

# The Fertilizer Situation and Outlook in China

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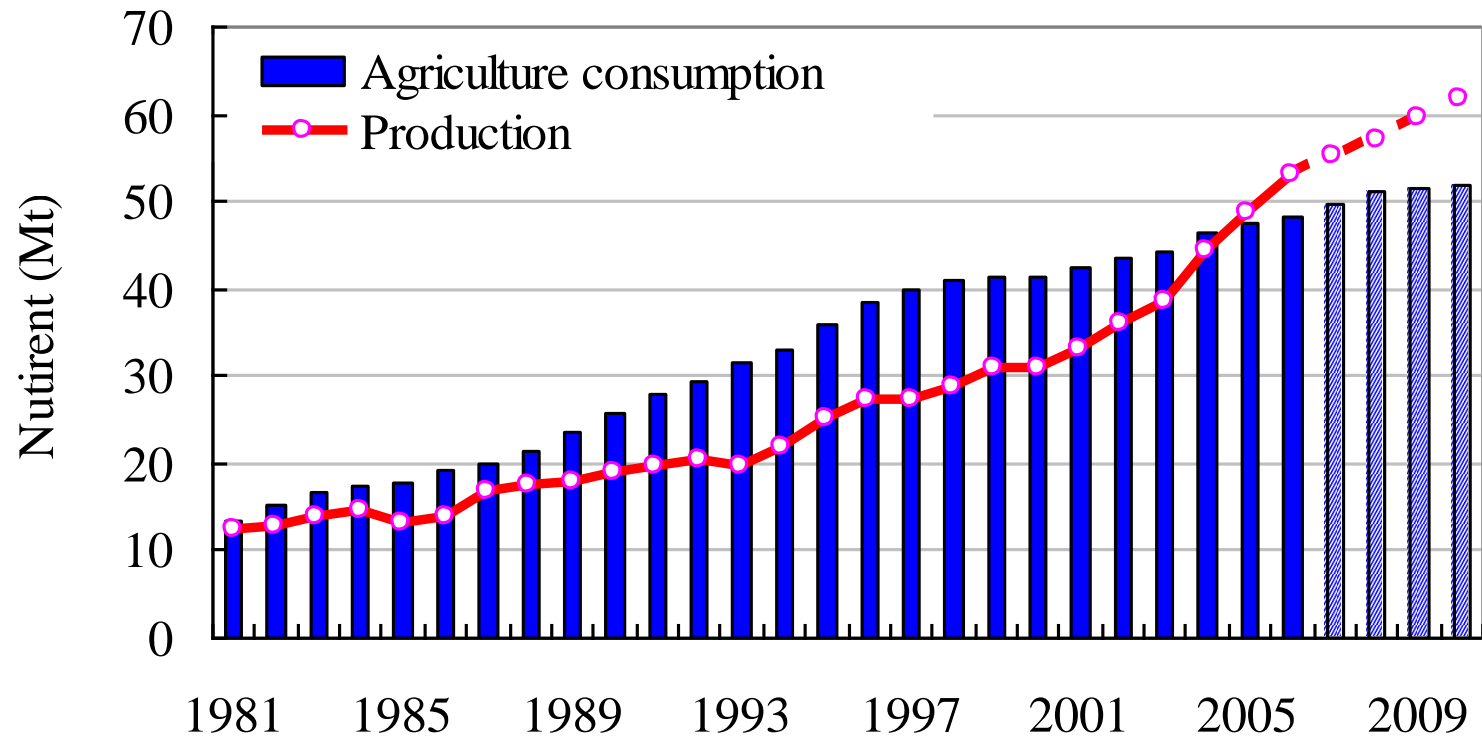
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# Outline

- The situation of fertilizer in China
- The outlook beyond 2007
- Challenges for fertilizer development in China

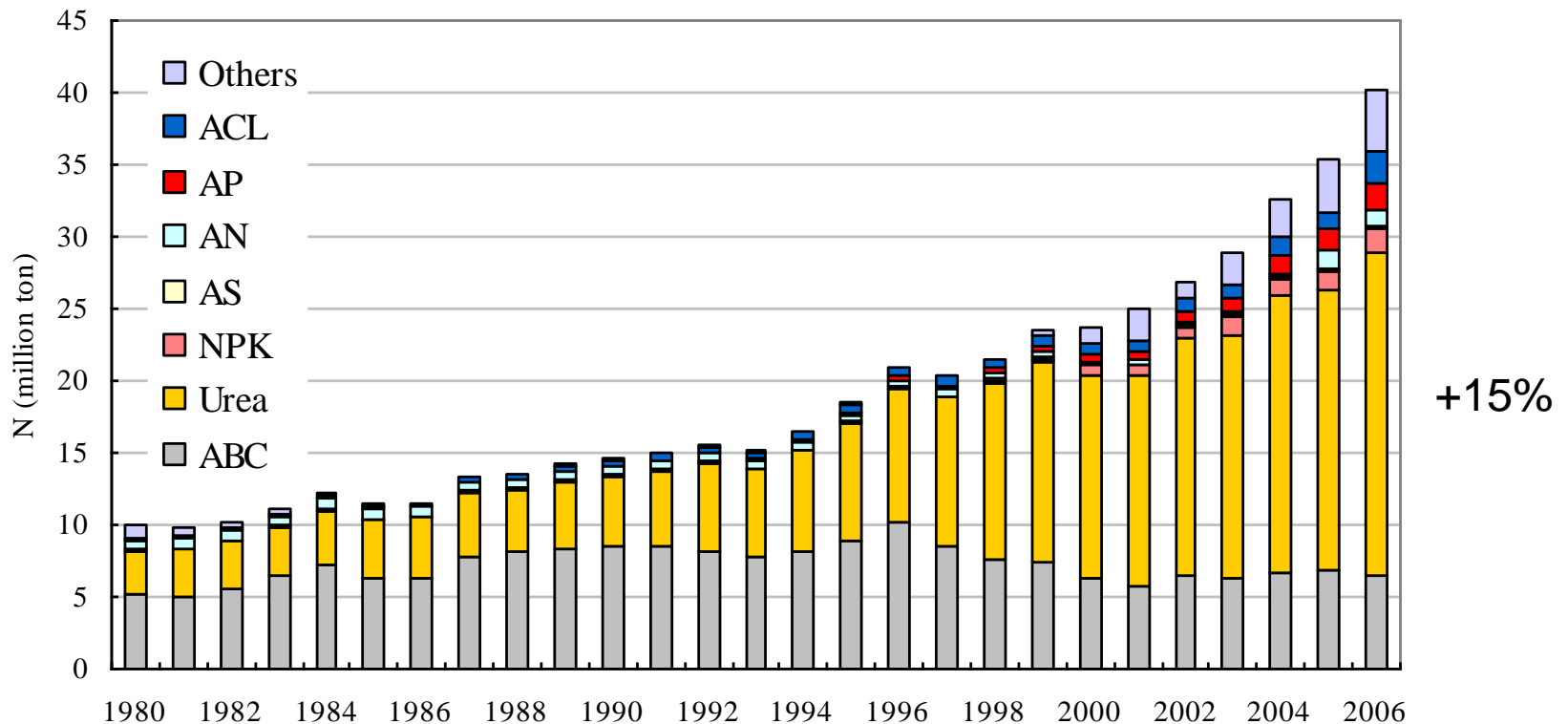
# Unexpected Rapid Development of Chinese Fertilizer Industry



*Note: Data for 1981-2006, The Statistics Bureau of China*

*Data for 2007-2010, forecasted by industry survey and crop based expert model*

# Growing and Changing of N fertilizer industry



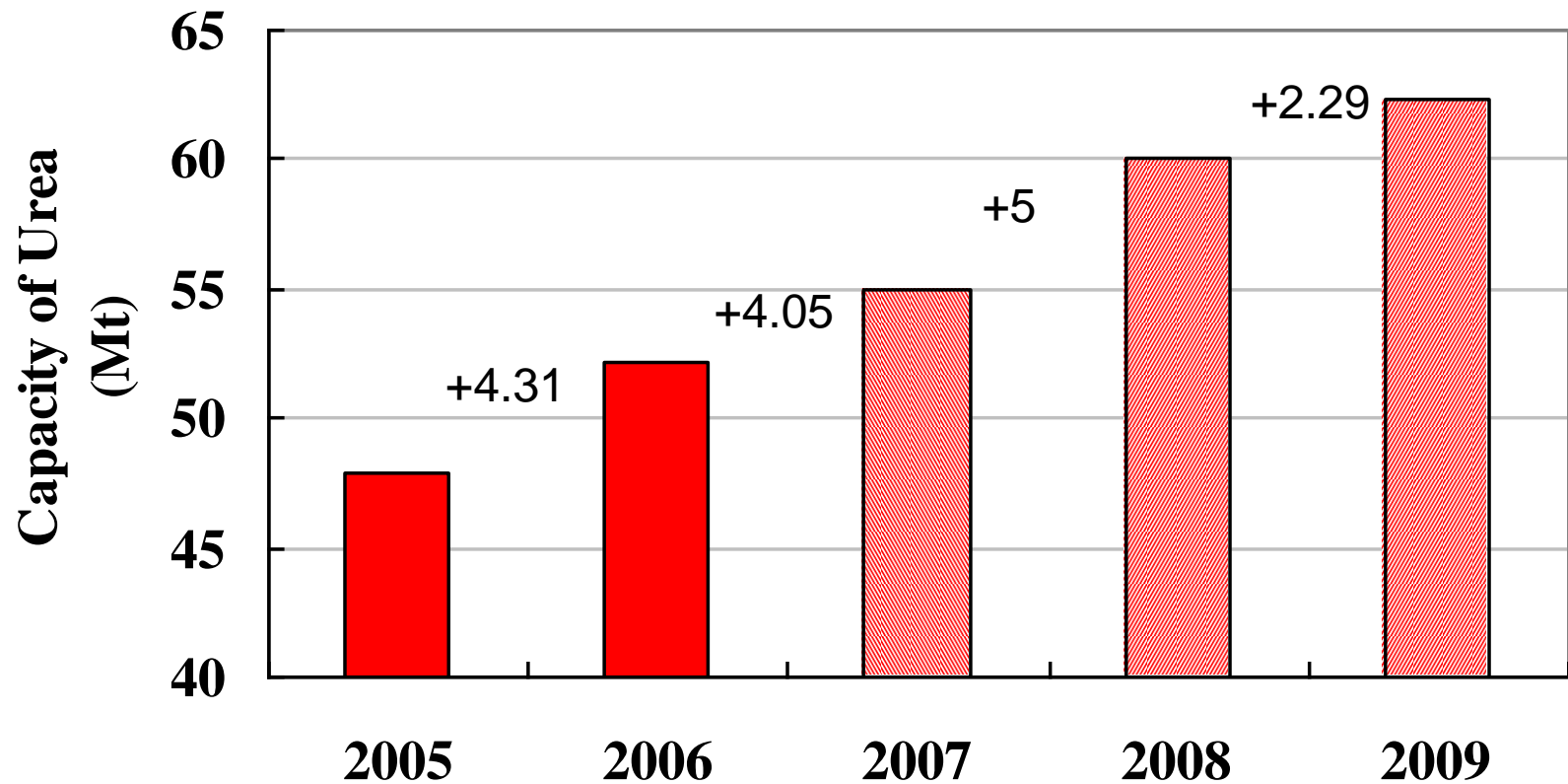
**Development trend of nitrogen fertilizer in China**

# Different trends of main N fertilizer products

	<b>Gross weight</b>				<b>Unit: Mt</b>
	Urea	ABC	ACL	AN	AS
Capacity in 2005	47.83	50.00	7.00		1.70
Production 2005	42.23	40.06	4.44	3.57	0.95
Production 2006	48.54	38.59	9.08	3.20	1.00
Growth rate in 2006	+15%	-3.7%	+105%	-10.4	+5%

