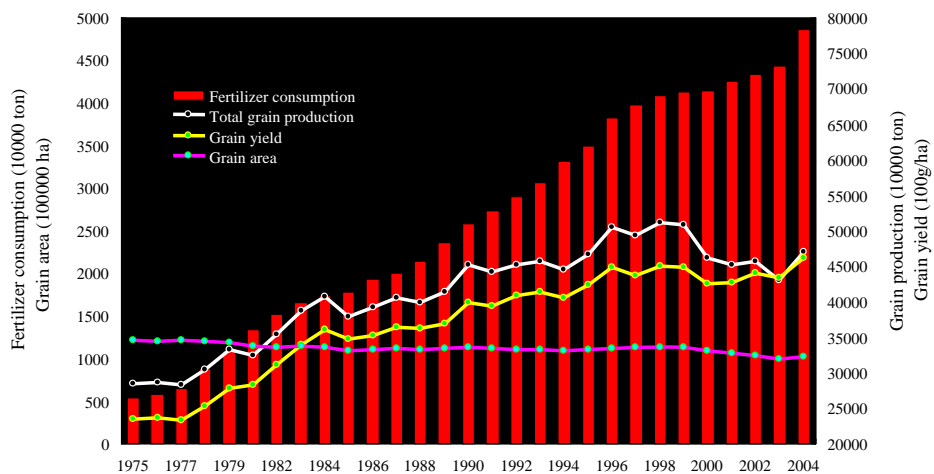
- **Why fertilizer consumption does not correlated with grain production?**
- **Why the average data could not be used for making political recommendation in China?**
- **What is the driving force for fertilizer consumption and production?**
- **Why nutrient management?**
- **How to do nutrient management?**
- **Future challenges**

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Why fertilizer consumption does not correlated with grain production closely any more?

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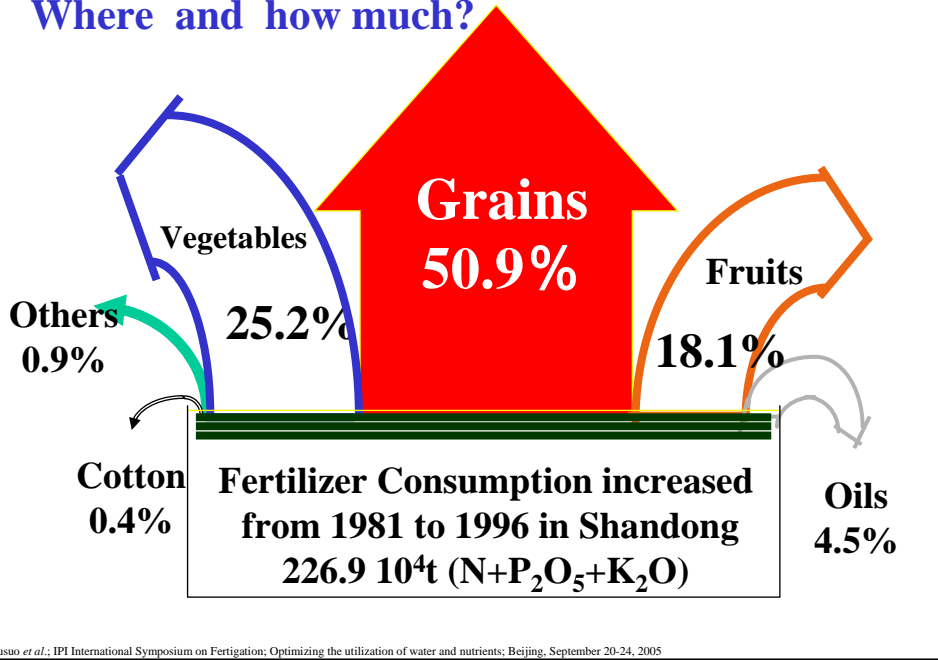
Trends of grain yield, production, grain area and fertilizer consumption (1975 – 2004)



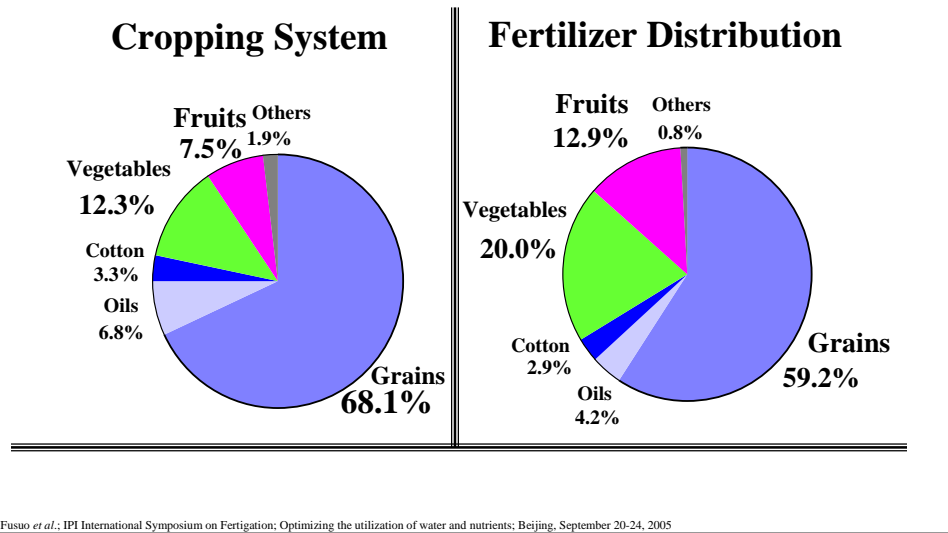
From 1984 to 1994, Fertilizer consumption increased by 90%, But the grain production increased by 9%!

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Where and how much?



