

Fertilizer Consumption Trends in China vs. the Rest of the World

Patrick Heffer, IFA





Setting the Scene

- Population of 1.4 billion → food security is a top priority
- Chinese Government supports fertilizer consumption
 - encourages fertilizer production
 - subsidizes fertilizers at different steps
- Fastest growing fertilizer market in past decades
- Today, accounts for ~30% of global fertilizer use
- Average application rate among the highest in the world
- Prevalence of hunger halved between 1990-92 and 2014-16
- ... but environmental side effects



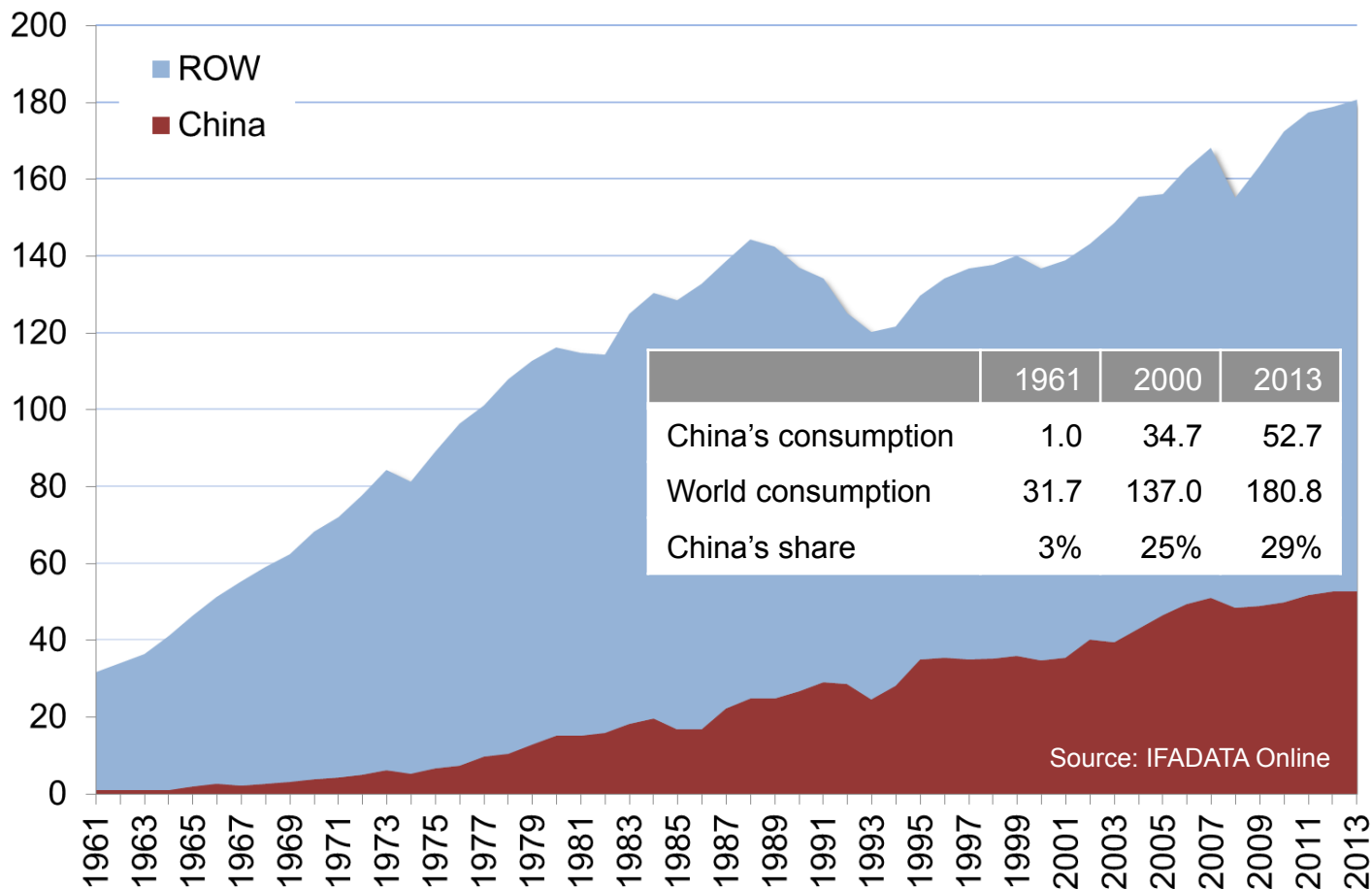


Historical Trend and Current Situation





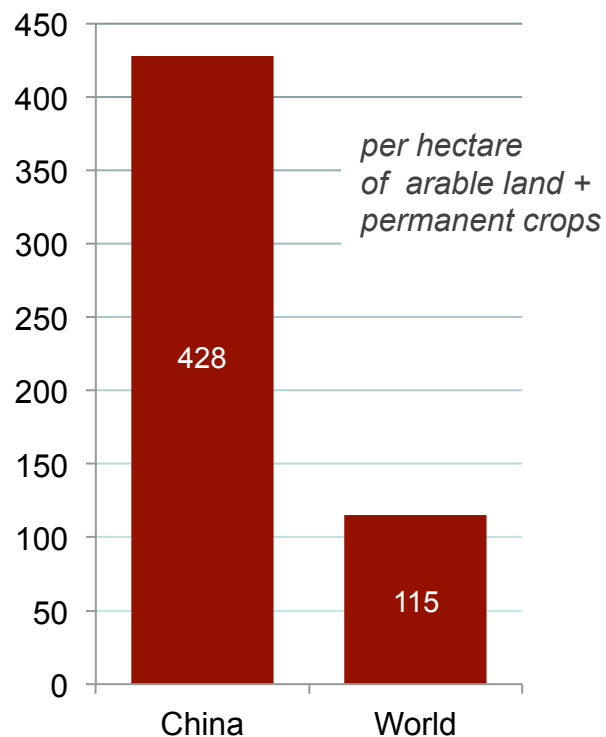
Fertilizer Consumption (*Mt nutrients*)