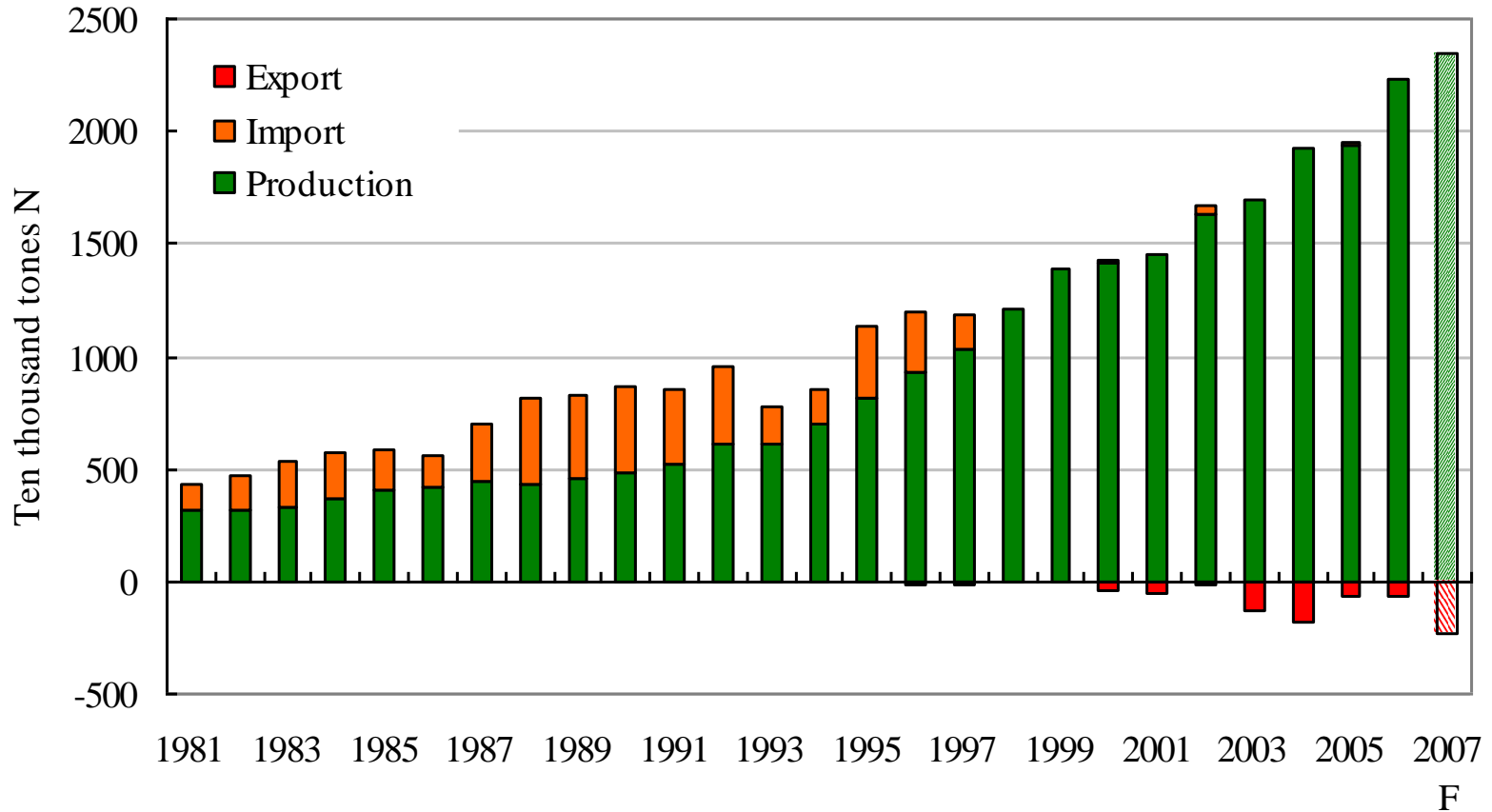
*Note: Data from the Nitrogen fertilizer association of China*

# Quickly development of Urea



*Note: Data from the Nitrogen fertilizer association of China*

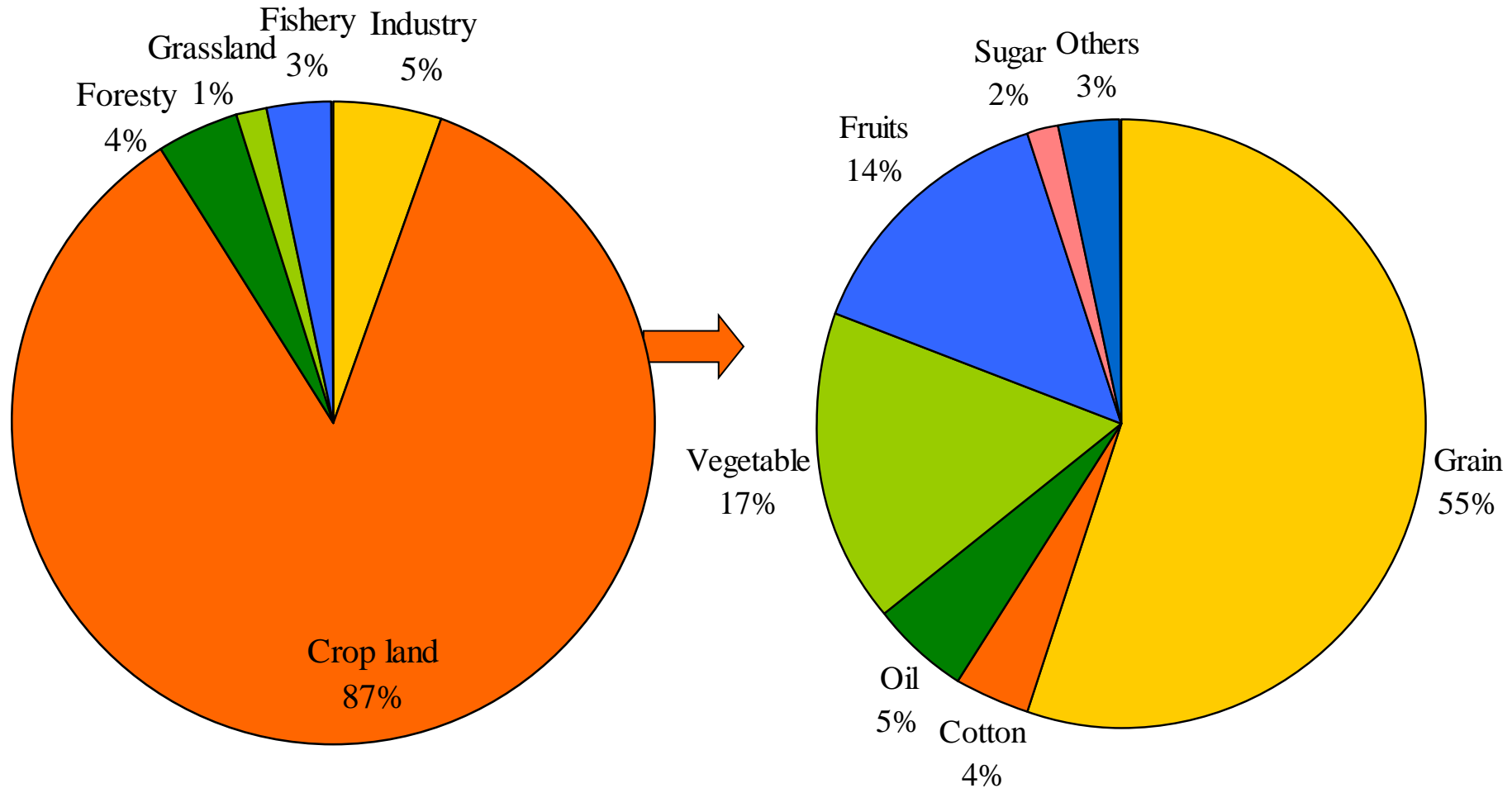
# Strong trends to export of Urea



Trends of Urea market of China

*Note: Data from the Nitrogen fertilizer association of China and statistic bureau*

# Where is the potential demand of N fertilizer?

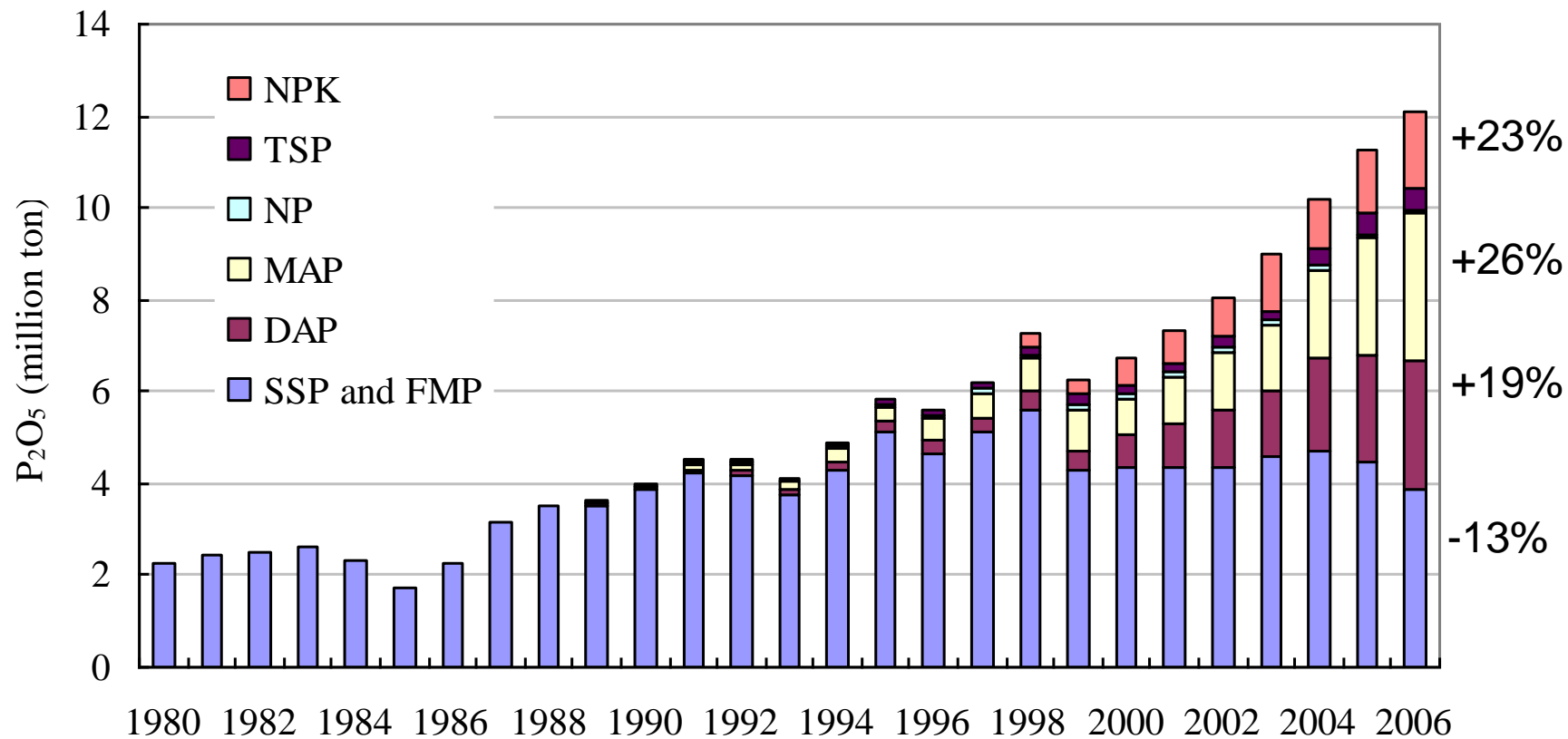


Nitrogen fertilizer distribution in different part of China

*Note: Calculated by the crop based experts' model*



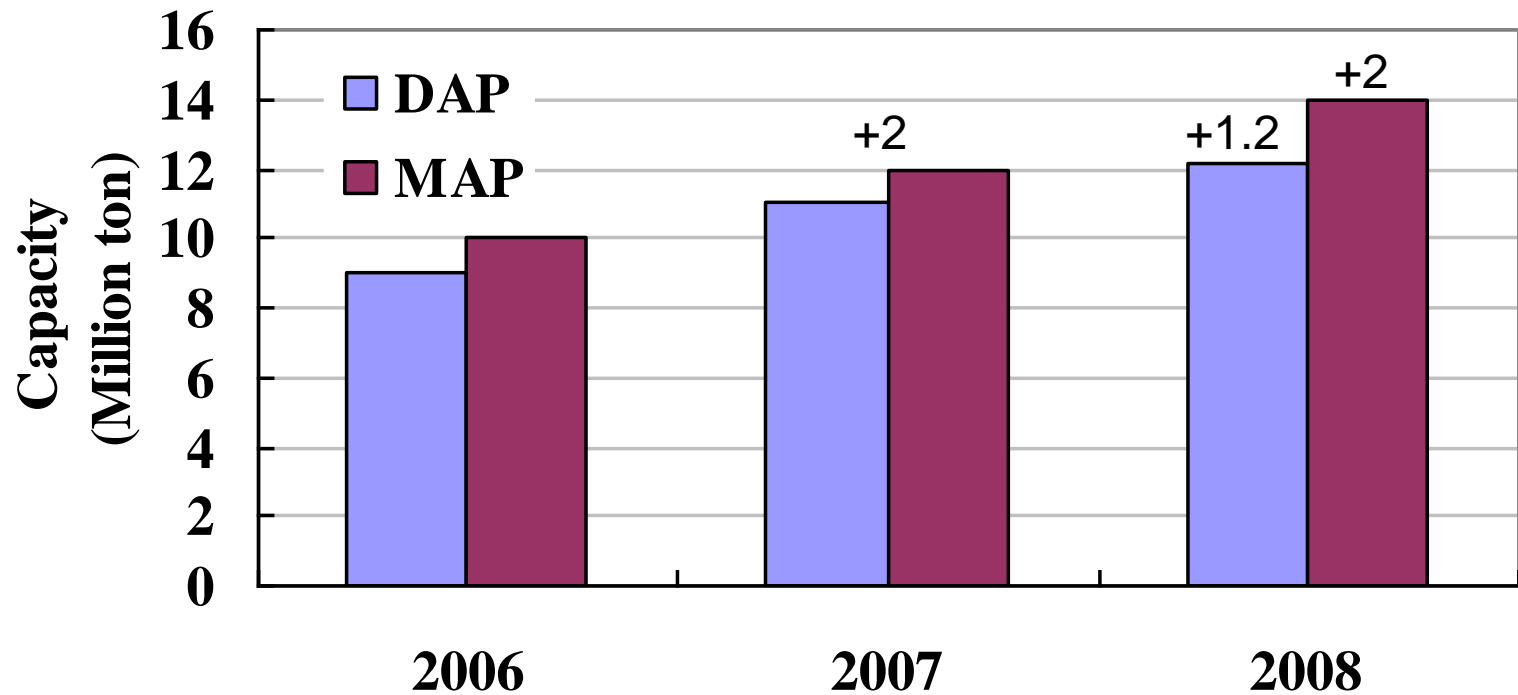
# Growing production and Remarkable changing structure of phosphate fertilizer