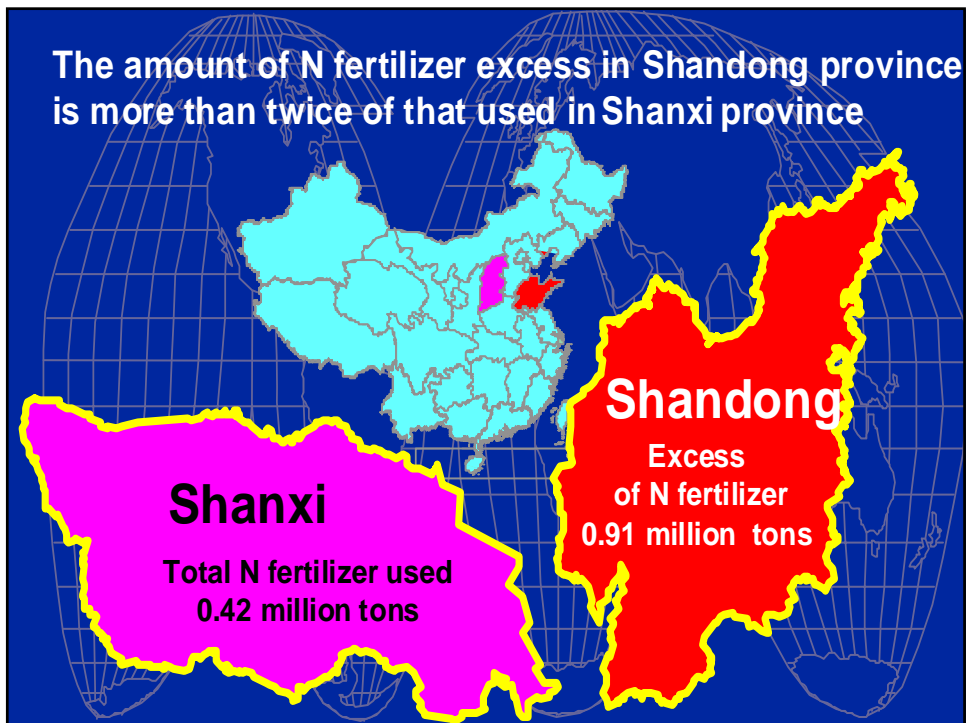
Cropping System and Fertilizer Distribution in Shandong, China



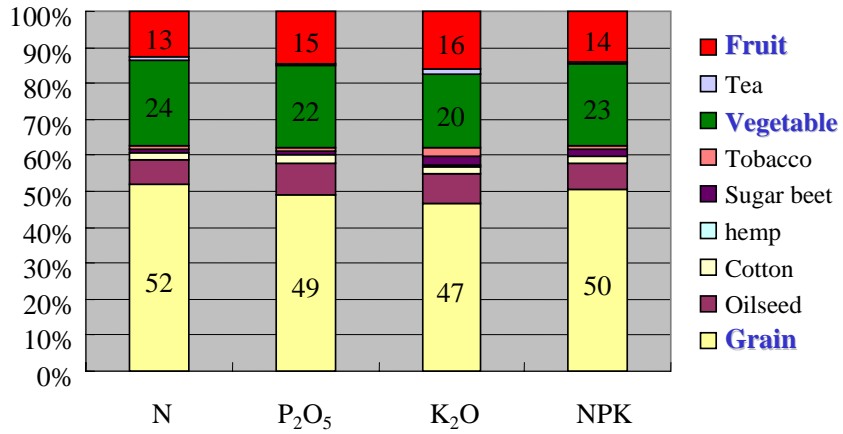
**Benefit and Efficiency of Fertilization
in Greenhouse Cucumber in Shouguang, Shandong**

Fertilizer type/rate	Yield increase	Benefit	Recovery
kg/ha	kg/kg	I/O	%
N	≥ 1200	34.5	19.3
P2O5	≥ 1200	24.4	11.8
K2O	≥ 750	23.1	13.0

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The contribution of different crop to the increased fertilizer consumption from 1980 to 2000



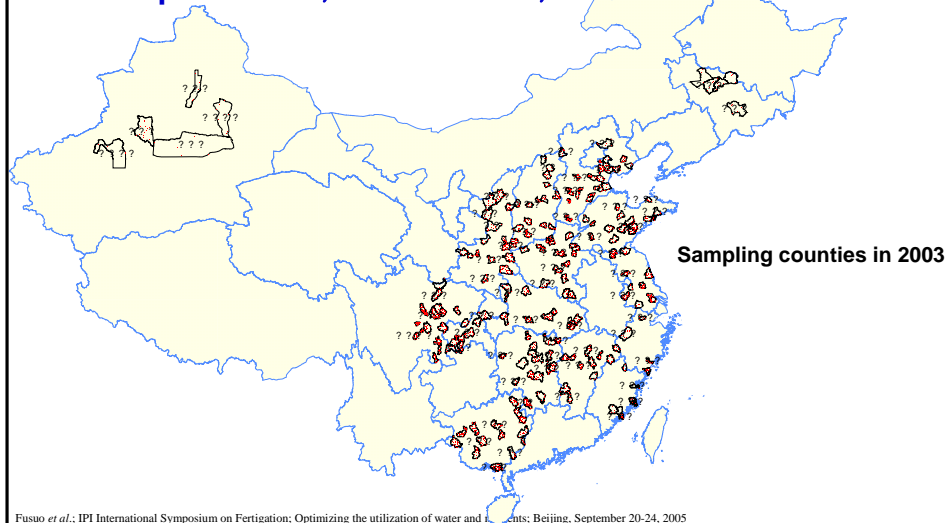
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Why the average data could not be used to make a general policy for fertilizer production and consumption for China?