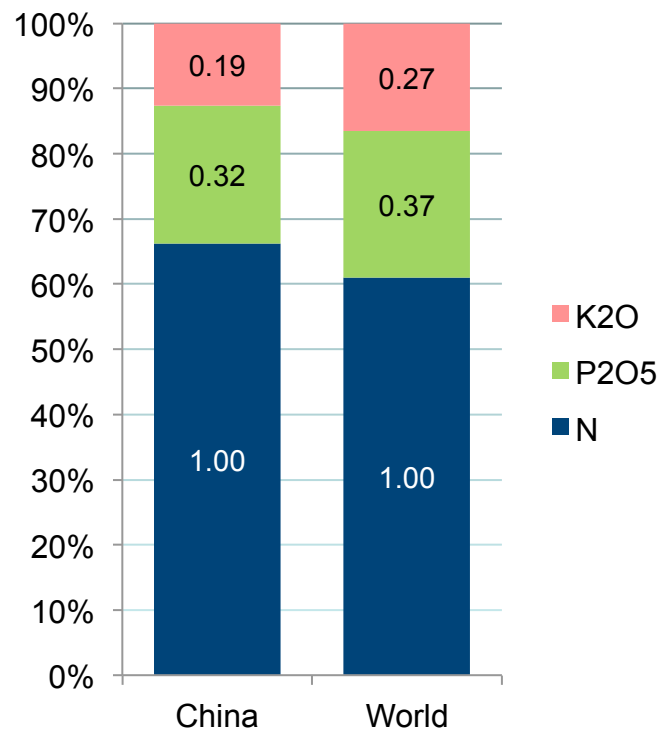
High Application Rate and Unbalanced N:P:K Ratio

Average Application Rate (kg nutrients/ha)