## Developing trends of phosphate fertilizer of China

*Note: Data from China phosphate fertilizer industry association and statistic bureau of China*

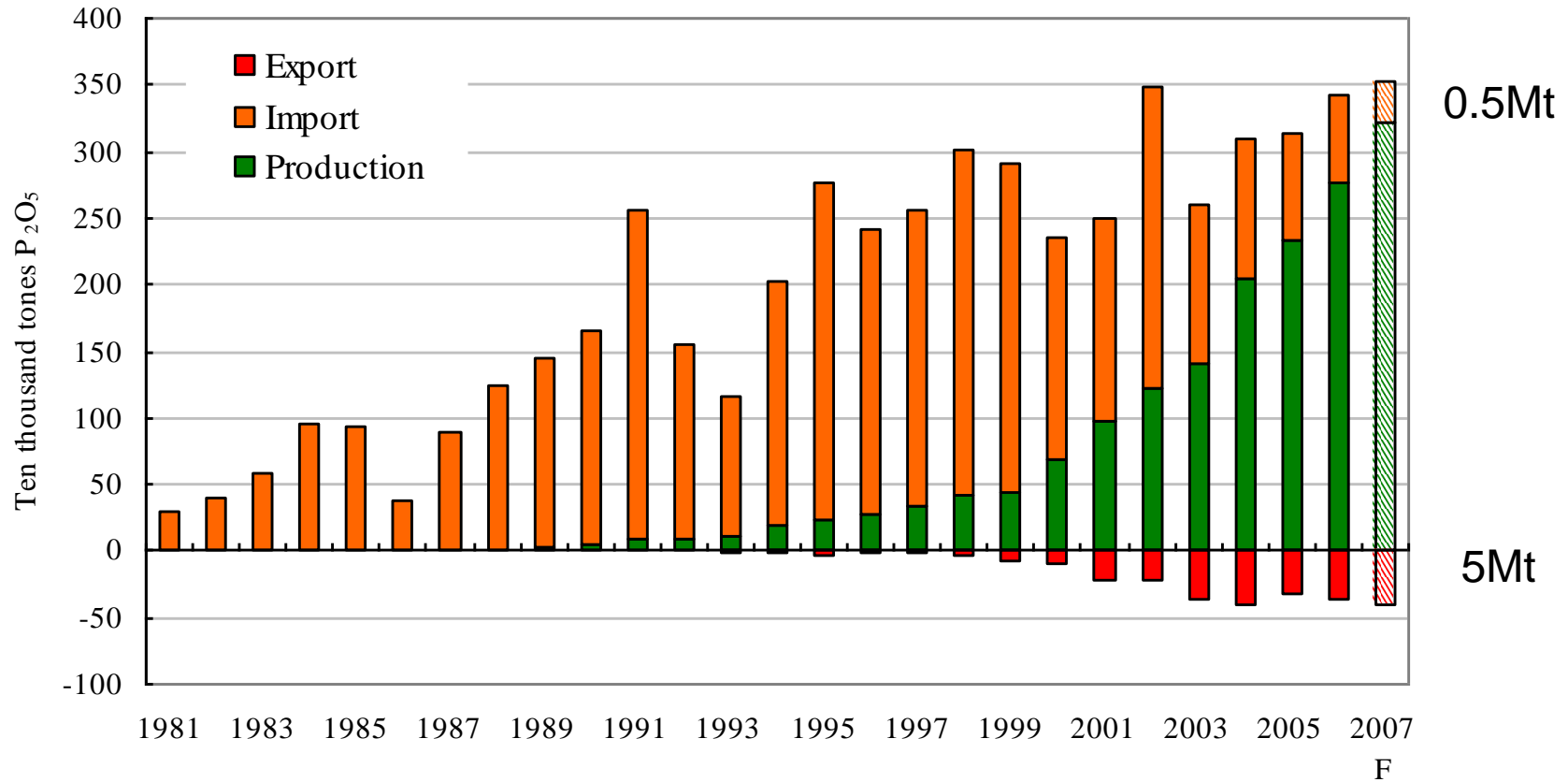
# Strong capacity for AP



Forecast for the capacity of DAP and MAP in China

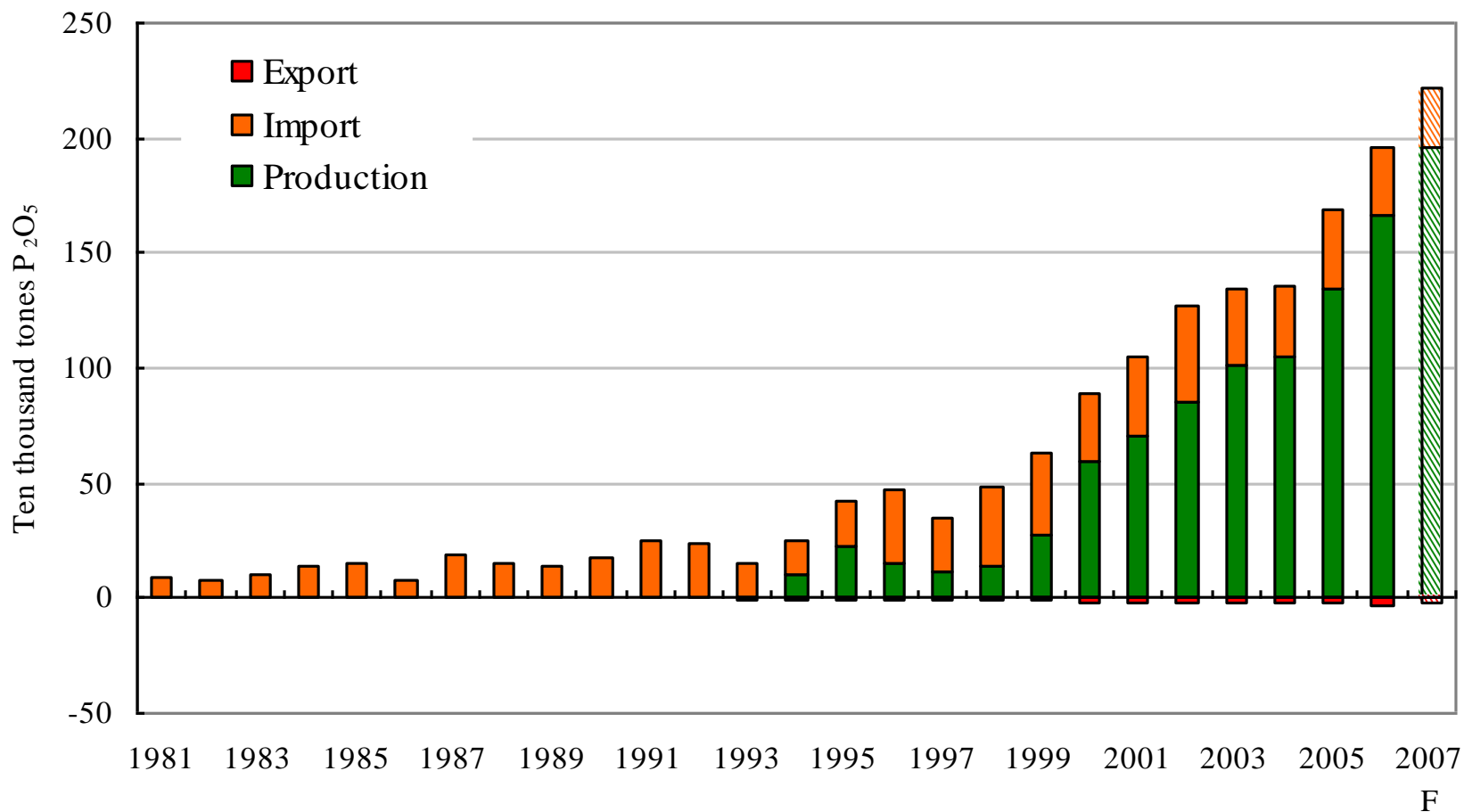
*Note: Data from the China Phosphate fertilizer industry association  
Forecast based on the industry survey*

# Changes of DAP market



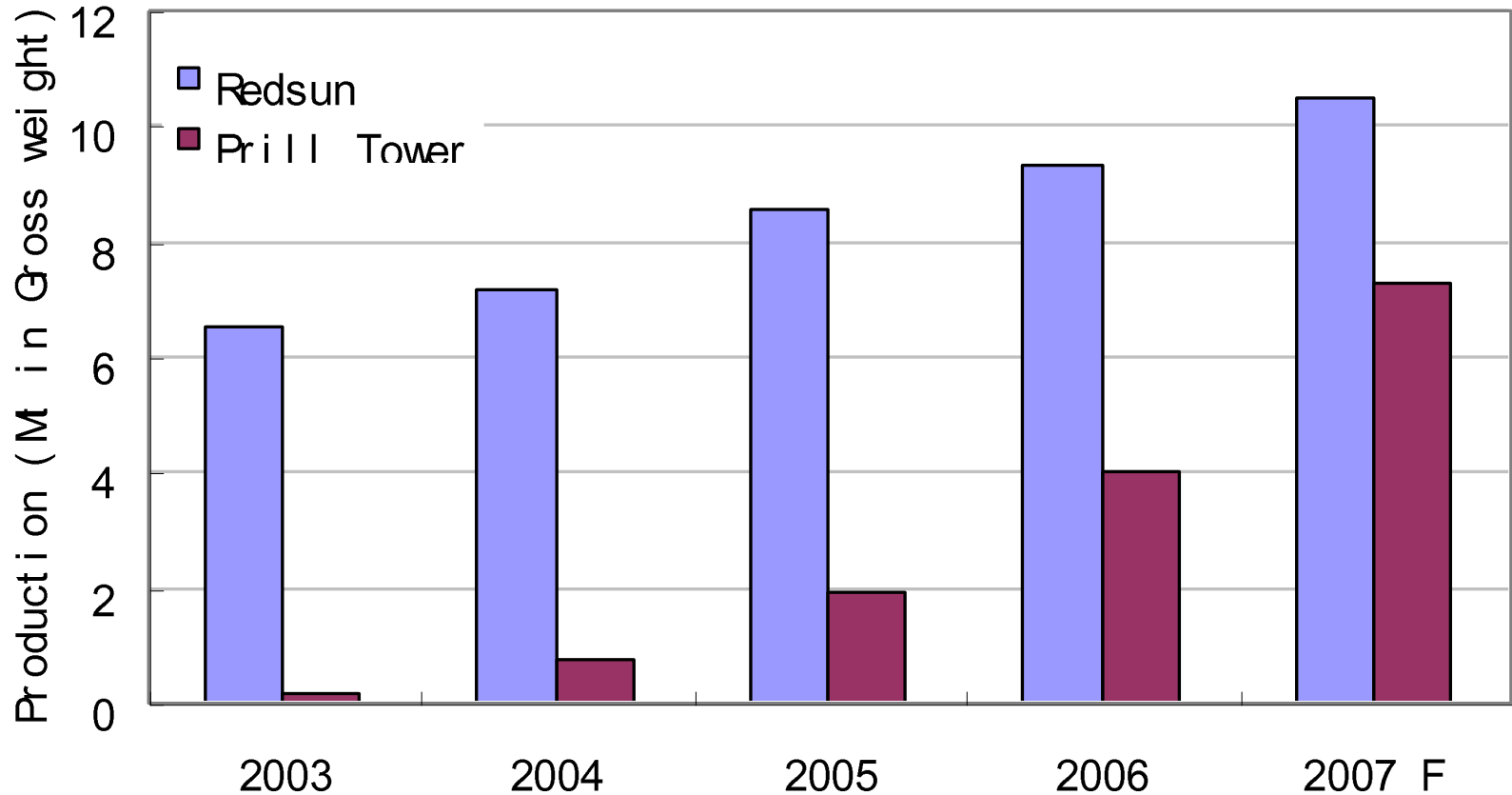
*Note: Data from China statistic bureau and China phosphate fertilizer association*

# Changes of compound fertilizer market



*Note: Data from China statistic bureau and China phosphate fertilizer association*