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National farmer's survey

2002 : 22provinces , 200counties , 11000farmers
2003 17provinces , 219counties , 14000farmers

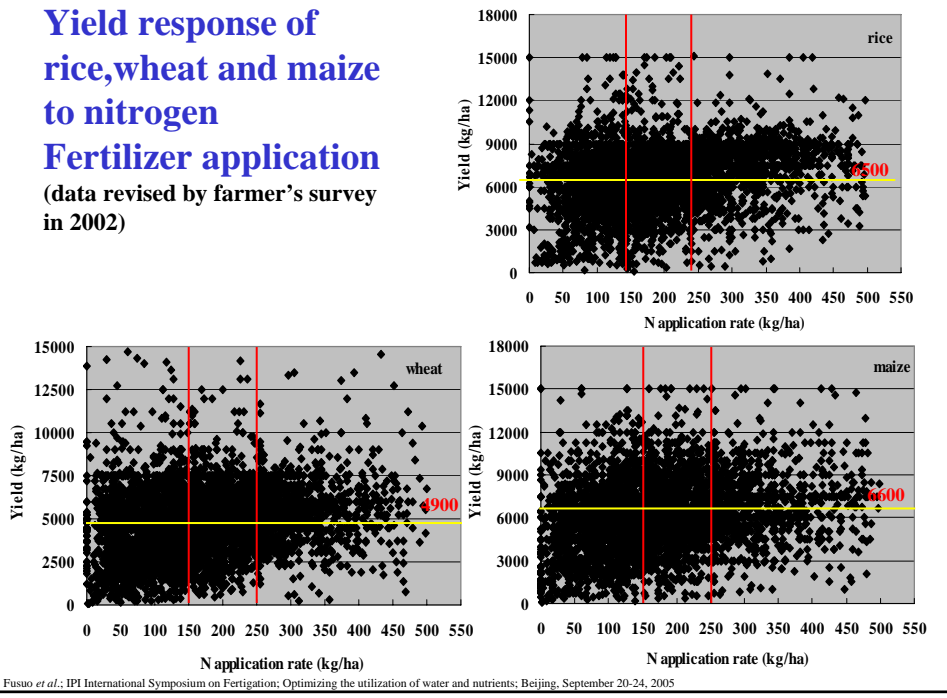


Methods

- **Sample/Selection** some counties were selected and 75-120 farmer households from 9-12 villages in each county were visited.
- **Questionnaire** : including information on Location, Family member, types of land use, crop fertilization and fertilizer application method and efficiency and so on

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**Yield response of
rice, wheat and maize
to nitrogen
Fertilizer application**
(data revised by farmer's survey
in 2002)



Only 1/3 of farmers use reasonable amount of N fertilizer

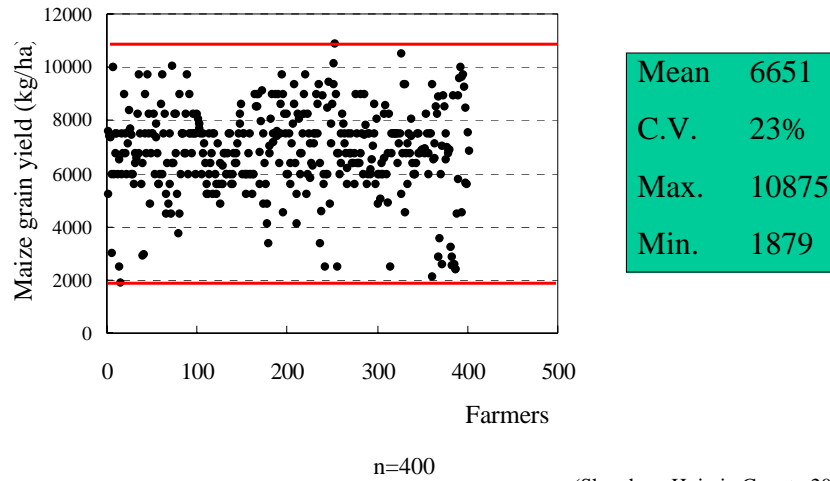
1/3 too much, 1/3 too less

Crop	N rate kg/ha N		
	<150	150-250	> 250
Rice	32.3	34.2	33.6
Wheat	34.5	39.1	26.4
Maize	34.9	34.3	30.8

(more than 10000 farmers in 22 provinces)

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Variability of maize yield among farmers



(Shandong Huimin County, 2003-2004)

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Variability of fertilizer application rate and efficiency under same production of wheat (15t/ha)

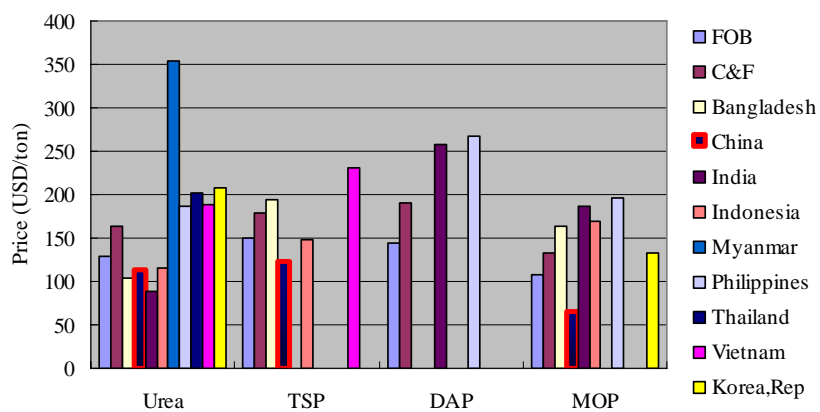
Fertilizer application	Amount of farmers	Fertilizer nitrogen	Organic nitrogen	Ratio of Output/ input (kgN/kgN)
kg/ha	no.	kg/ha	kg/ha	
>1500	3	1639.2	431.3	0.20
1200-1500	1	1264.2	212.1	0.28
900-1200	6	863.6	200.9	0.40
600-900	27	576.8	149.2	0.60
300-600	13	445.0	62.2	0.85
<300	2	274.9	0	1.52
average	(52)	639.9	145.2	0.55

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What is the driving force for fertilizer consumption and production?