Sources: IFADATA Online + FAOSTAT

N:P₂O₅:K₂O Ratio

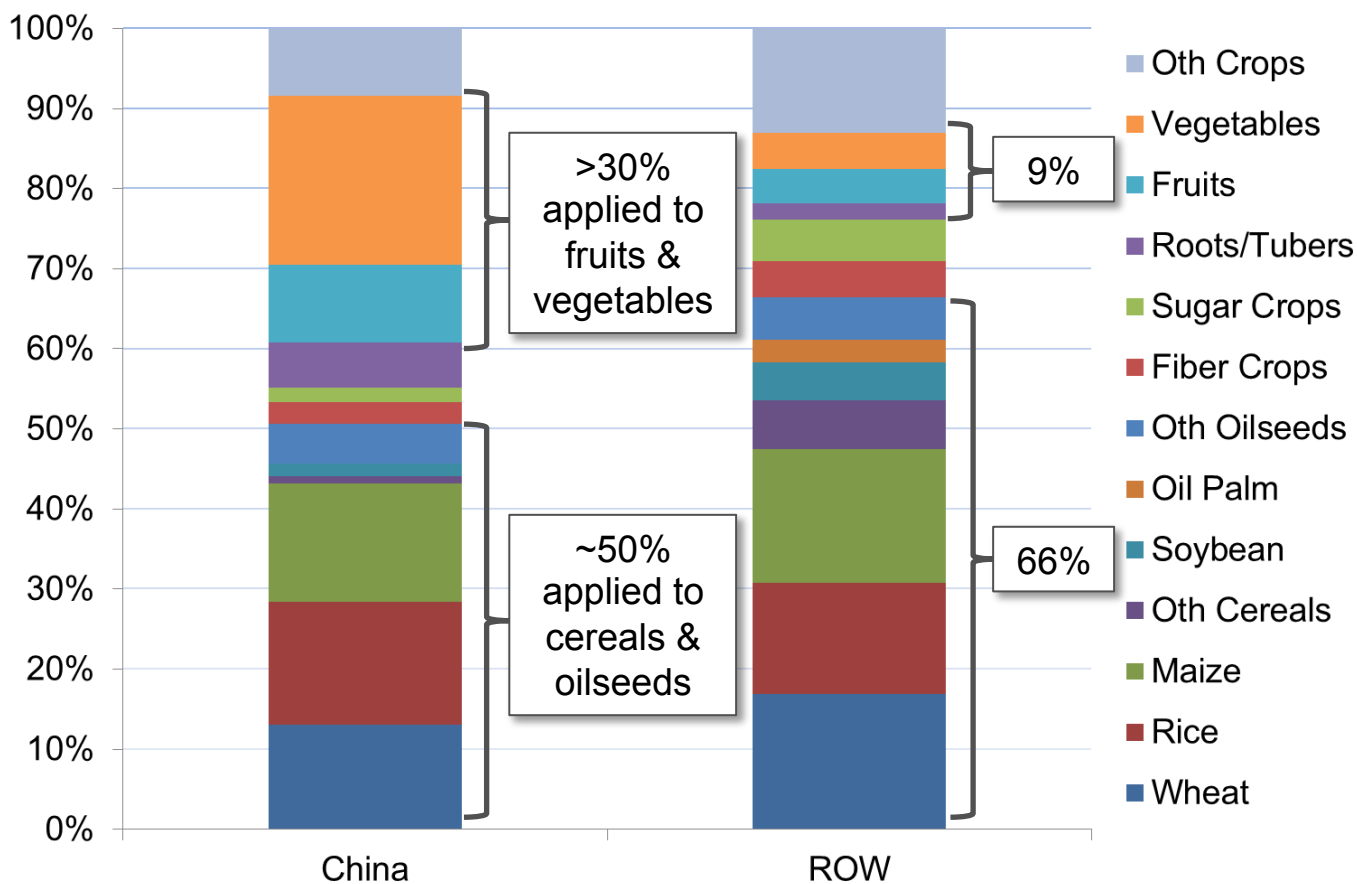


Source: IFADATA Online





Fertilizer Use by Crop in 2010/11

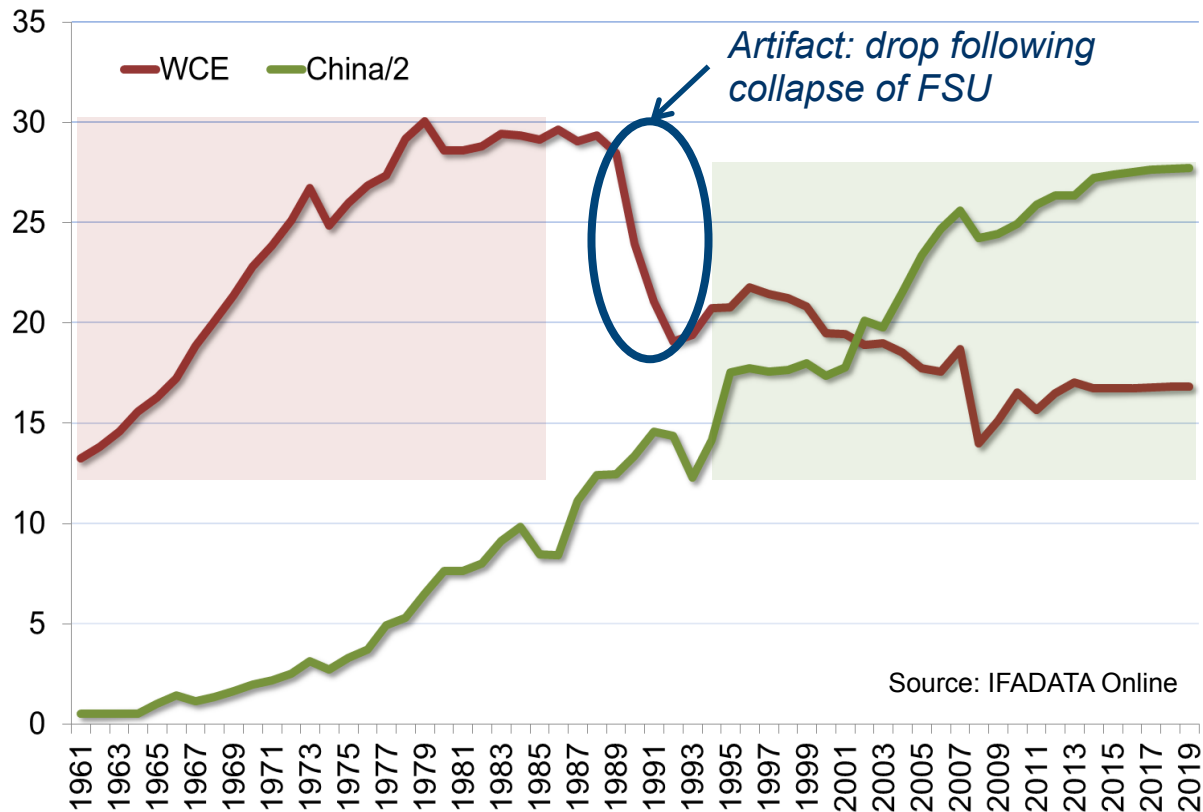


Source: Heffer, 2013



China vs. West & Central Europe

Fertilizer Consumption (Mt nutrients)



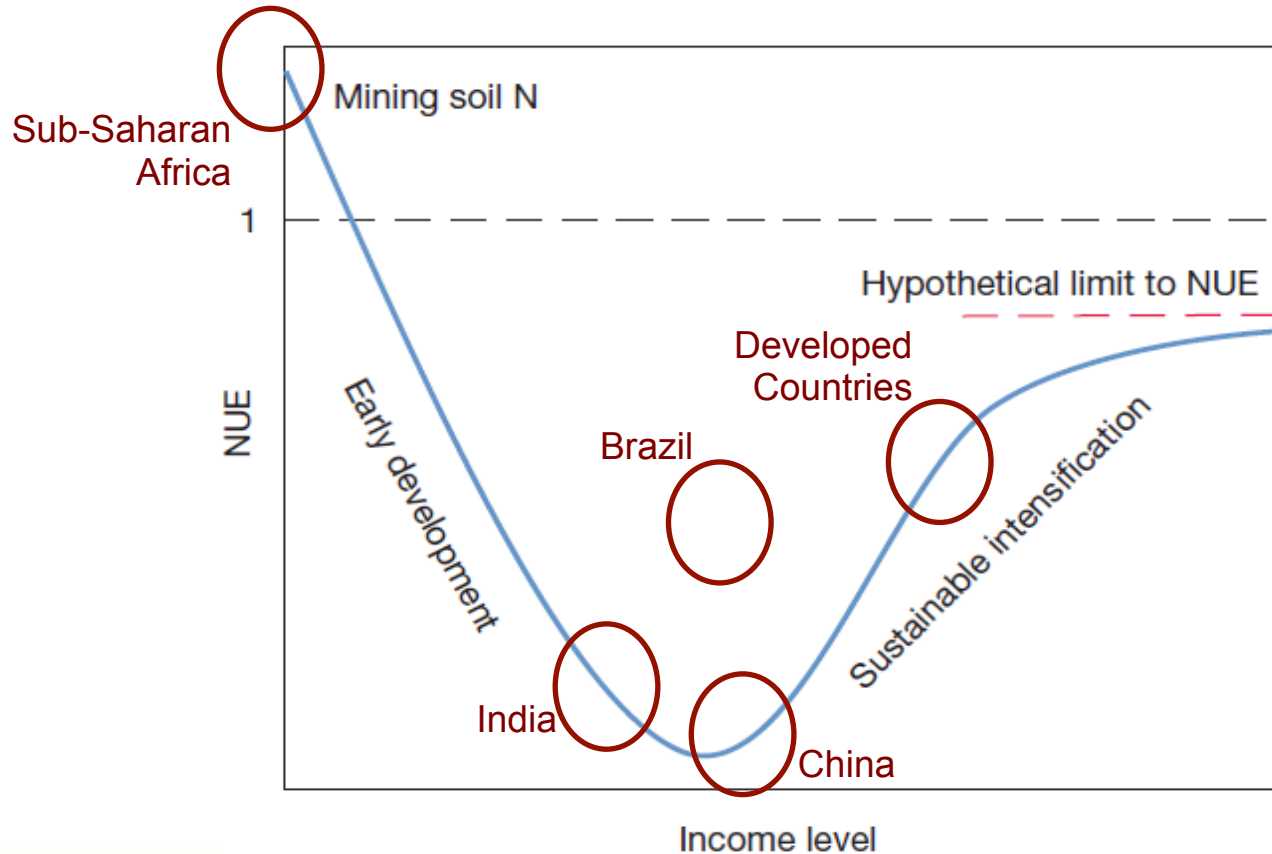
Similarity in trend with WCE 3 decades earlier
(red and green areas)

- Long history of agriculture and soil mining
- Followed by high application rates to rebuild soil fertility
- Positive nutrient balances for long periods
- Followed by plateauing demand
- Contraction in WCE since 1990s largely due to manure recycling