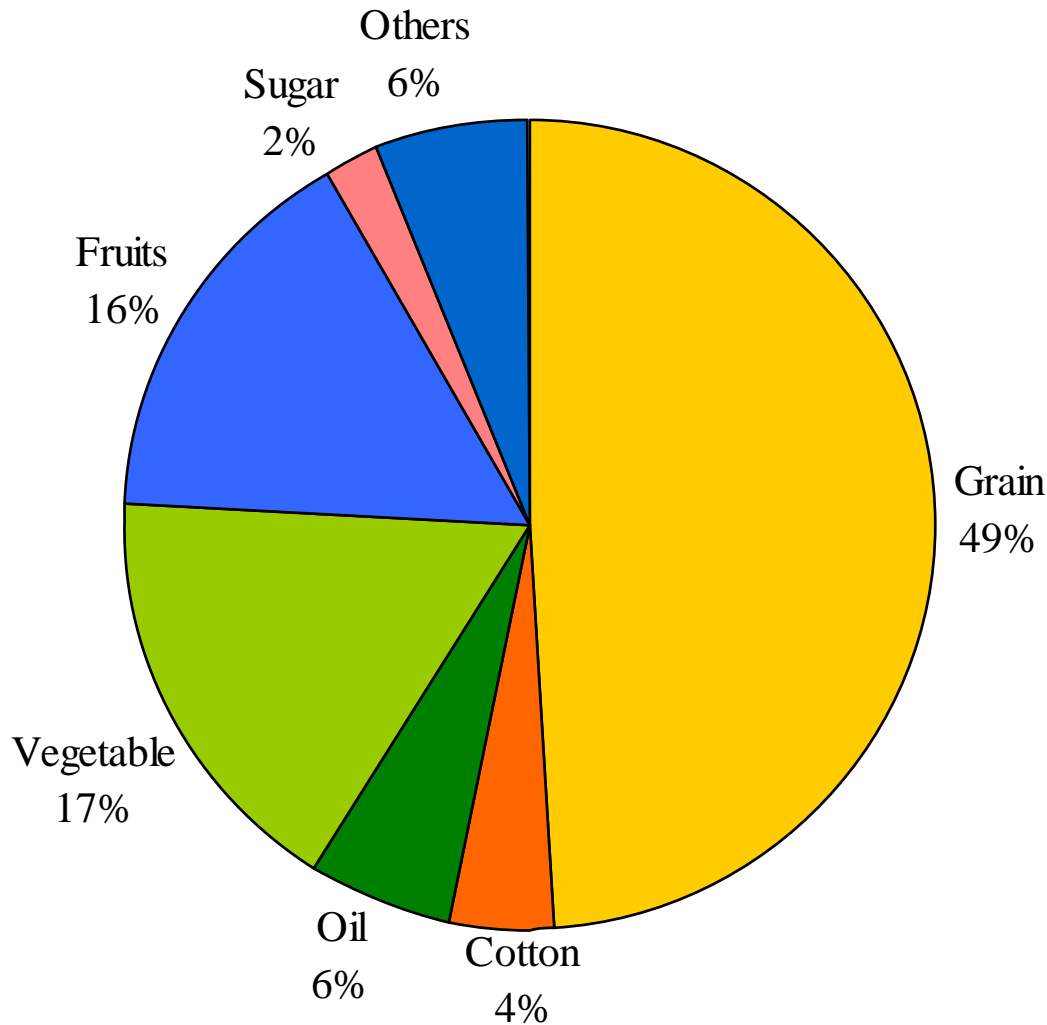
# Development of NPK industry



The total production capacity of compound fertilizer would be 200 million ton in 2007 and 300 million ton in 2008. But the real production is only 20 million tons

*Note: Data from China phosphate fertilizer association*

# Where is the potential demand?



## Potential demand for:

Maize

Potato

Vegetable

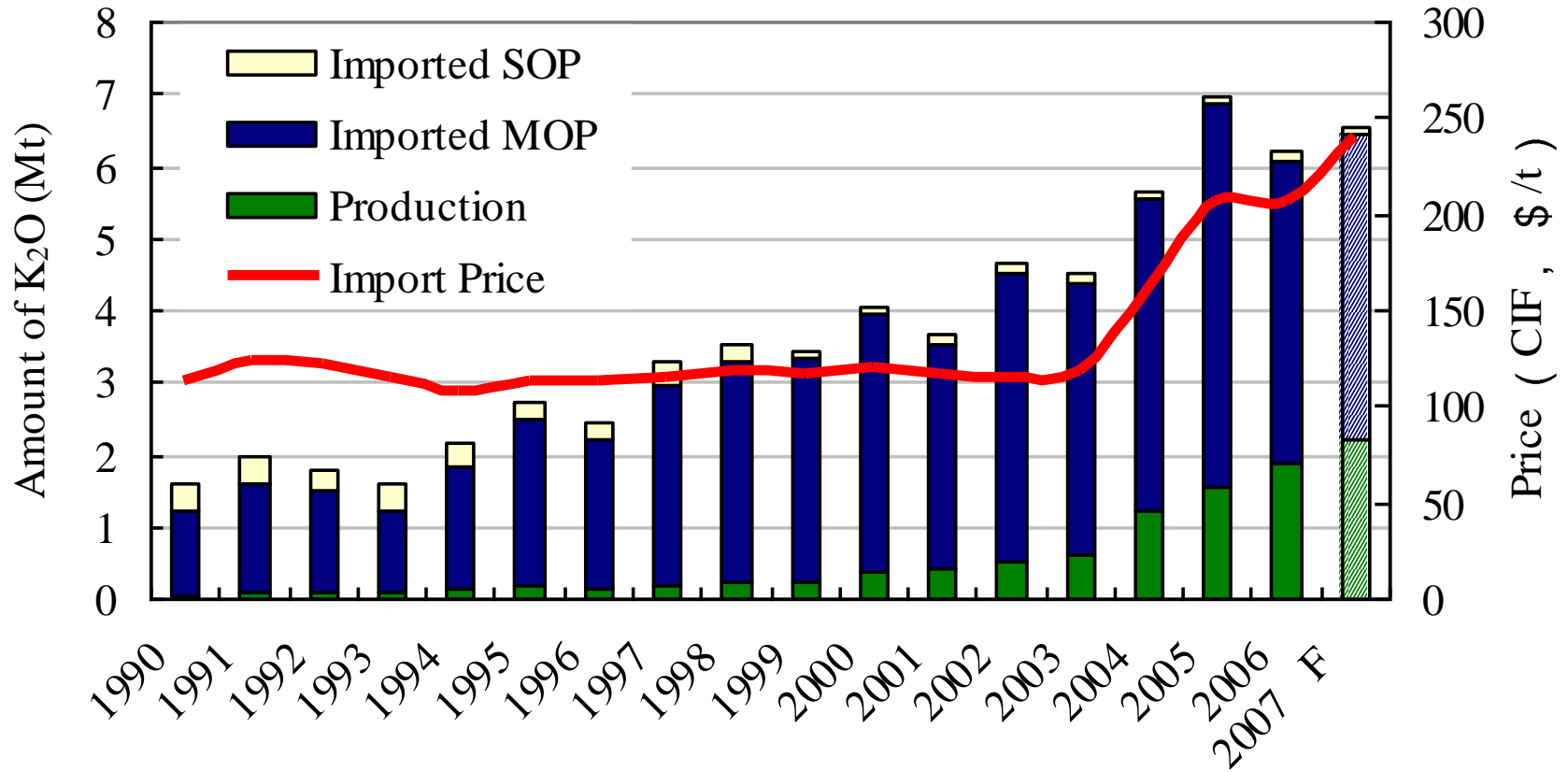
Fruits

Oil rape and peanut

Distribution of phosphate fertilizer in China

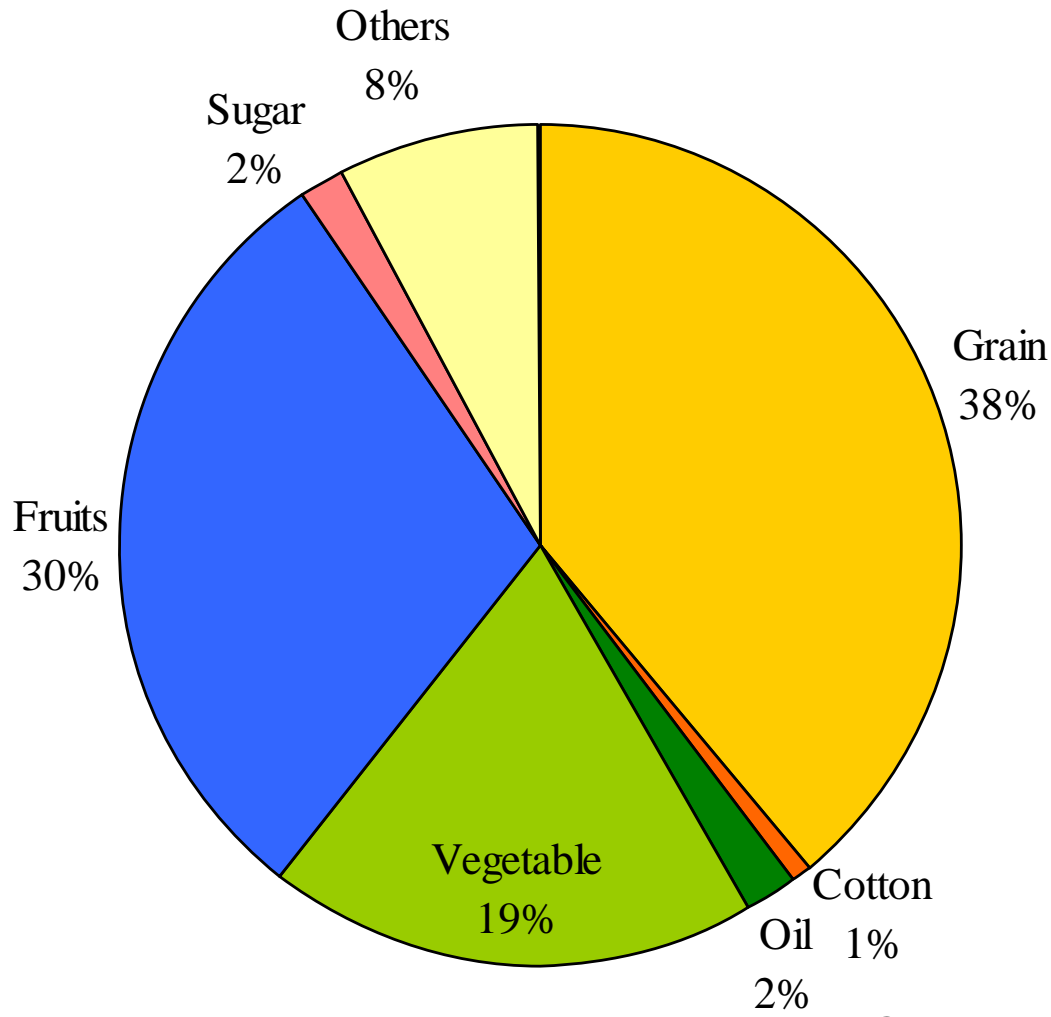
*Calculated by the crop based experts' model*

# We need more K , but.....



*Note: Data from China statistic bureau and China Potash fertilizer association*

# Where is the potential demand?



Distribution of Potash fertilizer in China

## Potential demand for

Rice and maize

Potato and soybean

Vegetable

Sugarcane

Oilseeds and peanut

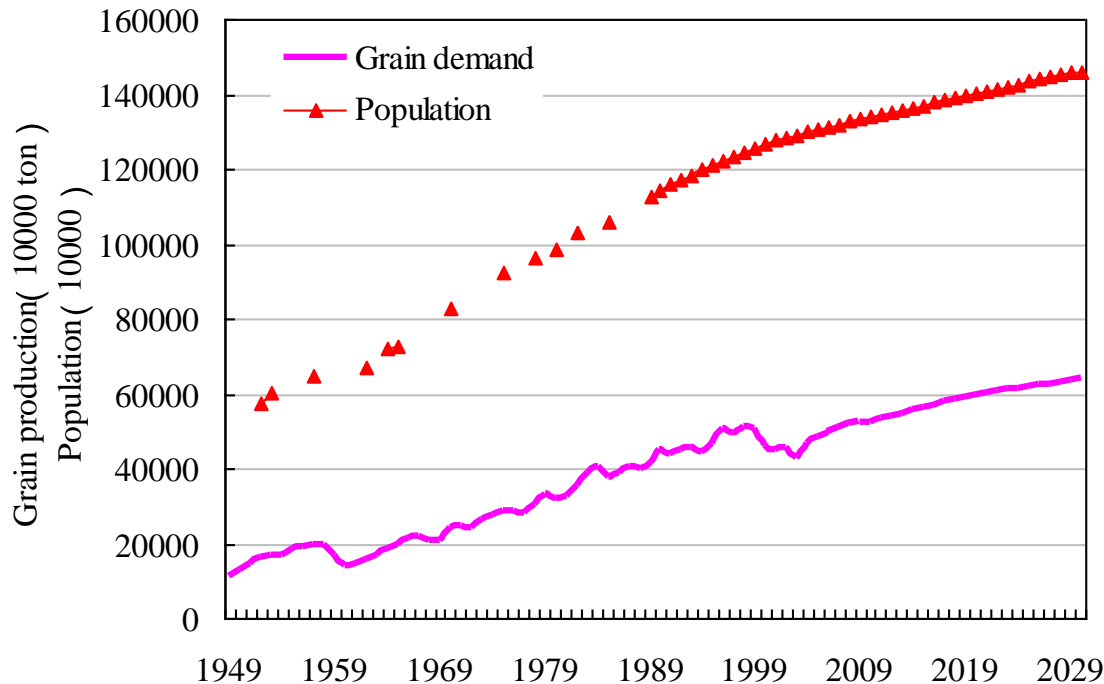
*Note: Calculated by the crop based experts' model*



