SRUC

Long-term management of nutrients in organic farming: principles and practice

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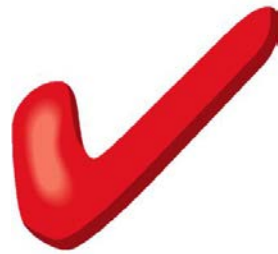
Leading the way in Agriculture and Rural Research, Education and Consulting

Preparing for the future

- A threefold challenge now faces the world:
  - Match the rapidly changing demand for food from a larger and more affluent population to its supply
  - Do so in ways that are environmentally and socially sustainable
  - Ensure that the world's poorest people are no longer hungry

- This challenge requires changes in the way food is **produced, stored, processed, distributed**, and **accessed** that are as radical as those that occurred during the 18th- and 19th and …. 20th-centuries

Food Security: The Challenge of Feeding 9 Billion People
Godfray, Beddington, Crute, Haddad, Lawrence, Muir, Pretty, Robinson, Thomas, Toulmin
Science 327, 2010



Organic farming

- Principle of Ecology: "*Organic Agriculture should be based on living ecological systems and cycles, work with them, emulate them and help sustain them.*"
- Regulation: **Council Regulation (EC) No 834/2007 of 28 June 2007 Whereas ..**(13) The essential elements of the organic plant production management system are soil fertility management, choice of species and varieties, multiannual crop rotation, recycling organic materials and cultivation techniques. Additional fertilisers, soil conditioners and plant protection products should only be used if they are compatible with the objectives and principles of organic production.

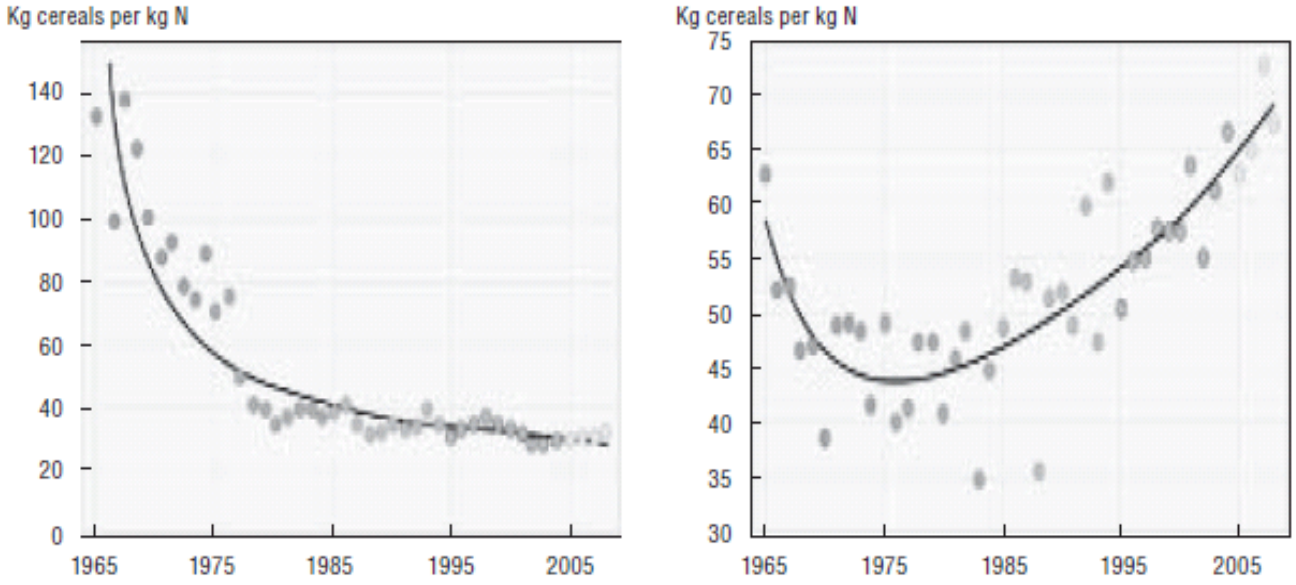
Nutrient management– are we meeting the objectives and principles?

- **Are we optimising recycling of nutrients within farms?**
  - farm scale efficiency
  - organic vs conventional?
  - human waste
- **Are we optimising recycling of nutrients between farms?**
  - poultry - arable partnerships
  - could similar ideas help organic glasshouse horticulture?
- **World trade issues**
  - how can we balance imports and exports?
  - how can we waste less?
- **Sustainable sourcing**

More efficient use of nutrients

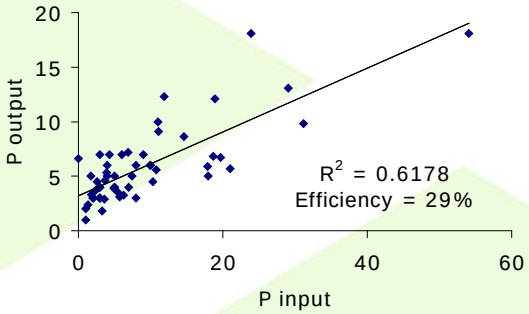
Figure 2.14. **Evolution of nitrogen use efficiency in China and United States**

China (left figure) and United States (right figure)



Source: International Fertiliser Association.