Typical Evolution of Nitrogen Use Efficiency (NUE) over Time

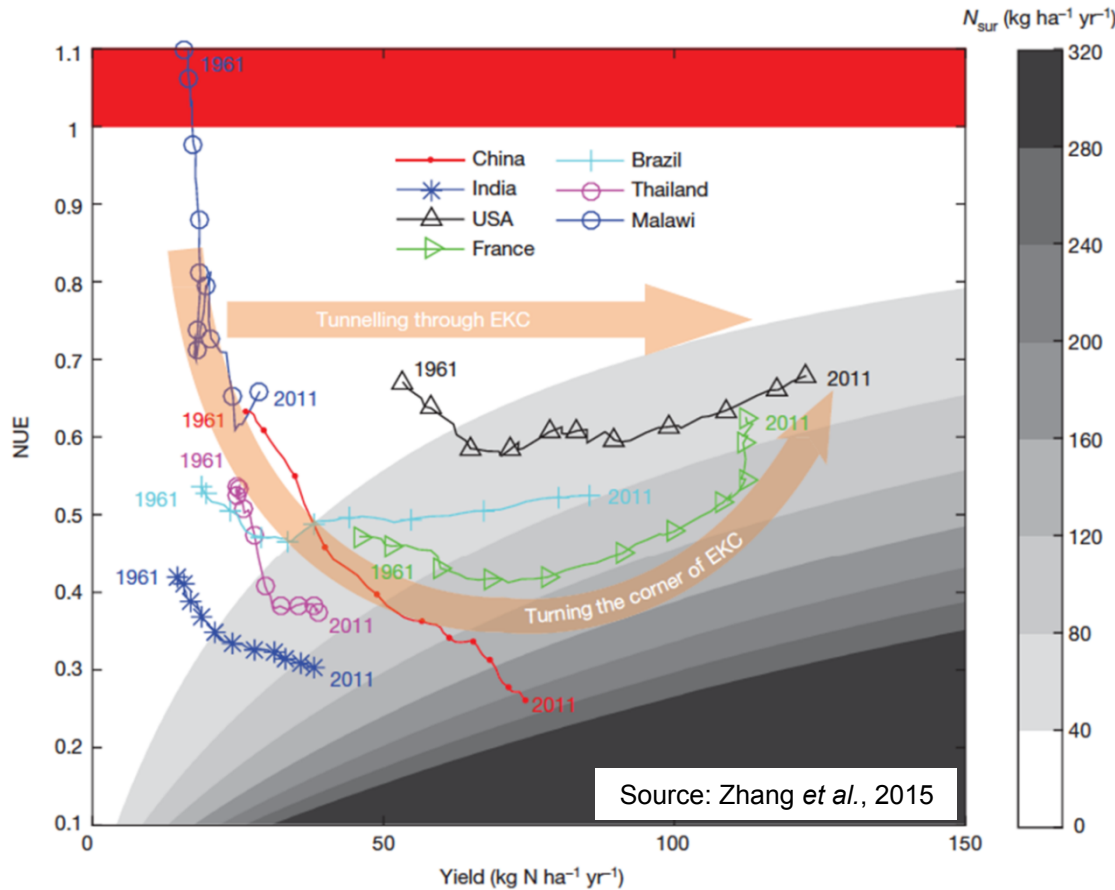
Different countries are on different points on the curve



$$NUE = \frac{N \text{ output}}{\text{Sum of } N \text{ inputs}}$$



Patterns of Nitrogen Use Efficiency (NUE) and Surpluses (N_{sur})



Recent Estimates of NUE

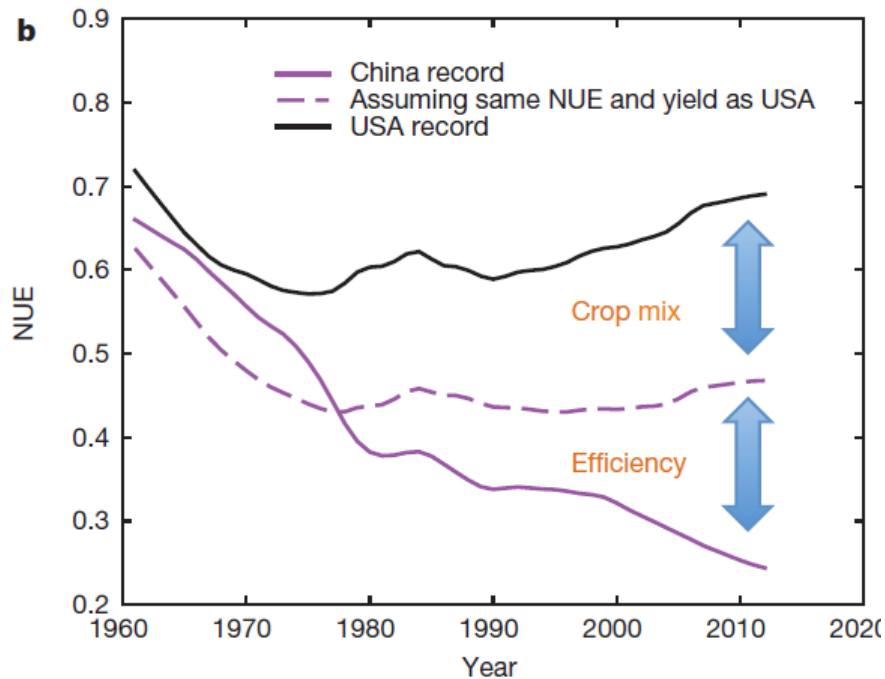
	China	World
Lassaletta <i>et al.</i> , 2014 (for 2009)	28%	47%
Zhang <i>et al.</i> , 2015 (for 2010)	25%	42%

Low NUE in China due to:

- Price incentives (fertilizer-to-crop price ratio)
- Sub-optimal farming practices (extension, mechanization)
- Unique crop mix (fruits and vegetables)



Impact of the Crop Mix on Nitrogen Use Efficiency (NUE)