# Outline

- The situation of fertilizer in China
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# 1. Increasing population and food demand



**2010**

**+32 million people  
+41 million tone grain**

**2020**

**+95 million people  
+116 million tone grain**

**2030**

**+152 million people  
+156 million tone grain**

*(Data from National Statistics Bureau)*

**Li *et al.*(2001) predicted, that “In 2030 , we have to have at least 72 million tons of NPK fertilizer to meet the demand of food production and agricultural development.”**

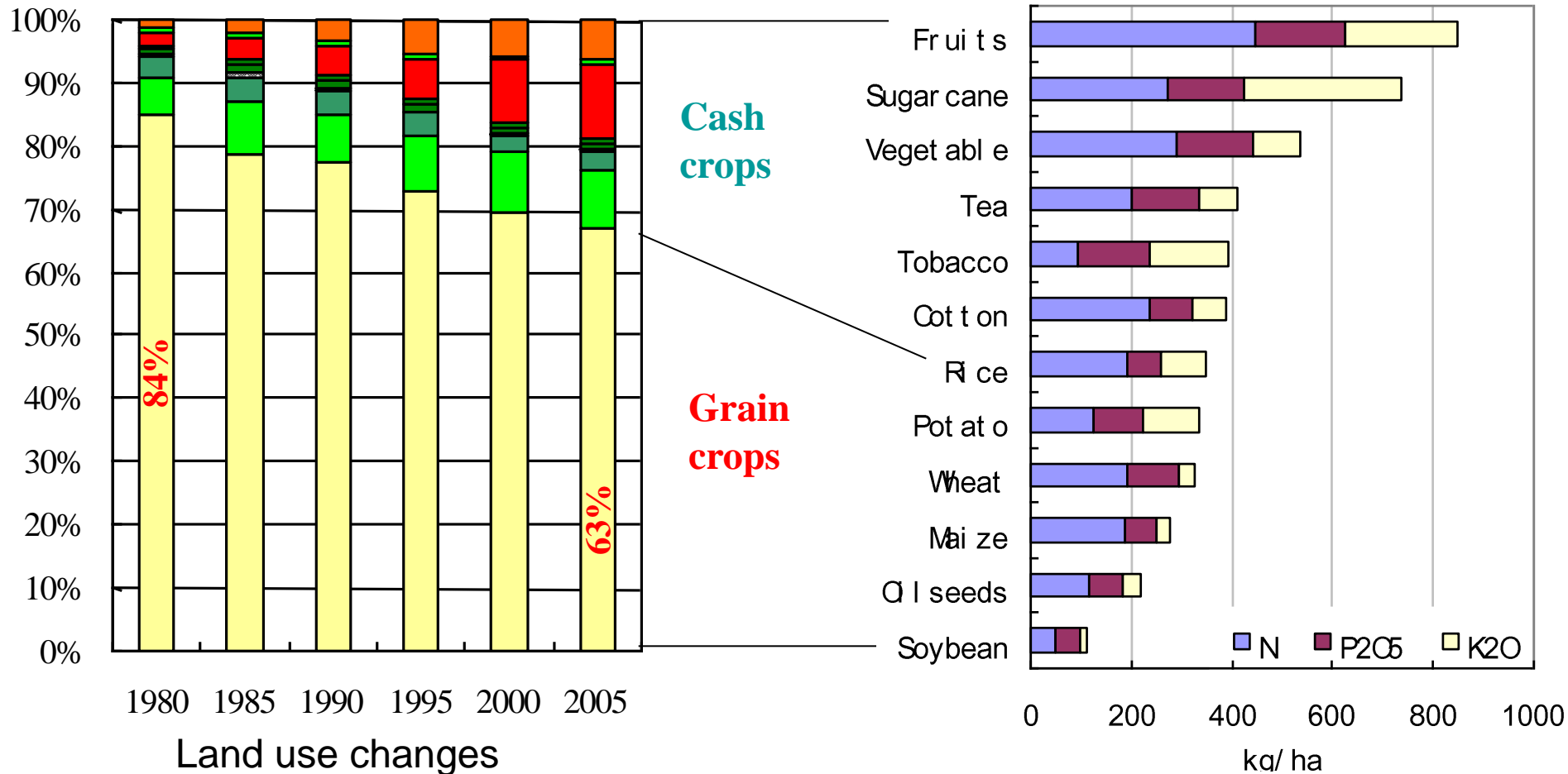
# More and more subsidies for grain producers

Items	2006	2007	2008
Subsidy (billion Yuan)	26.7	42.7	More
Subsidy per ha (Yuan/ha)	300	450	
Subsidy per unit nutrients (Yuan/ton)	300	600	
Fertilizer prices changed compared to 2004(Yuan/ton nutrient )	800	1000	More

*Note: Subsidies includes direct subsidy for grain production, and indirectly subsidy for raw material consumption, such as oil, fertilizer and pesticide used for grain production.*

# 2. Increasing cash crop production

More than 50% fertilizers were used on cash crops in China in 2005



Note: Data from statistic bureau and farmer survey

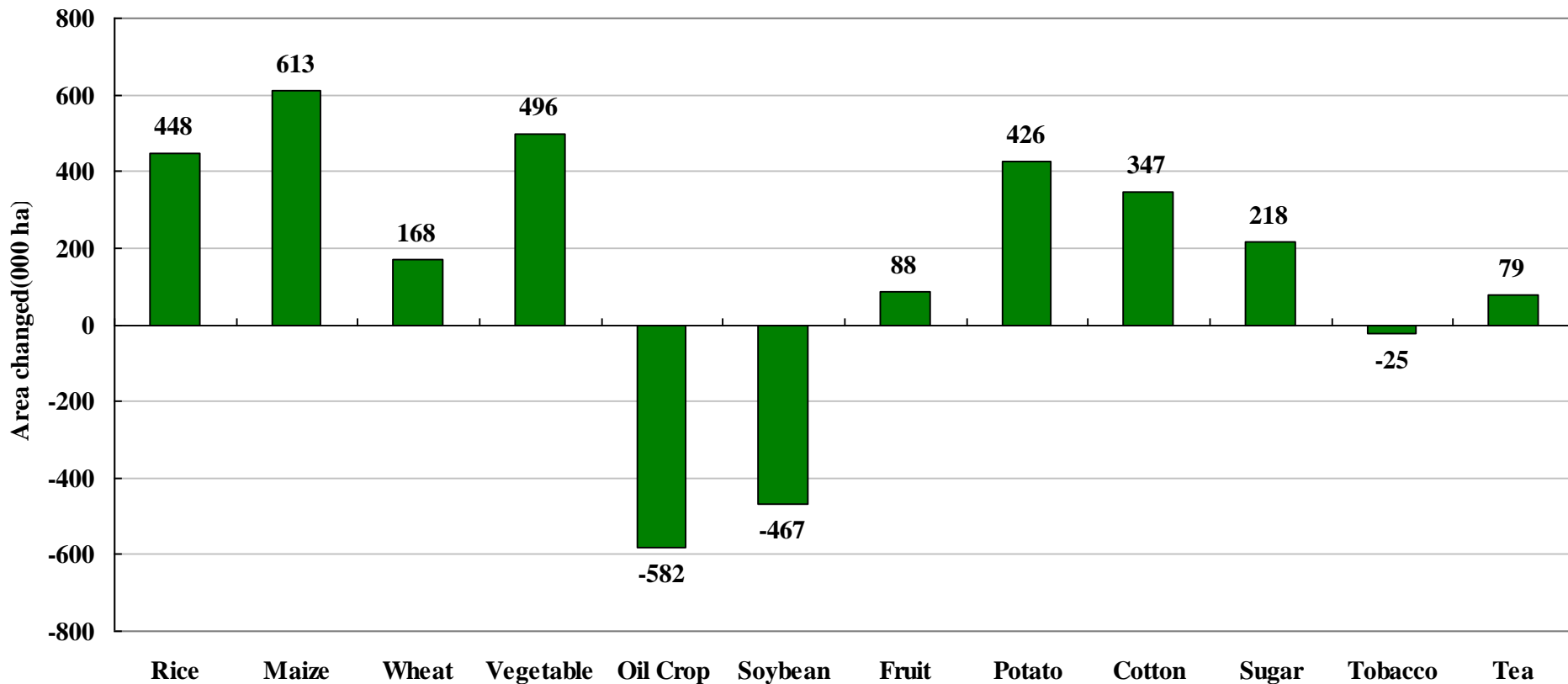
# Planting structure changes affect the fertilizer demand

$$\ln( CF ) = a_0 + a_1 \ln( A ) + a_2 \ln( Ar ) + a_3 \ln( Aw ) + a_4 \ln( Am ) + a_5 \ln( As ) + a_6 \ln( Ap ) + a_7 \ln( Ao ) + a_8 \ln( Ac ) + a_9 \ln( Asb ) + a_{10} \ln( At ) + a_{11} \ln( Afv )$$

## The elasticity of fertilizer consumption on planting structure

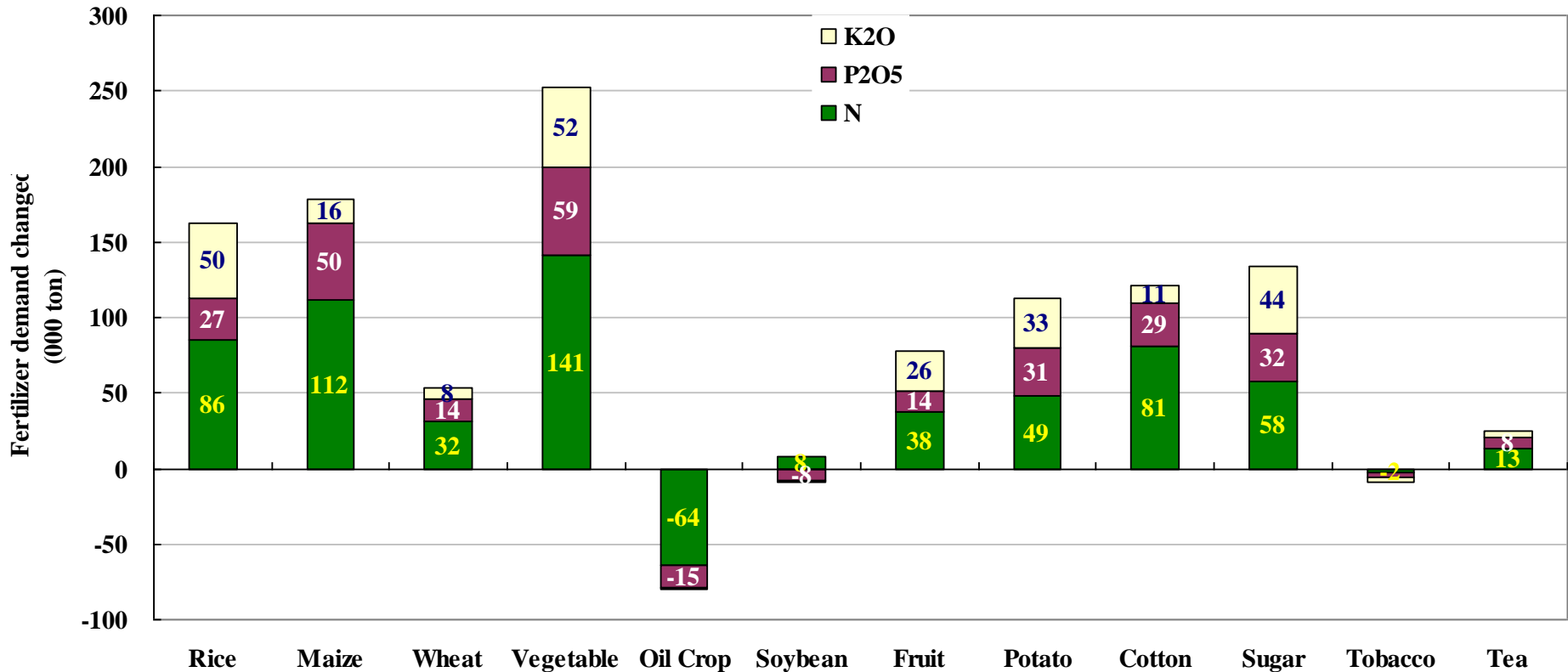
Factors	Rice	Wheat	Corn	Potato	Oil crop	Cotton	Sugar	Tobacco	Fruits and vegetable
Total	5.132	-2.068	2.222	2.37	0.996		0.931		0.951
N	4.686	-2.054	2.594	2.418	1.048		0.901		0.821
P <sub>2</sub> O <sub>5</sub>	6.585	-2.017			0.767	0.887	0.946		1.142
K <sub>2</sub> O	6.086				0.997	1.523	1.003	-0.534	2.634