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Fertilizer price lower than the other countries

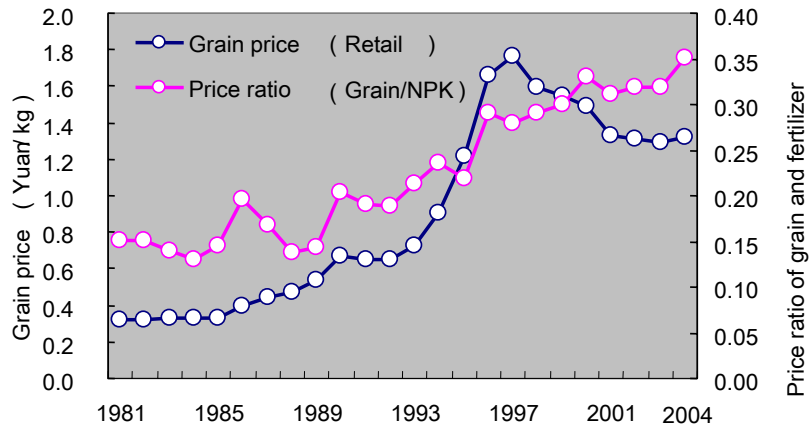


The comparison of fertilizer's retail price between some countries in 1993

M.Hossain & V.P.Singh, 2000

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Grain price increasing but fertilizer price decreased



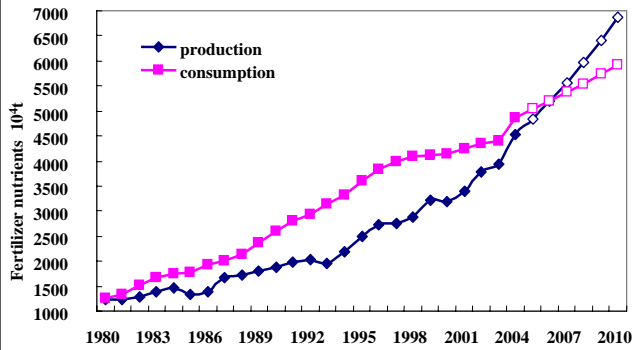
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Financial support to fertilizer industry by Chinese government (Billion RMB), 2004

Item	Nitrogen	phosphorous	Remarks
Raw material	5.9		Include coal and natural gas
Electric power	7.9	0.57	
Value added tax	27.4	9.1	Include the tax in production and distribution
Transportation	4.3	3.3	Include the railroad fee of the raw material and products
Subsidy	3.7	0.35	
Total	49.2	13.3	
Percentage of production value	47%	20%	Total production value in current exchange rate

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Lots of money was invested in Fertilizer industry by enterprises and the fertilizer production capacity was increased rapidly in these years



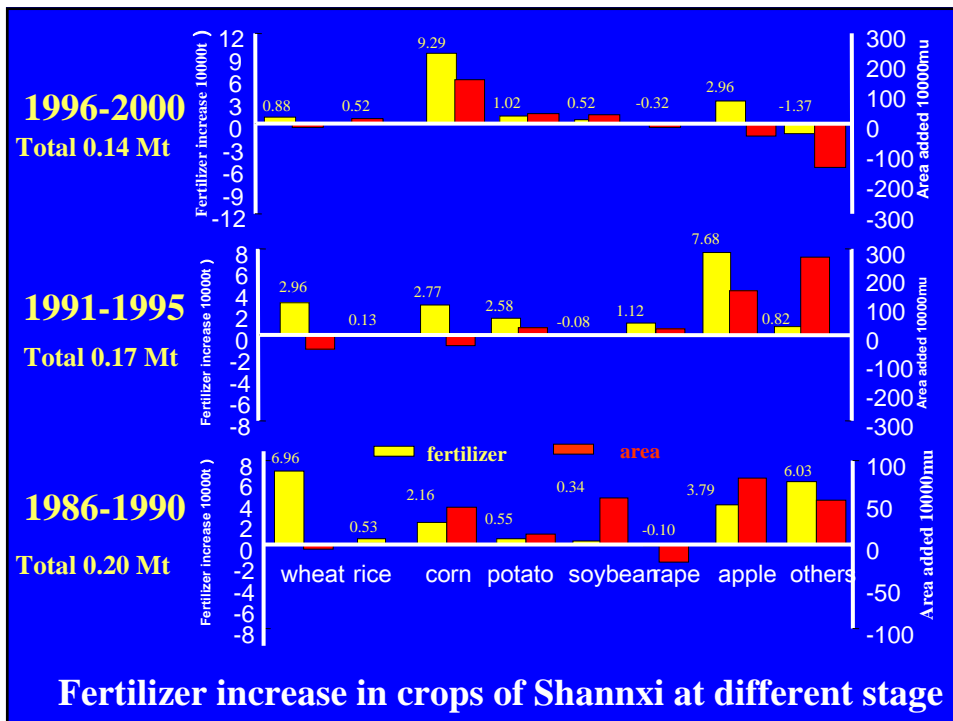
Layout forecasted according enterprises' plan