Nutrient management strategies



Nutrient use efficiency

Appropriate plant breeding

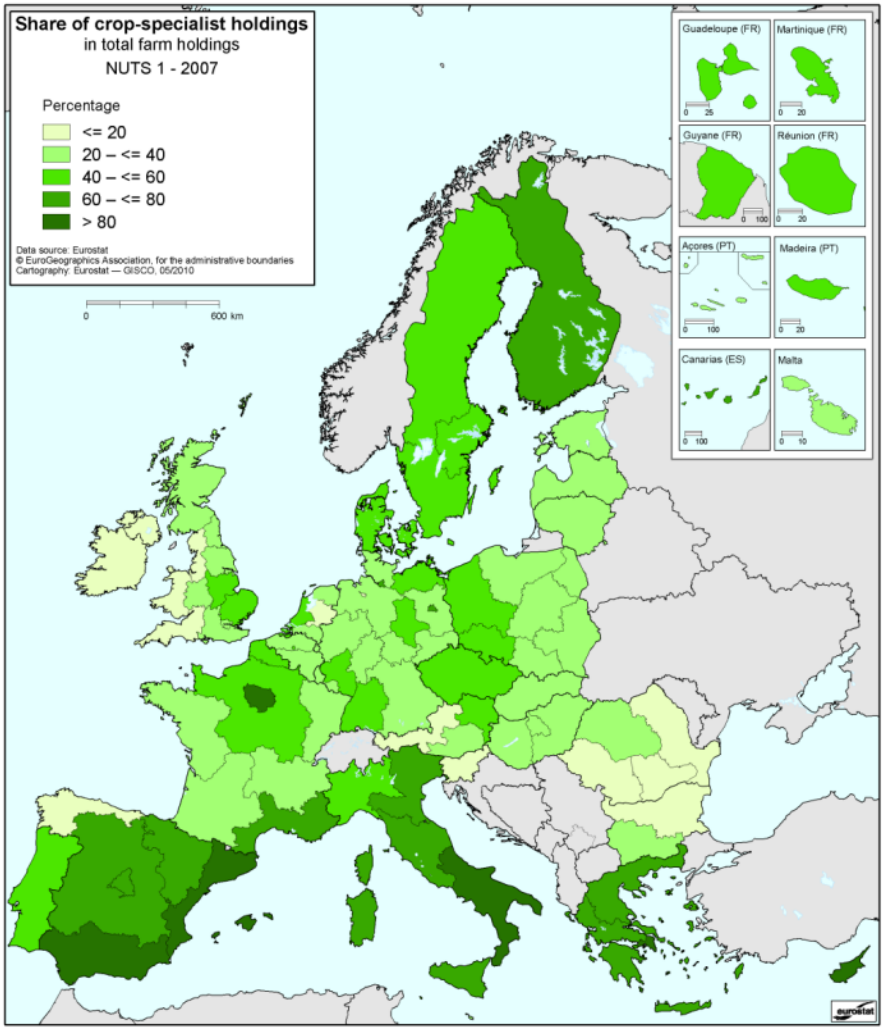
Better rotations

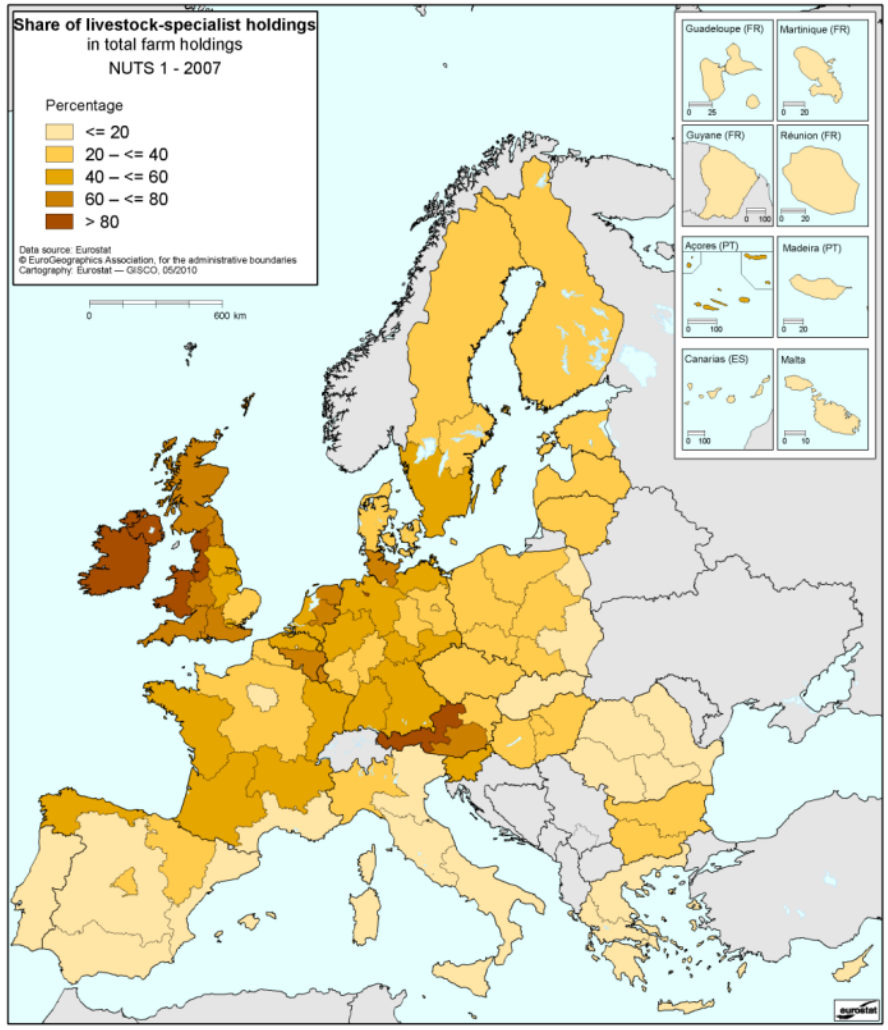
Better use of legumes

Effect of legume on following crop in rotation

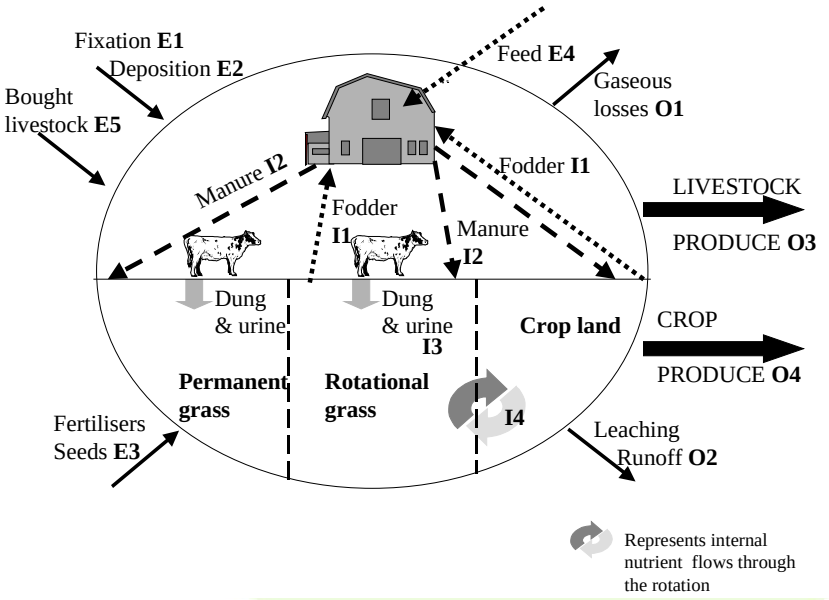
Pre crop	Subsequent crop	Yield effect %	Yield effect Kgha^{-1}	Source
Pea	Barley	13-62	671-1500	Jensen et al. 2004
	Barley	15	799	Jensen and Haahr 1990
	Wheat	9	493	Jensen and Haahr 1990
	Wheat	-2	-147	Kaul 2004
	OSR	10	580	Charles and Vullioud 2001
	OSR	19	499	Jensen and Haahr 1990
	OSR	54	1364	Kaul 2004
Faba bean	Wheat	3		Keskitalo et al. 2012
	Wheat	62	2693	Köpke 1997
	Wheat	3	221	Kaul 2004
	OSR	13	328	Kaul 2004

EU agriculture: Separation (disconnection) of crops and livestock – can organic do better? Mixed farming?