# Planting area changed in 2005 and 2006 in China



Totally, 1% increased in 2006

# Fertilizer demand changed in 2005 and 2006

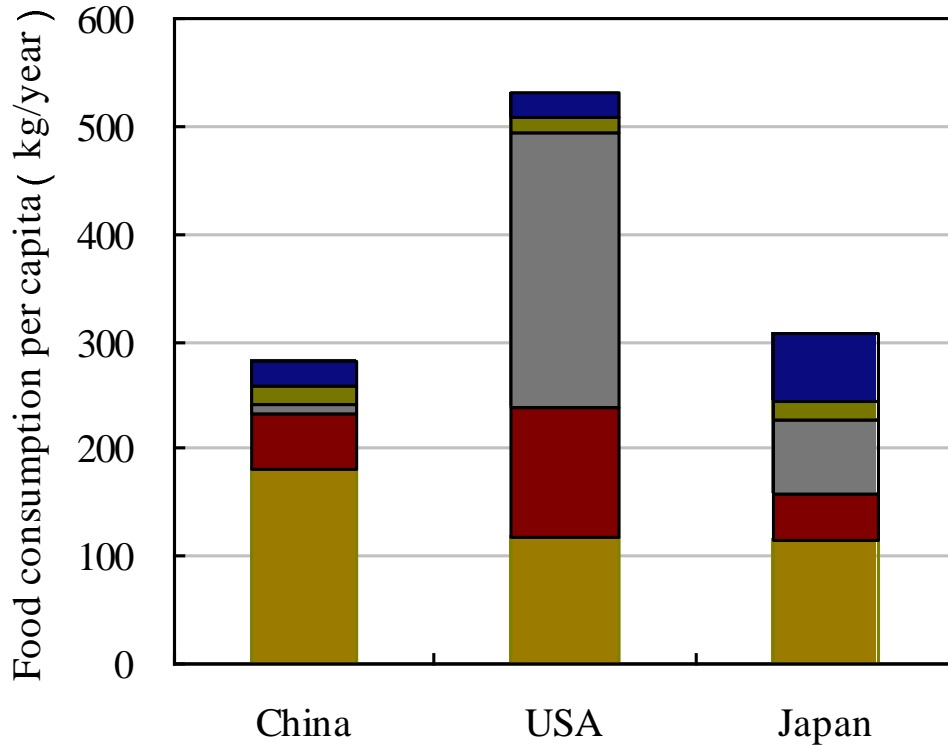


**Total increased N , P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O is 550kt, 237 kt and 239kt**

*Note: Calculated based on the crop based experts model of China*

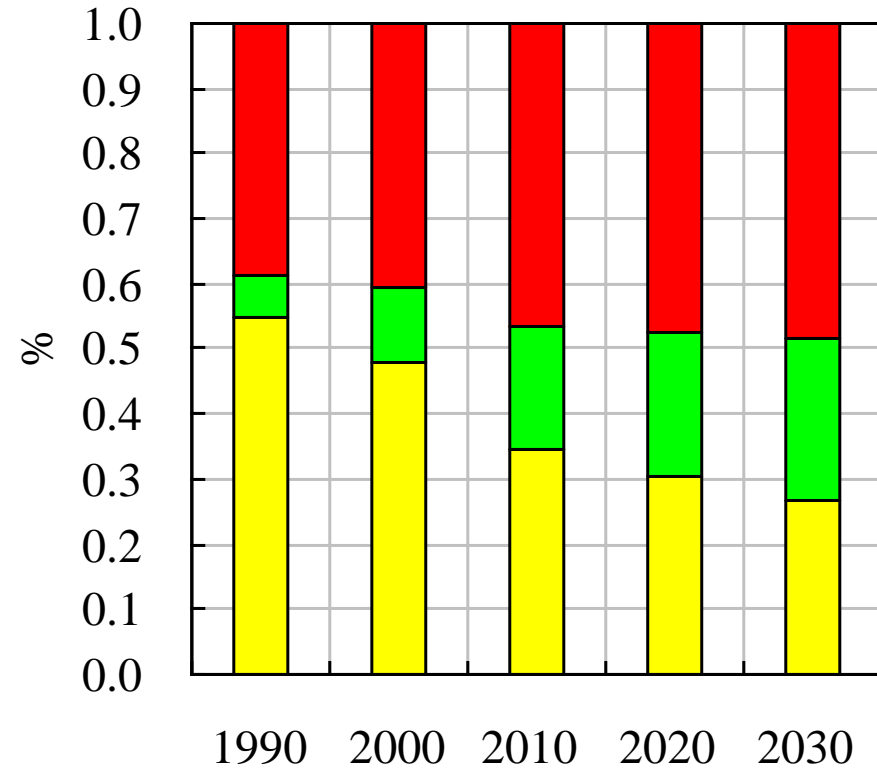
# 3. Increasing animal production

■ Grain ■ Meat ■ Milk ■ Egg ■ Fish



Food consumption in different country

■ Vegetable and Fruits  
■ Animal food  
■ Grain

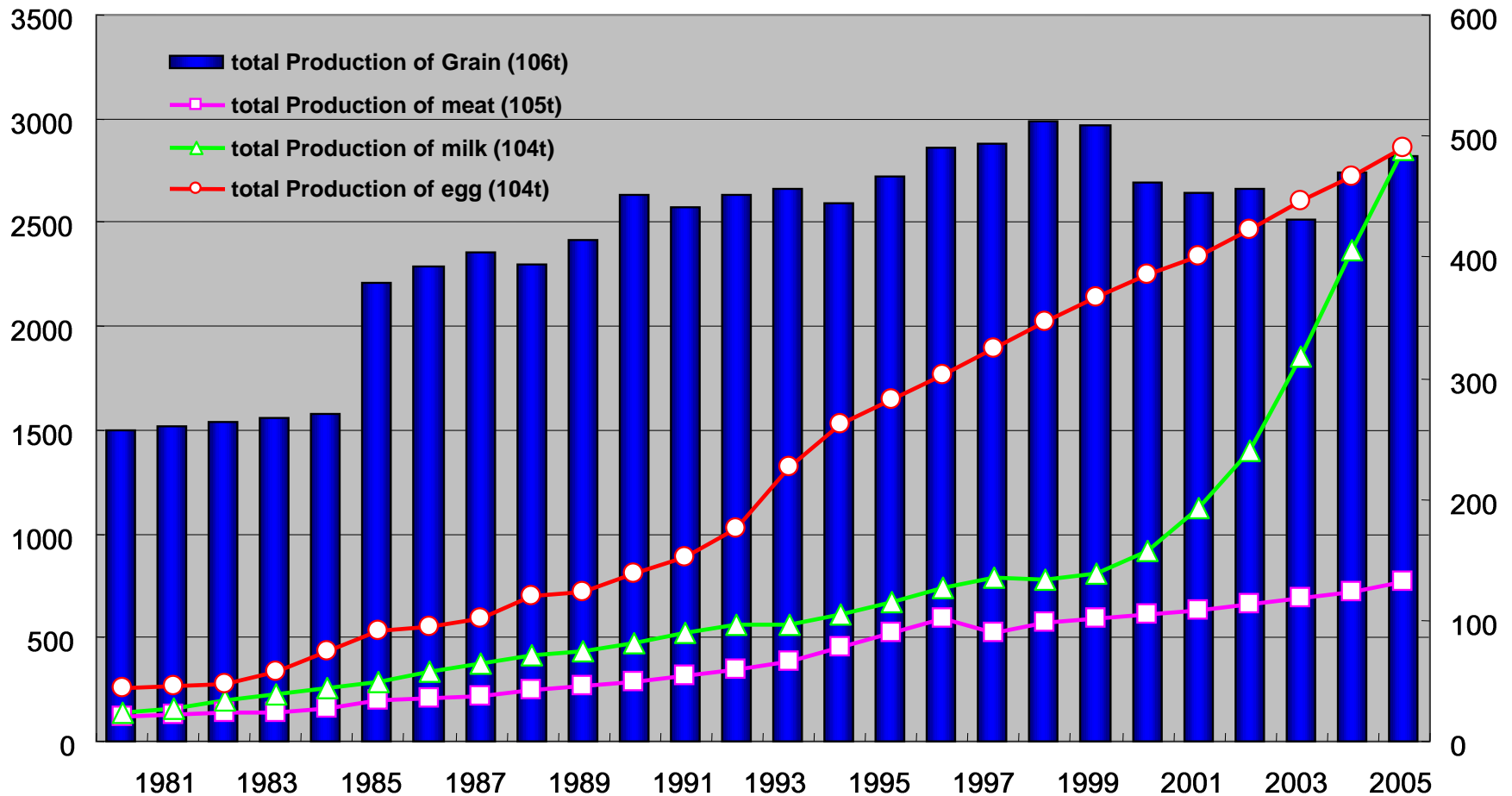


Food demand in China

*Note: Data came from the Statistics Bureau of China and FAO  
Forecasted data from the reference of Liu Jiang (2000); Xu Shiwei (2003)*



Compared with **1980**, grain production increased **89%**, while the production of meat, egg and milk increased **6.4**, **11.2** and **20.8 times** respectively in 2005



Trends of grain production, meat production, milk production and egg production

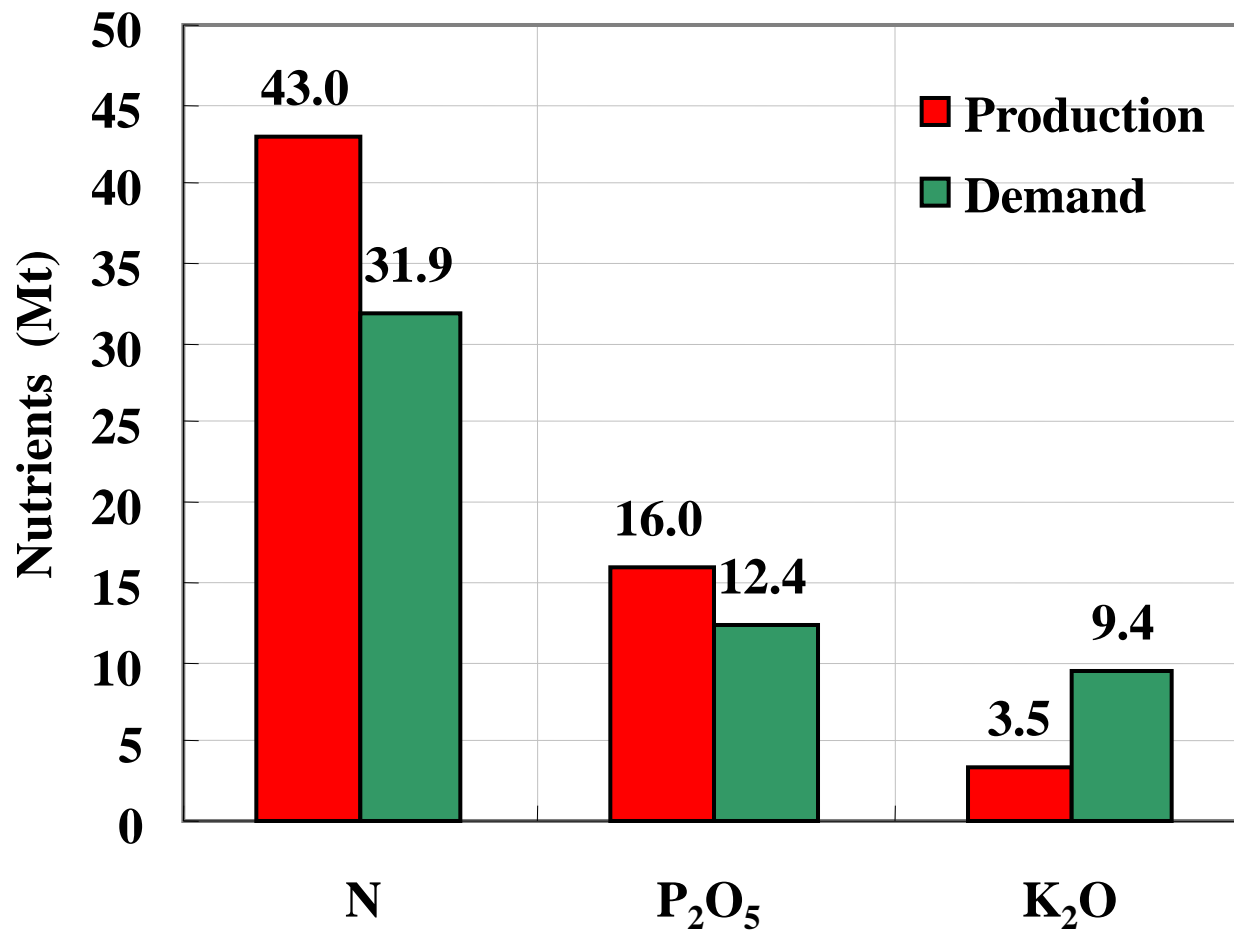
Data from China statistic bureau

## 4. Increasing production of bio-energy crops

	2010 (Mt) (Biofuel accounting for 1% of total energy demand)			2020(Mt) (Biofuel accounting for 4% of total energy demand)		
	Biofuel Production	Crop demand	Fertilizer demand	Biofuel Production	Crop demand	Fertilizer demand
Ethanol	2	5.76 corn	0.77	10	28.8 corn	3.48
Diesel	0.5	3.68 soybean	0.49	2	14.7 soybean	1.96
Sum	2.5	9.44	1.26	12	43.5	5.44