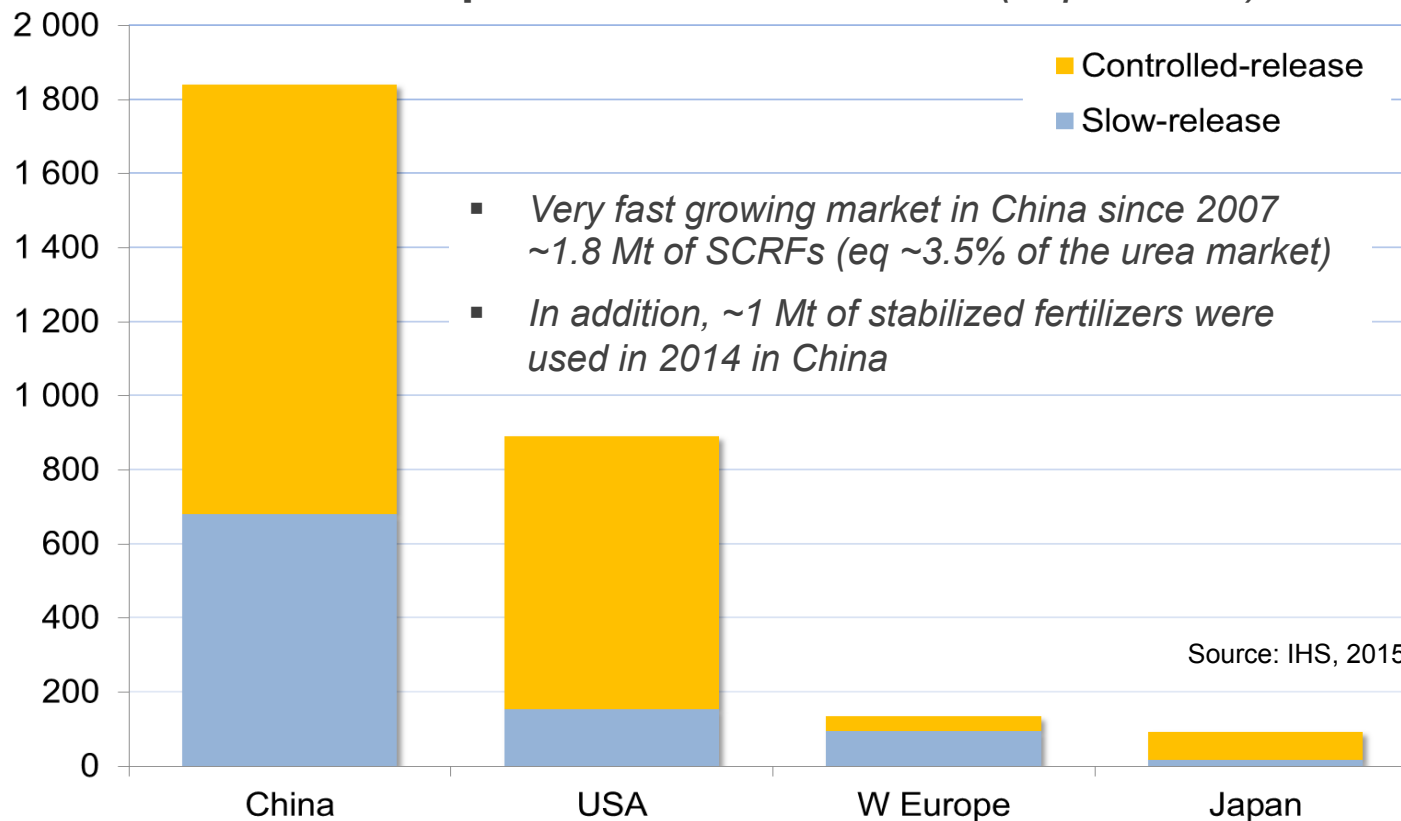
	Current (2010)		
	Harvest N (Tg N yr ⁻¹)	Input N (Tg N yr ⁻¹)	NUE
By crop type‡			
Wheat	13	30	0.42
Rice	11	29	0.39
Maize	13	28	0.46
Other cereal crops	5	9	0.53
Soybean	16	20	0.80
Oil palm	1	1	0.46
Other oil seed	4	10	0.43
Cotton	2	5	0.37
Sugar crops	1	5	0.19
Fruits and vegetables	3	25	0.14
Other crops	5	11	0.41
Total	74	174	0.42

Source: Zhang *et al.*, 2015



Adoption of Slow-and Controlled-Release Fertilizers (SCRFs)

Consumption of SCRFs in 2014 (kt products)





Medium-Term Prospects





Main Drivers of Medium- and Long-Term Fertilizer Demand in China

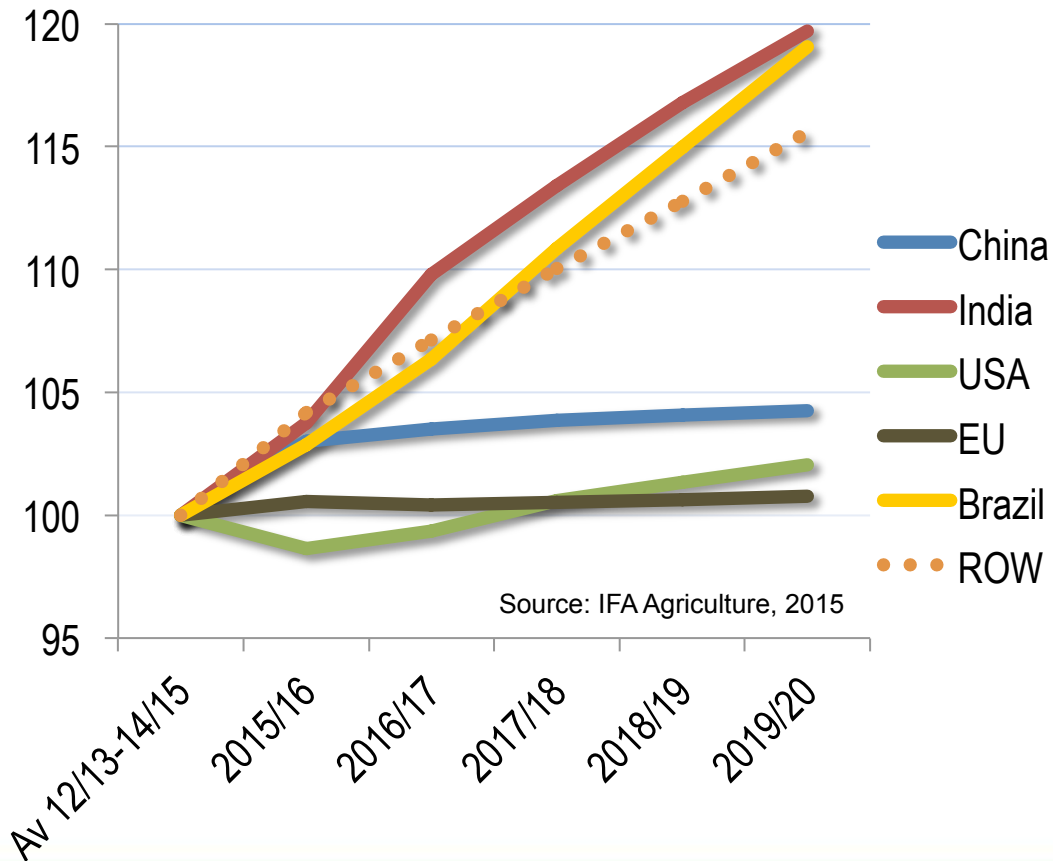
- Demographics (population peak towards 2030)
- Robust but progressively decelerating income growth and related diet diversification (livestock products, fruits & vegetables)
- Rising feed imports (soybean and maize)
- Larger amounts of livestock manure available for recycling
→ *virtual fertilizer imports*
- Large area planted to fruits and vegetables
- Labour shortage → mechanization → supports BMP adoption
- Fertilizer capping policy
How is it going to be implemented?
Reinforces trend observed since 2007
- Agricultural production to grow faster than fertilizer demand
→ *Improved fertilizer use efficiency*