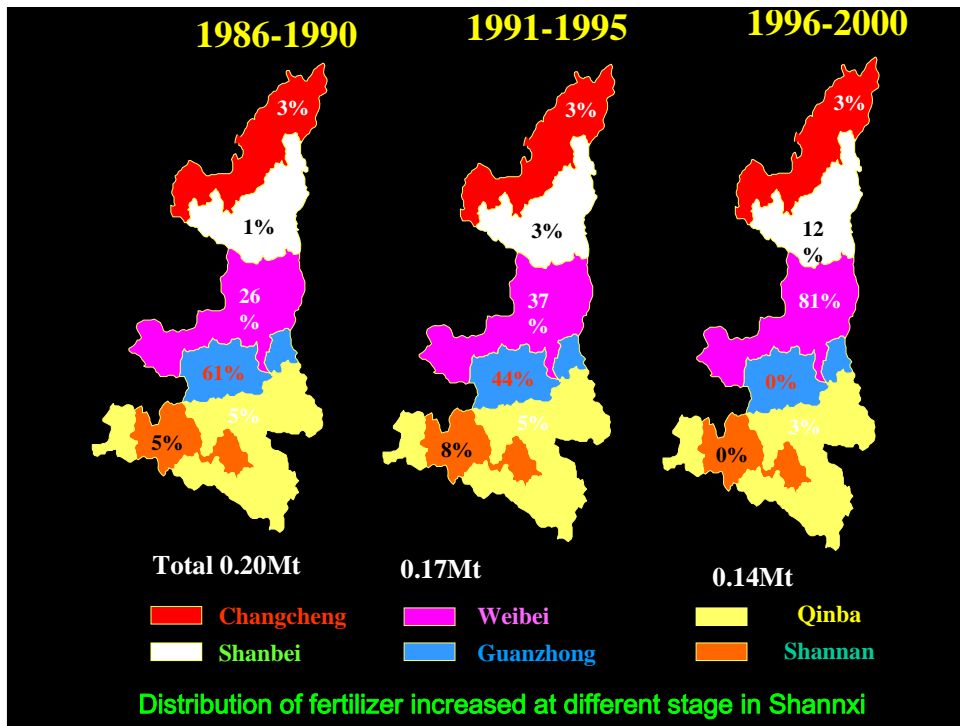
Forecasting of production		
fertilizer	2005	2010
N	3500	4000
P2O5	1100	1200
K2O	250	400
Total	4850	5600

Projected according to the raise rate from 2000 to 2004

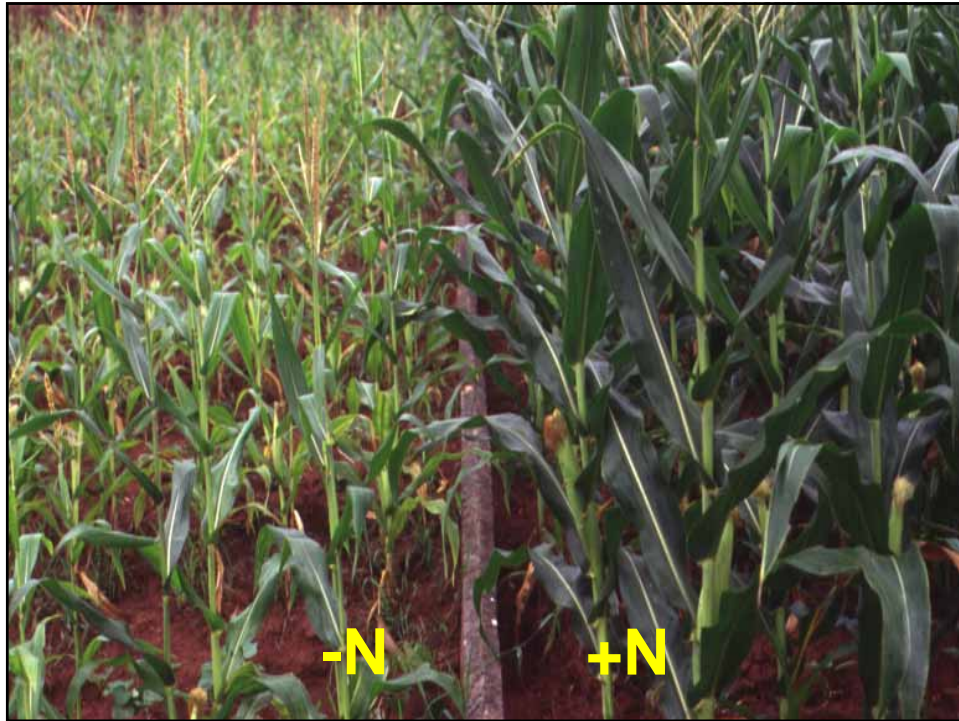
Data came from China phosphorous fertilizer industry

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Why nutrient management?



Inappropriate use of chemical fertilizer and improper nutrient management result in decline of maize productivity and nutrient use efficiency

Under-fertilization



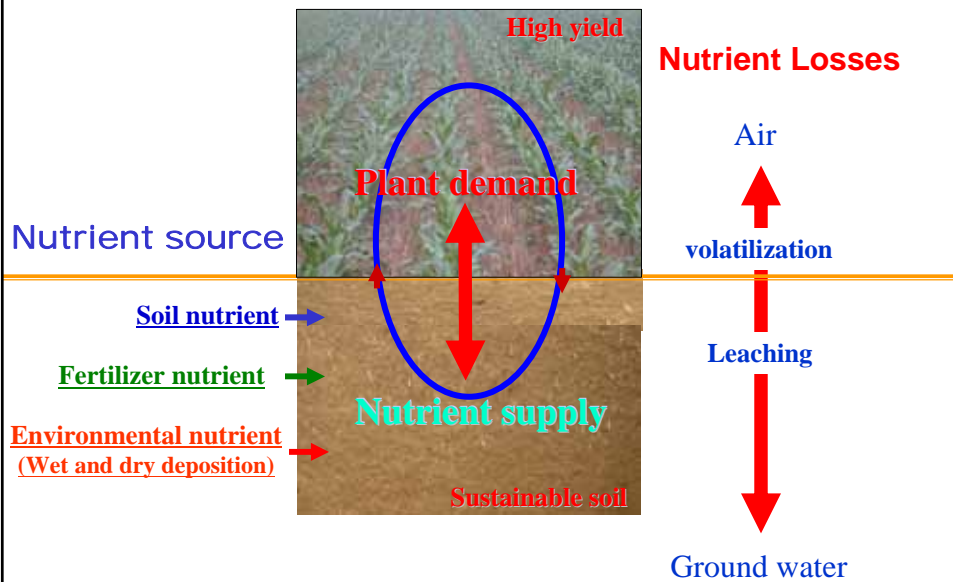
Over-fertilization



Nutrient management (NM) can solve the both under- and over-fertilization problems