*Data source:*

*Medium term forecast for biofuel development,  
- China reform and development committee, 2006*



**Forecast of chemical fertilizer production and demand by China in 2010**

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# 1. Impact of changing environmental policies

- **“Create a no fertilizer county”** — 《Miyun County Director 24》 2001-3-28
- **“Pesticide and fertilizer are not allowed to be used within 5 km to the sea in Dalian city”** — 《Dalian Environmental Director》 2002-6-24
- **“The pesticide and nitrogen fertilizer consumption should be reduced by 30% and 20% in Tai Lake in 2010 ”**— 《Jiangsu Government Director 97》 2007-9-10
- **More and more.....**

# Eutrophication

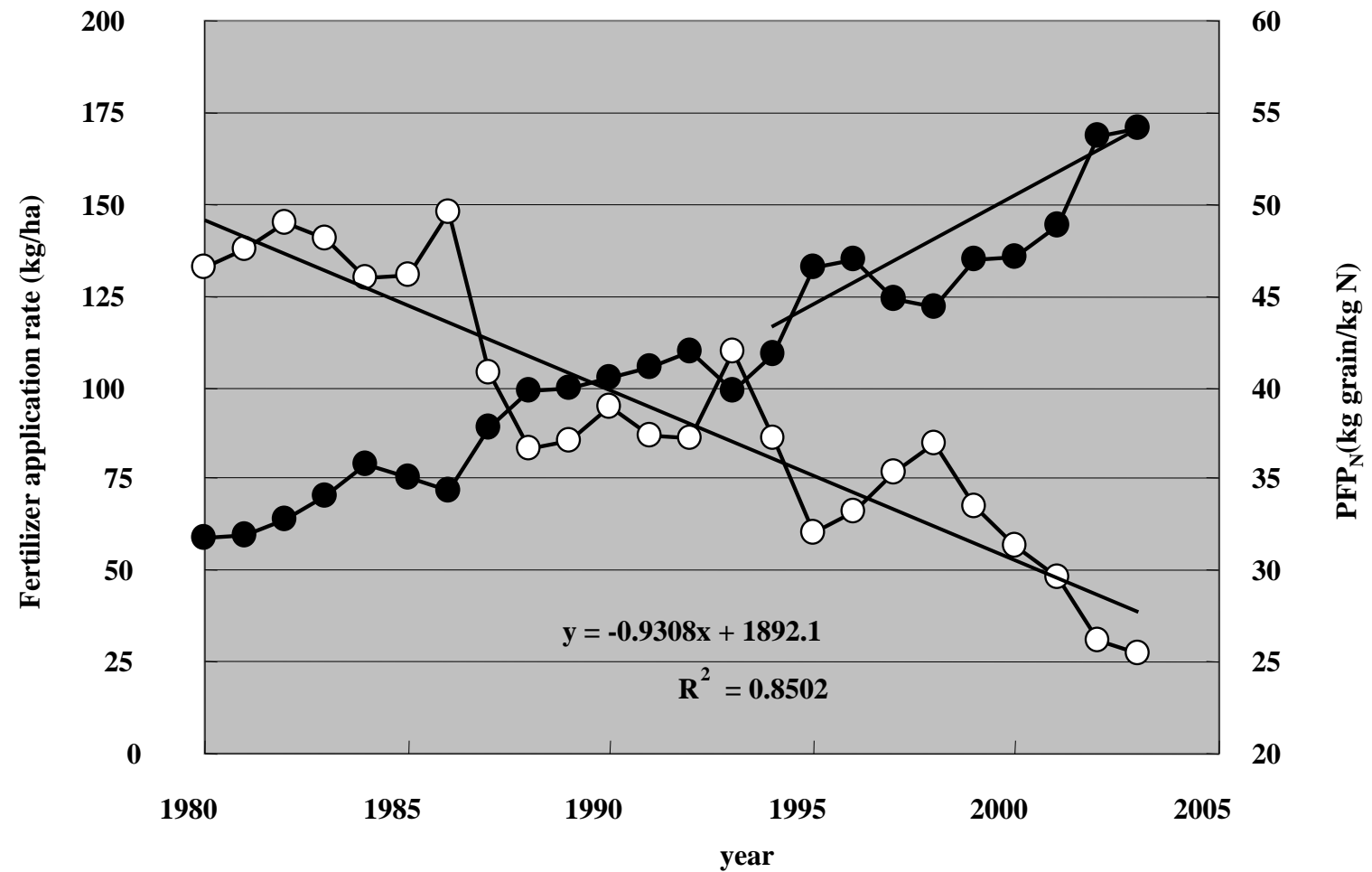
## Non-point source pollution

- Four fold increase in N inputs to estuaries since 1980
- Increased N inputs contribute to eutrophication, decreased fish production, and toxic algal bloom (red tides)
- The occurrence of red tides increased from 10/yr in the 1960s to 300/yr now

(Norse and Zhu,2004)

# Substantial decrease in fertilizer use efficiency ---Low PFP

**Partial factor productivity:**  $PFP_N = \text{kg harvest product per kg N applied}$

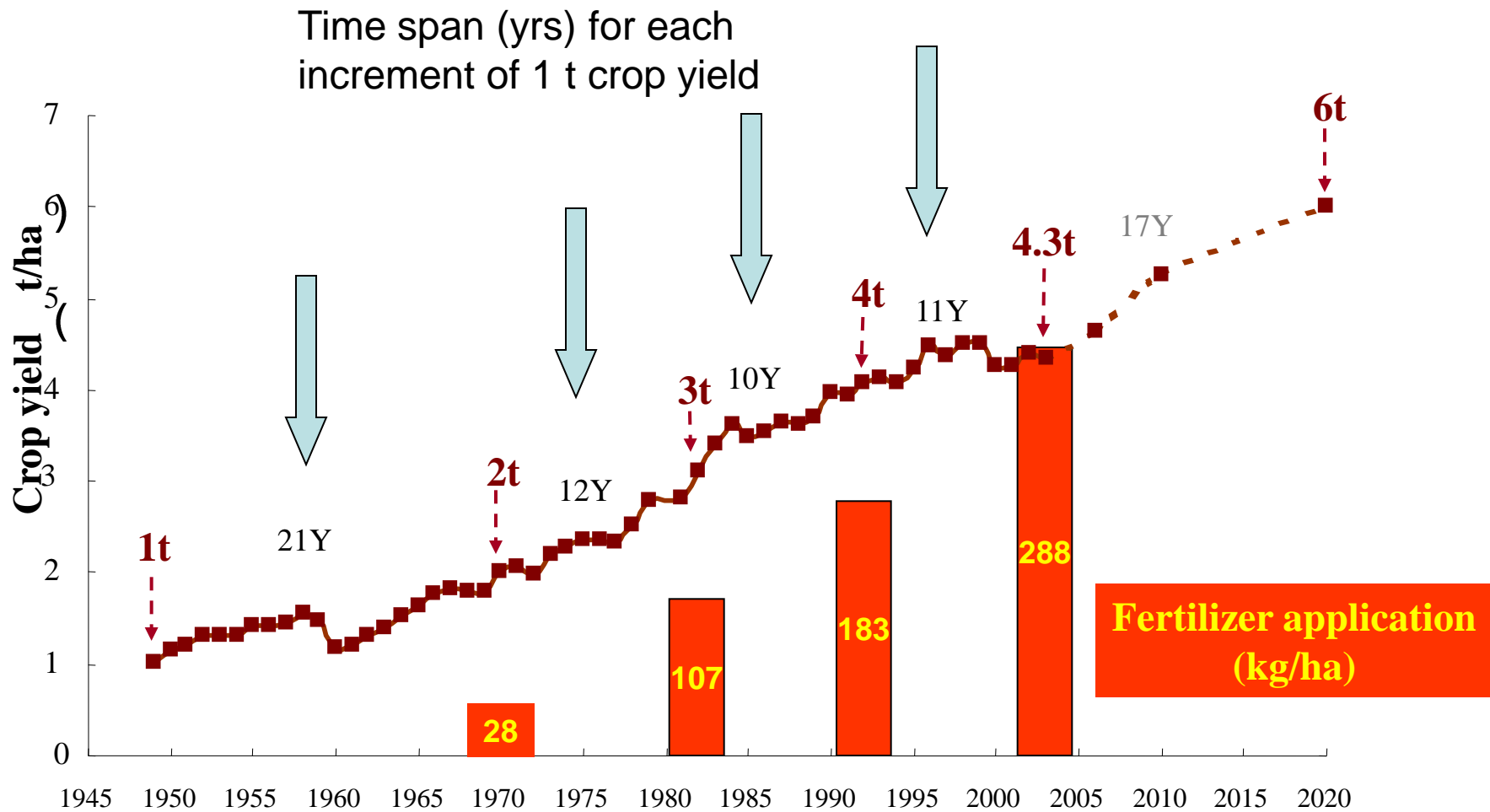


## Grain yield and N rate of rice crop

Country	Grain yield* (t ha <sup>-1</sup> )	N rate (kg ha <sup>-1</sup> )
China	6.26	~200
Japan	6.42	70
South Korea	6.79	110