Medium-Term Fertilizer Demand Prospects in the Main Markets

Aggregate Fertilizer Demand (Mt nutrients)



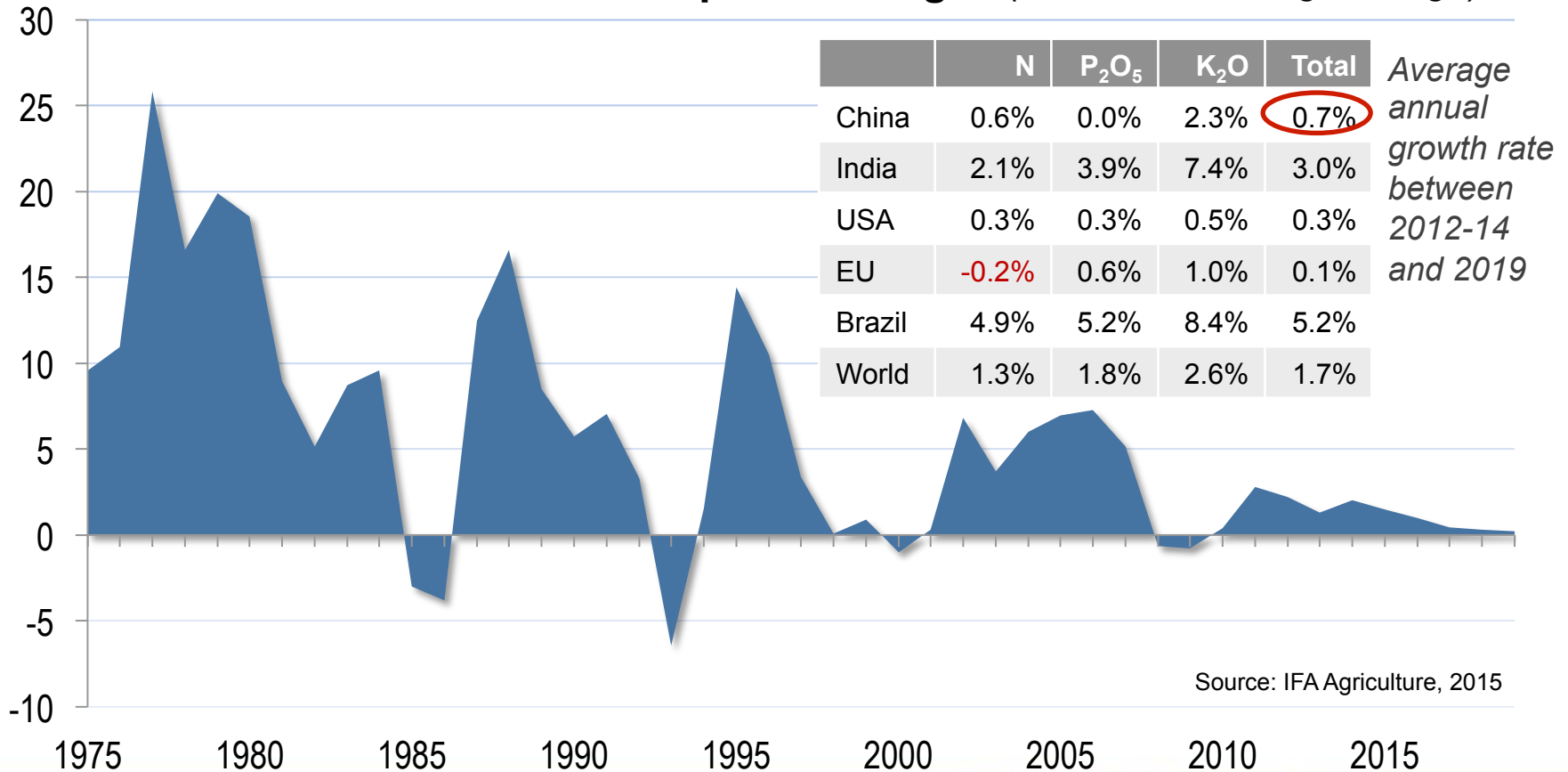
- Demand reaches a plateau in China
- Marginal growth in the EU and the US
- More than half of the world market is 'mature'
- Robust rebound in India
- Steady growth in Brazil (*Latin America equals North America in 2019/20*)
- Firm growth in the ROW
- Africa 4th contributor in volume