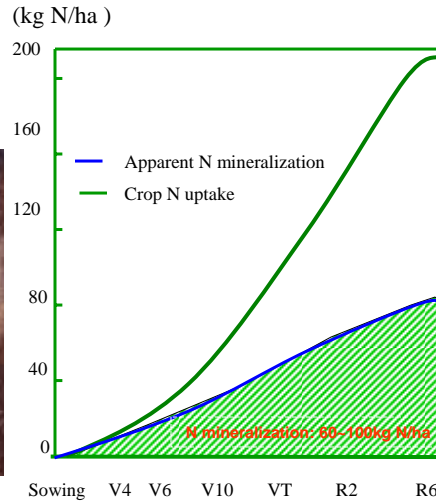
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Nutrient management in maize production



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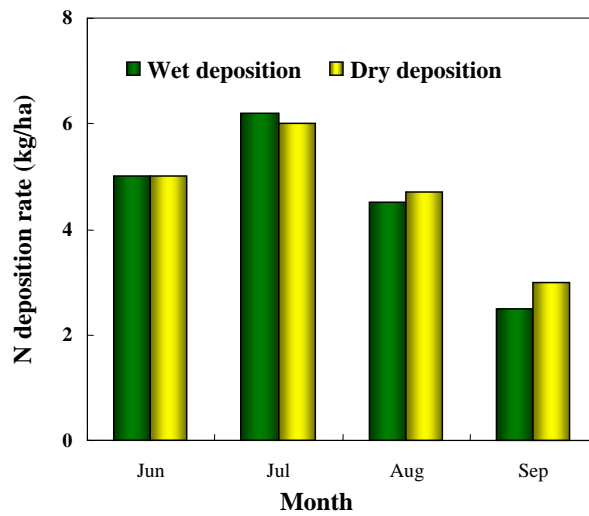
Farmer never knows that there are nutrients in organic fertilizer and how much!



The North China Plain

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Important N source- wet and dry deposition



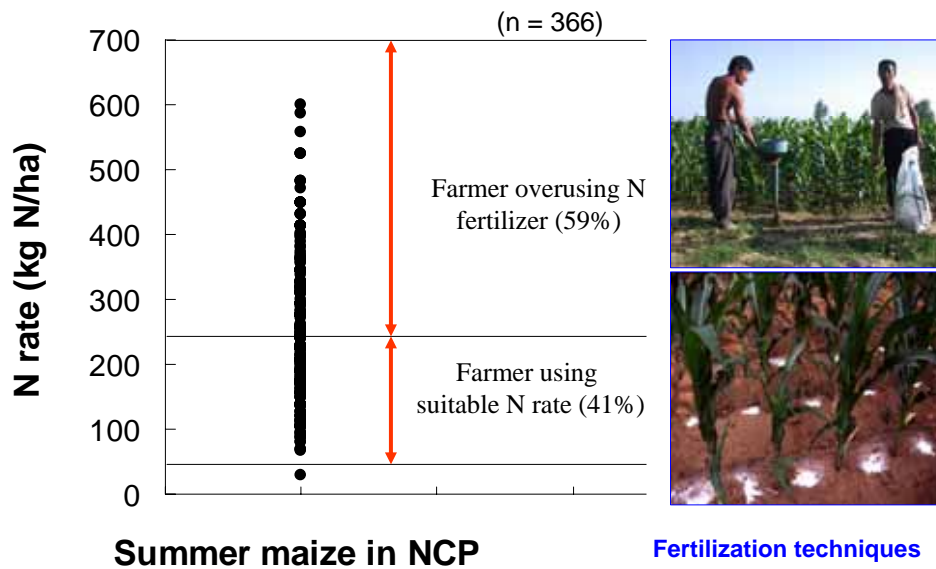
Total wet N deposition in the North China Plain(NPC) 35~40kg N/ha/yr

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How to do better nutrient management?

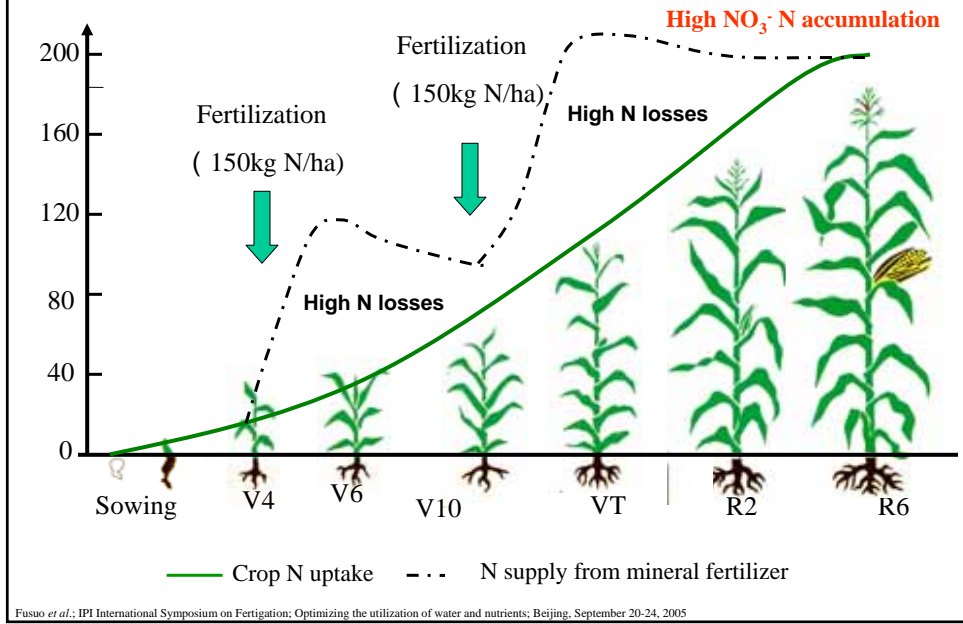
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Farmers' N fertilization to summer maize in Northern China Plain