\*FAO, 2004



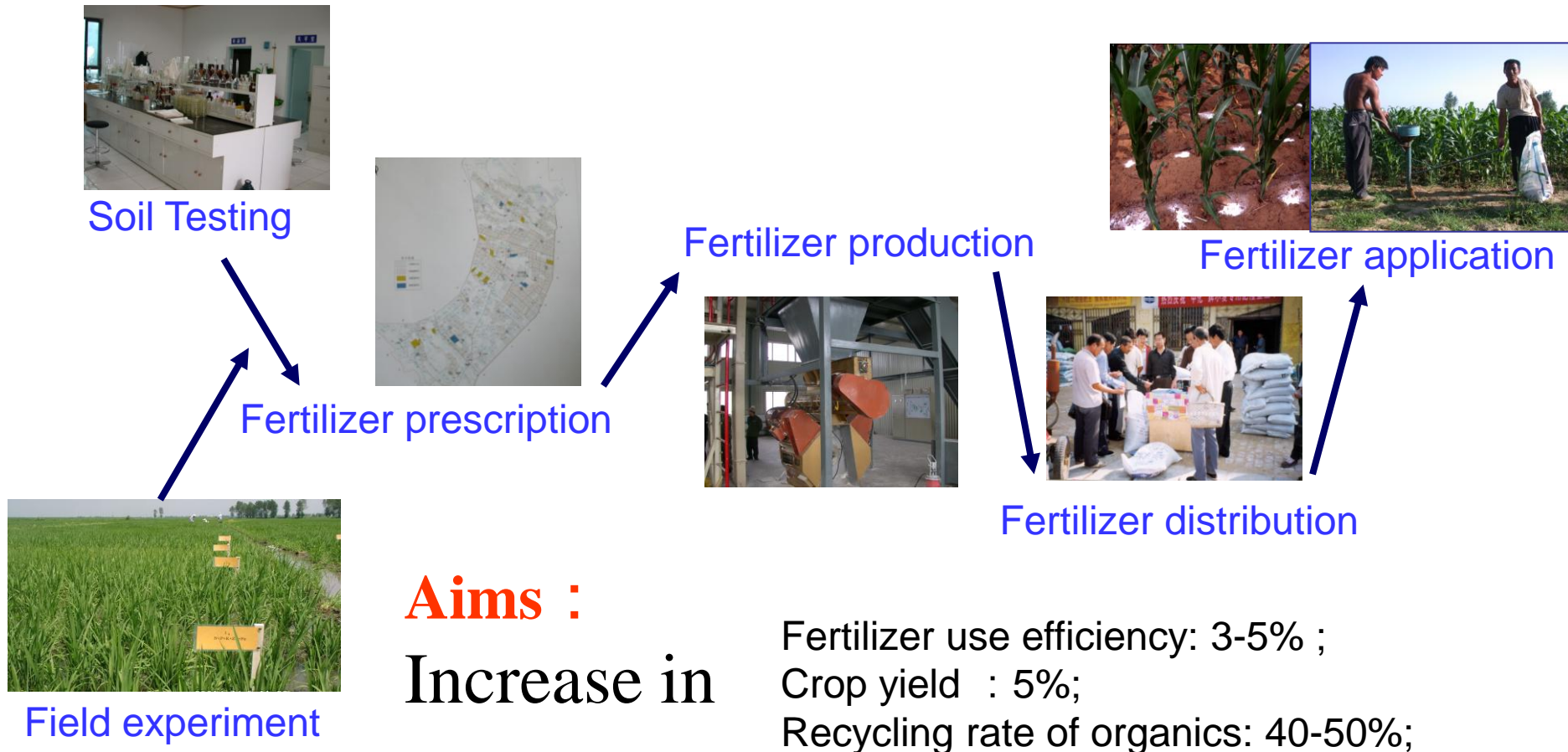


**The challenge** - Can we increase crop yield and nutrient use efficiency at the same time? How?

# Action of The Ministry of Agriculture

## National Program for Soil Testing and Fertilizer Recommendation

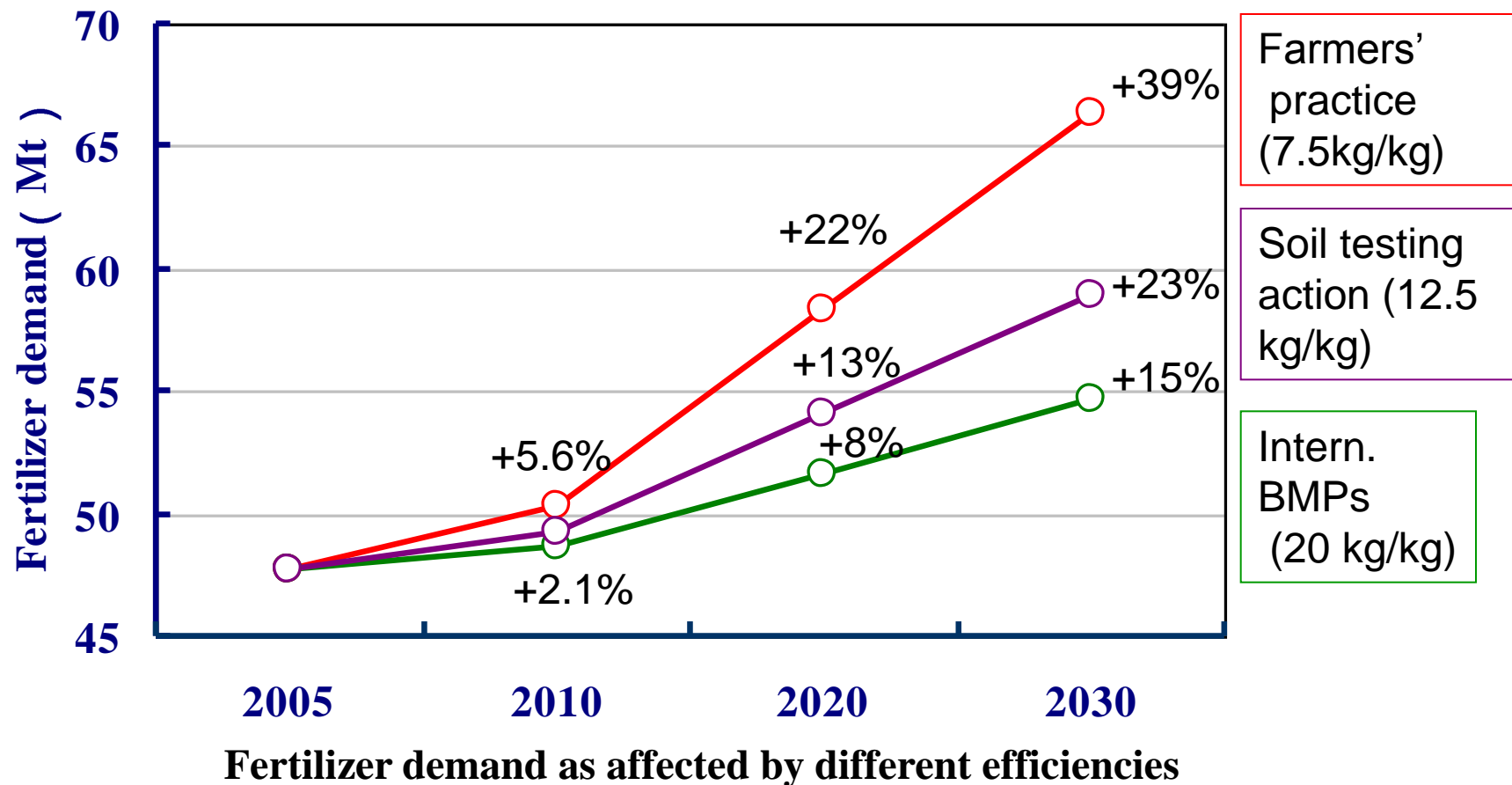
200 Million RMB ¥ covers 200 counties in 2005, 500 Million RMB ¥ covers 600 counties in 2006, and 900 Million RMB ¥ covers 1200 counties in 2007



**Aims :**  
Increase in

Fertilizer use efficiency: 3-5% ;  
Crop yield : 5%;  
Recycling rate of organics: 40-50%;

# 11.7 million tons fertilizer can be saved by the above actions



*Note:*

*Increased demand of cash crops is not included*

*grain demand is 520 Mt, 580 Mt and 640 Mt in 2010,2020 and 2030*

*Efficiencies (AE) in three practices are 7.5kg/kg,12.5kg/kg and 20kg/kg*

*(W Zhang  
Unpublished)*

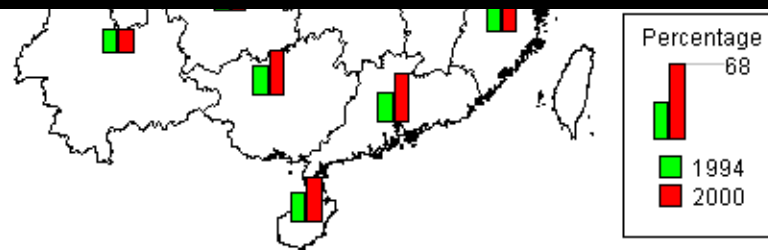
## 2. Reuse of organic wastes impacts chemical fertilizer production

### **Nutrient amount of organic wastes in China(2000,10<sup>4</sup>t)**

<b>Source</b>	<b>N</b>	<b>P<sub>2</sub>O<sub>5</sub></b>	<b>K<sub>2</sub>O</b>	<b>Amount</b>	<b>Relative%</b>
<b>Excreta</b>	<b>1614</b>	<b>1029</b>	<b>1102</b>	<b>3745</b>	<b>51.30</b>
<b>Straw</b>	<b>690</b>	<b>210</b>	<b>1164</b>	<b>2064</b>	<b>28.27</b>
<b>Green manure</b>	<b>28</b>	<b>0</b>	<b>0</b>	<b>28</b>	<b>0.38</b>
<b>Oil cakes</b>	<b>186</b>	<b>36</b>	<b>38</b>	<b>260</b>	<b>3.56</b>
<b>Garbage</b>	<b>300</b>	<b>180</b>	<b>600</b>	<b>1080</b>	<b>14.79</b>
<b>Sludge(DW)</b>	<b>51</b>	<b>55</b>	<b>17</b>	<b>123</b>	<b>1.68</b>
<b>Total</b>	<b>2869</b>	<b>1510</b>	<b>2921</b>	<b>7300</b>	<b>100</b>

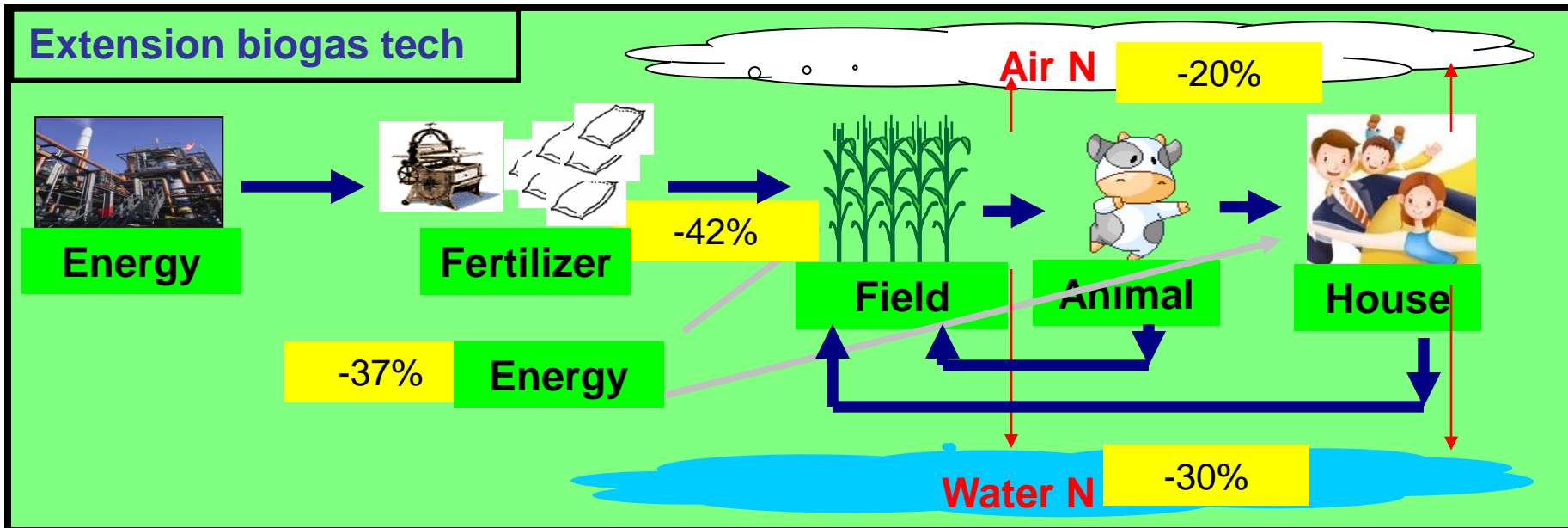
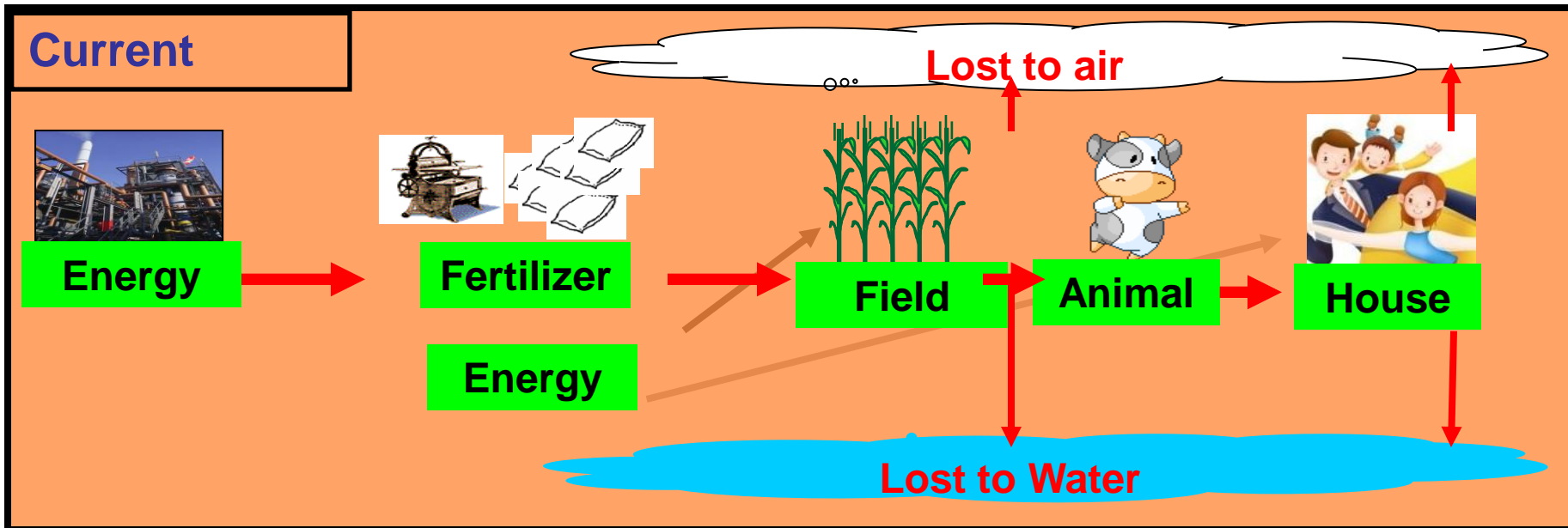
# Increased crop residues returning

On province-weighted average, returning rates of harvested crop straw were 23.5% in 1994 and 34.8% in 2000, respectively.



(Sources: Gao *et al.*, 2002; Zheng *et al.*, 2004)

# Extension of biogas technology in China



# Extension of biogas technology

Items	2005	2010	2015	Potential
Farmer biogas ( 10000 )	1807	4000	6000	14600
Biogas in animal plant	3556	4000	8000	40000
Coal saved ( 10000 t )	3006	6531	9886	24588
Urea saved ( 10000 t )	331	719	1089	2707
DAP saved ( 10000 t )	141	306	464	1153
Mop saved ( 10000 t )	238	517	783	1947

Calculated with data from 《 Biofuel Strategy of China ( 2007~2015 ) 》

**Potentially, biogas can substitute 37% energy demand in rural area, and substitute 46.7% N , 45% P<sub>2</sub>O<sub>5</sub> and 106.8% K<sub>2</sub>O demand of crop land.**

**•The challenge** — Fertilizer overuse is an issue, which leads to reduced income, low productivity and non-point source pollution

**What are the determinants of the use of fertilizers by farmers?**

High input and high output policy leads to higher use  
Modern varieties make it possible to apply more fertilizer  
extension leads to higher use

**•Perspectives:**

- Reform policies :agriculture and fertilizer industry
- Develop and extend fertilizer saving technologies
- Train farmers
- Reform current public agricultural extension system:
  - Stop the business of public agricultural extension agents
- Make new technology policy:
  - Encourage the development of fertilizer-sensitive technologies



# Acknowledgments

MOA (No. 2003-Z53)

*Thanks*

for your attention !

Welcome to Beijing



Plant Nutrition  
CAU, Beijing, China



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