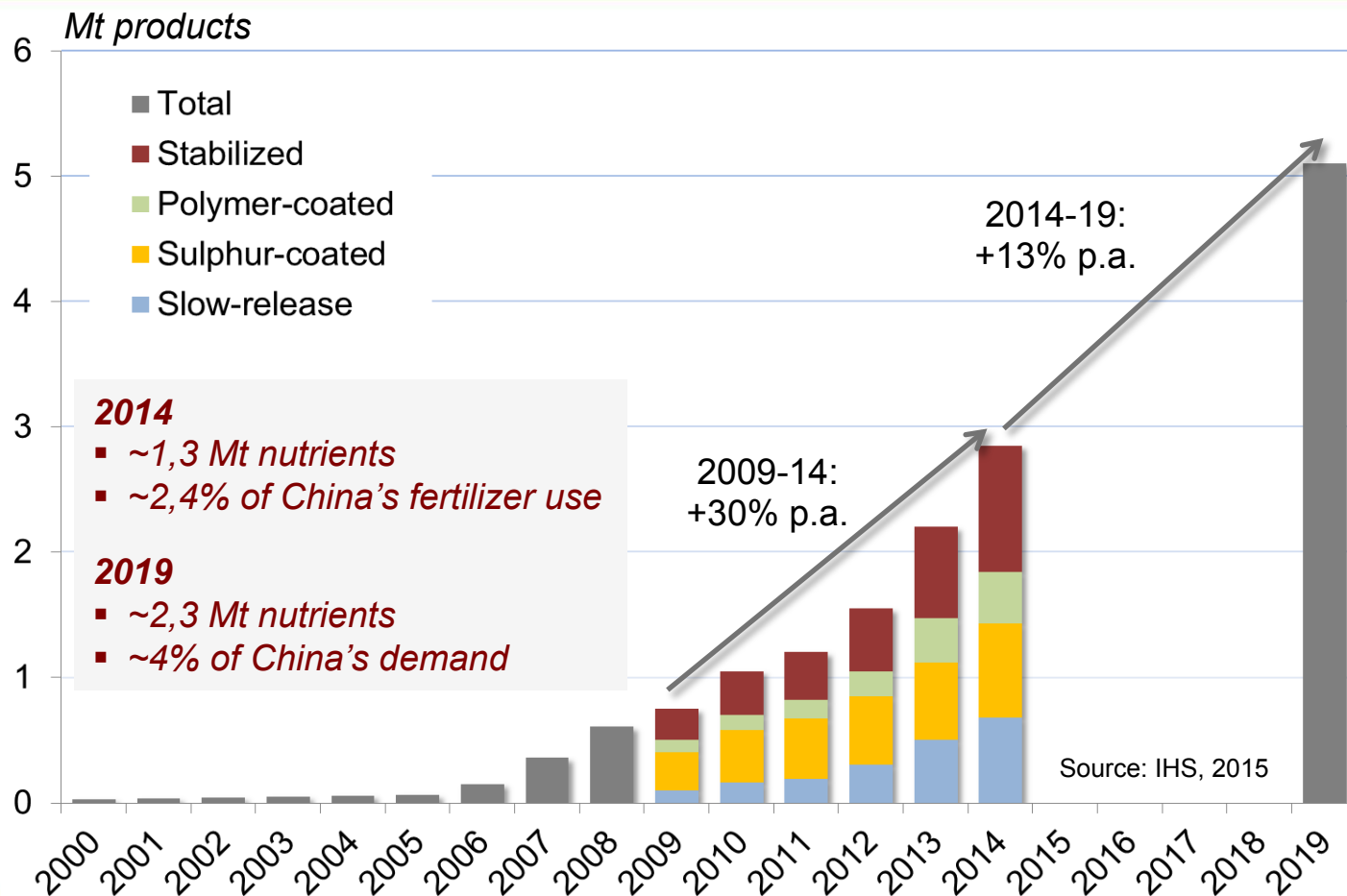
China's Progressive Move Towards Zero Consumption Growth

China's Year-on-Year Consumption Changes (%; 3-Year Moving Average)





Outlook for Slow-and Controlled-Release and Stabilized Fertilizer Use in China



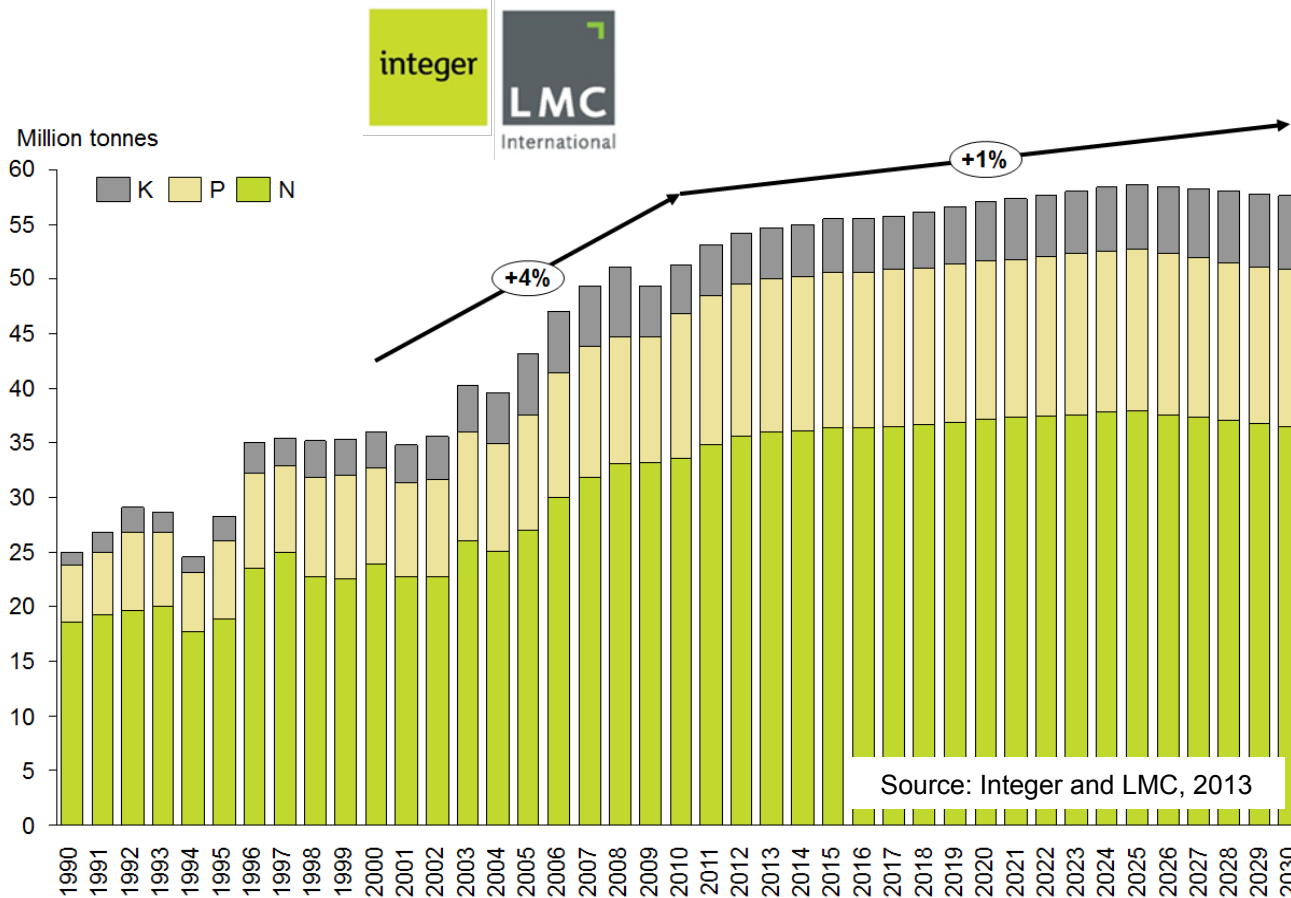


Long-Term Projections





Fertilizer Demand in China Projections to 2030 (*Mt nutrients*)



Assumptions bw 2010 and 2030:

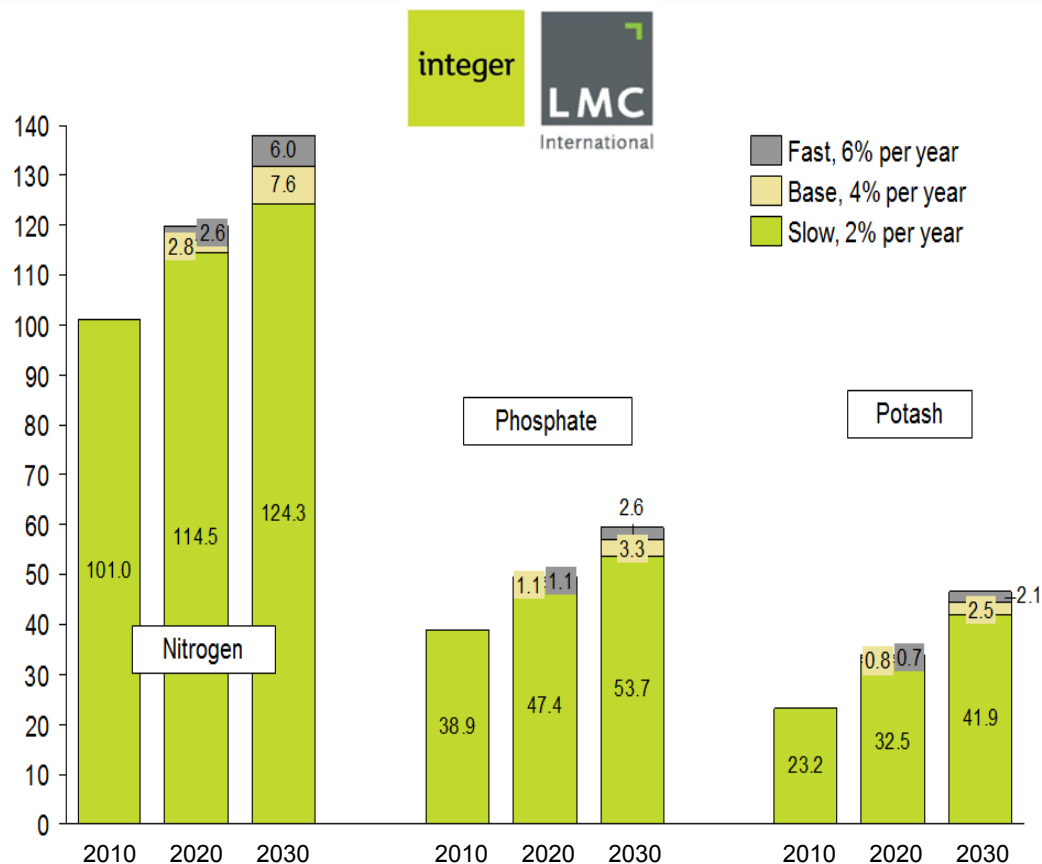
- 1% drop in cropland area (to 169 Mha)
- Rising area planted to fruits & vegetables (+23%) to detriment of cereals (-15%)
- Yield increases of 0.7-1.0% p.a. for cereals; 1.3% p.a. for fruits & vegetables
- Improved agricultural practices: lower rates for N and P and higher rates for K

NB: Projections developed before China's policy capping fertilizer demand growth



Global Fertilizer Demand Outlook

(Mt nutrients)



Source: Integer and LMC, 2013

Outlook to 2030 under Baseline Scenario (Mt nutrients)

	2000	2013	2030
China's consumption	34.7	52.7	57.6
World consumption	137.0	180.8	233.3
China's share	25%	29%	25%

Key lessons:

- Declining impact of China on global fertilizer demand growth
- Anticipated drop bw 2020 and 2030 would partly offset growth elsewhere (SE Asia, Latin America, Sub-Saharan Africa)



NUE Changes Needed to Halve Global N Surplus between 2010 and 2050

	Current (2010)				Projected (2050)			
	Harvest N (Tg N yr ⁻¹)	Input N (Tg N yr ⁻¹)	NUE	Surplus N (Tg N yr ⁻¹)	Projected harvest N* (Tg N yr ⁻¹)	Target NUE	Required input N (Tg N yr ⁻¹)	Resulting surplus N (Tg N yr ⁻¹)
By region†								
China	13	51	0.25	38	16	0.60	27	11
India	8	25	0.30	18	11	0.60	19	8
USA and Canada	14	21	0.68	7	19	0.75	25	6
Europe	7	14	0.52	7	10	0.75	13	3
Former Soviet Union	4	6	0.56	3	6	0.70	8	2
Brazil	6	11	0.53	5	10	0.70	15	4
Latin America (except Brazil)	7	12	0.52	6	10	0.70	15	4
Middle East and North Africa	3	5	0.48	3	4	0.70	5	2
Sub-Saharan Africa	4	5	0.72	2	9	0.70	13	4
Other OECD countries	1	2	0.52	1	2	0.70	2	1
Other Asian countries	8	19	0.41	11	10	0.60	17	7
Total	74	174	0.42	100	107	0.67	160	52

Projected changes bw 2010 and 2050 (Mt)

China	India	N. Am	WC Eu	Brazil	ROW
-24	-6	+4	-1	+4	+9

Source: Zhang *et al.*, 2015

THIS IS NOT A FORECAST. In their article, Zhang *et al.* argue that halving the global N surplus from 100 Mt N 2010 to 52 Mt N in 2050 would require increasing global NUE from 42% to 67%. In order to achieve this global target, NUE would have to increase from 25% to 60% in China during the same 40-year period. This would require reducing the total N input in China from 51 to 27 Mt N. The authors don't discuss whether this projection is achievable.





In Summary

- In past decades, China has been the main engine of global fertilizer demand growth
- Decelerating demand growth since 2007, to be followed by plateau towards 2020, and possible drop (for N and P) between 2020 and 2030 (and beyond); K demand would increase steadily
- Among the highest application rates and lowest NUE levels in the world; partly due to large fruit and vegetable area
- Reflecting anticipated yield increases and plateauing N demand, NUE is expected (has started?) to rebound, following three decades later trend observed in developed countries
- NUE in China is expected to remain lower than in developed countries owing to its crop mix



*for questions/comments:
pheffer@fertilizer.org*



2016 BEIJING, CHINA

CHINA WORLD HOTEL / Monday 4th - Wednesday 6th April

THE 4th INTERNATIONAL CONFERENCE ON SLOW- AND CONTROLLED- RELEASE AND STABILIZED FERTILIZERS

Organisers:



NEW AG INTERNATIONAL

Official Media Partner