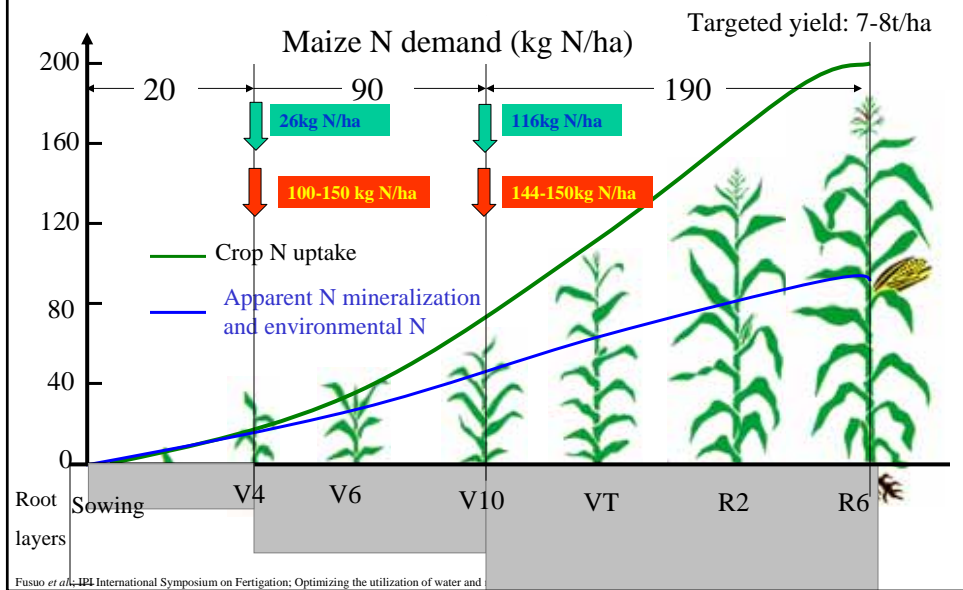


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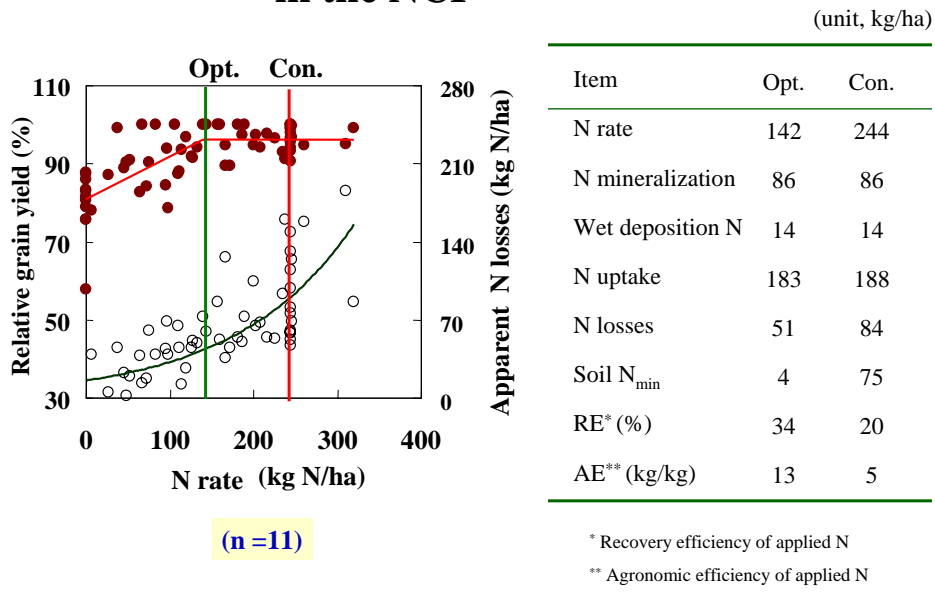
Main problems with split N application in the NCP



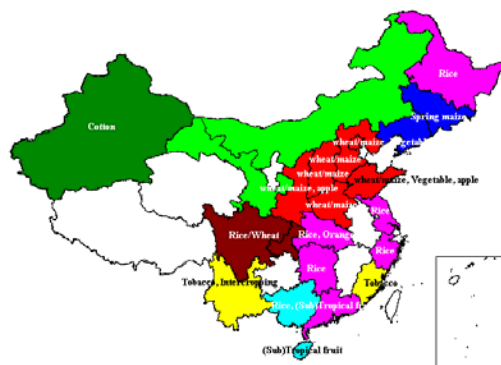
Nutrient management in summer maize, NCP



The practice of NM with summer maize in the NCP



Substantial reduction in fertilizer use with increased N recovery in 12 main crop systems

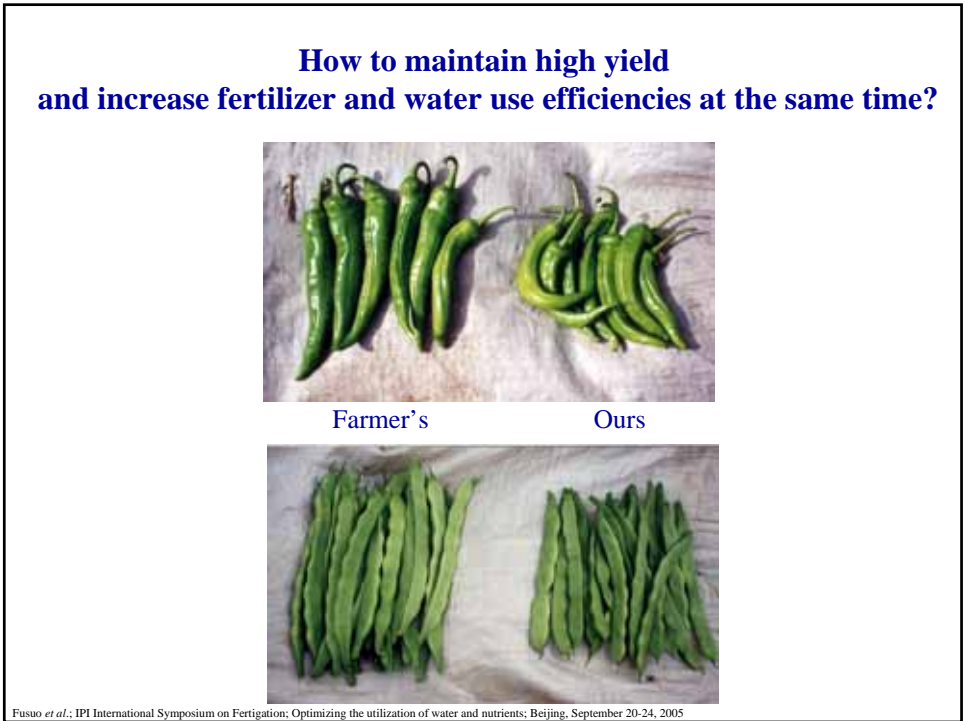


Crop	Save nitrogen (kg/ha)	Increment of N recovery rate (%)
Rice	60~100	10~15
Wheat	80~120	15~18
Corn	60~80	12~15
Cotton	30~40	4~6
Vegetable	300~500	12~20

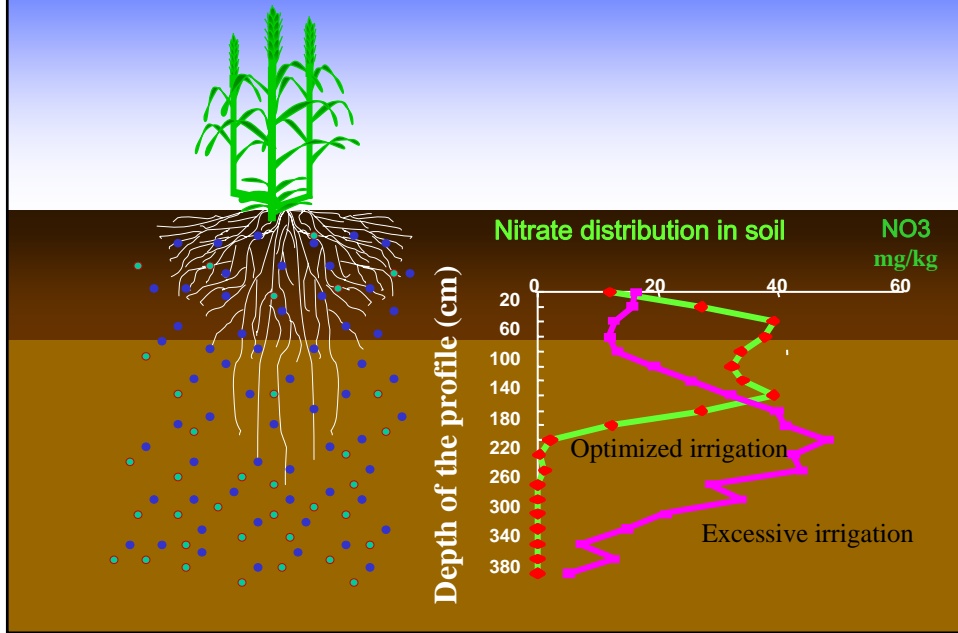
Future challenges

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Harmonize the water , nutrient supply and root growth



Big gaps between actual yield and potential yield in NCP

Actual yield:

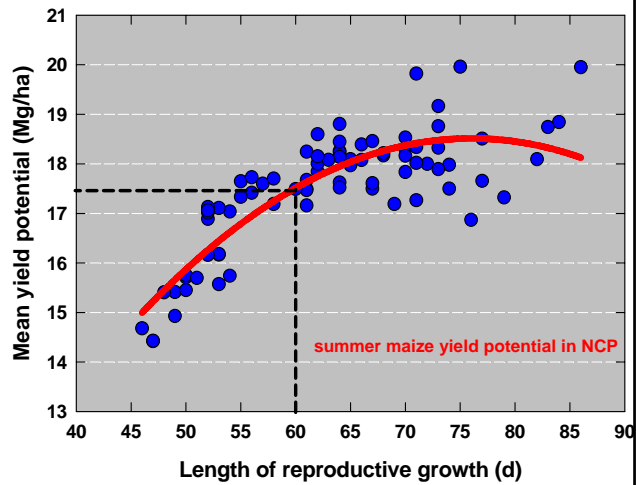
Winter Wheat
5000 kg/ha

Summer Maize
6000 kg/ha

Yield potential:

Winter Wheat
9000-11000 kg/ha

Summer Maize
11250-15000 kg/ha



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<p>Maximum NUE N rate: 140 kg N/ha Yield: 16.4 t/ha PFP_N: 117 kg/kg</p>	<p>Maximum Yield N rate: 230 kg N/ha Yield: 18.0 t/ha PFP_N: 78 kg/kg</p>
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(Dobermann, 2005)

Can we simultaneous fine-tune nitrogen and crop management ?

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