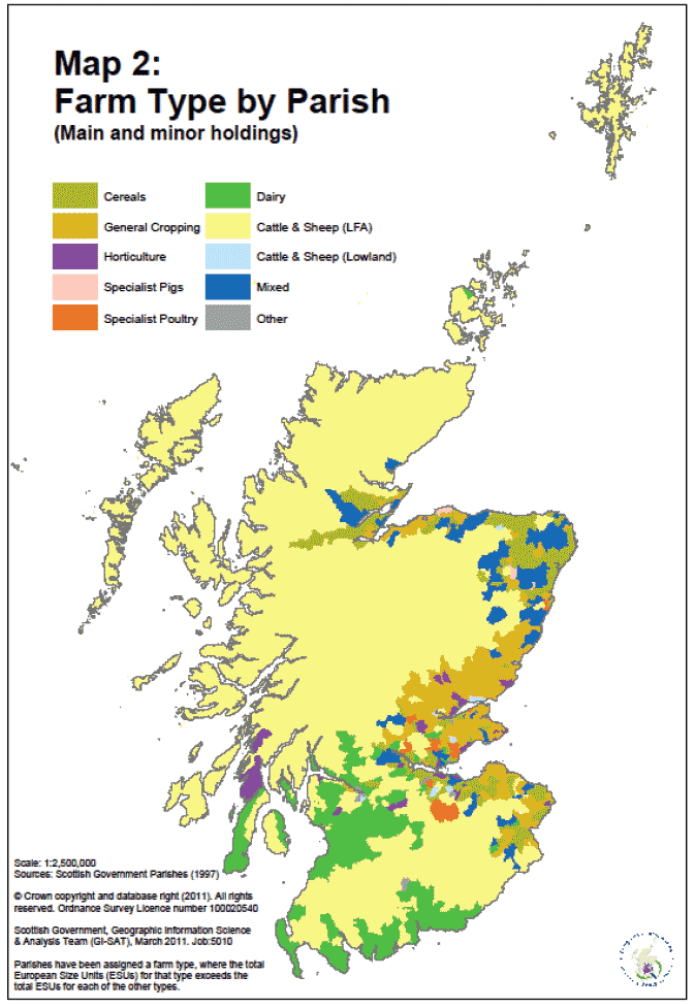




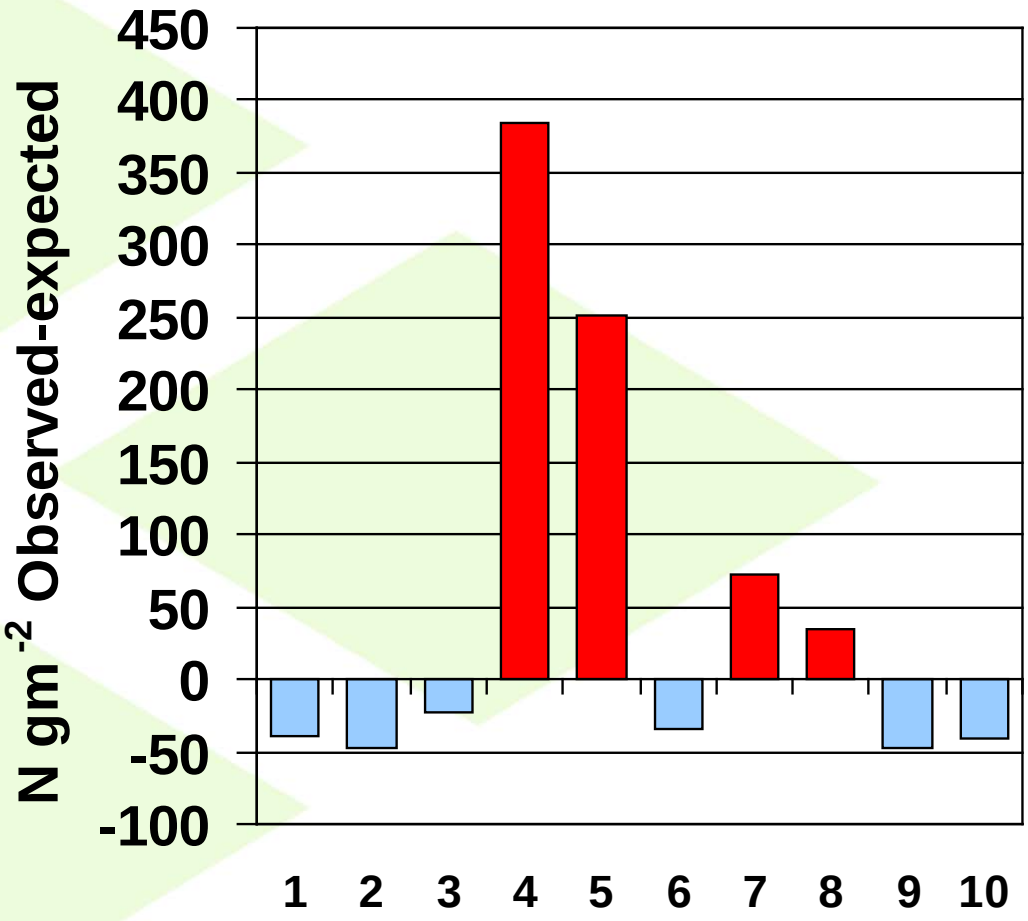
Mixed but at what scale?

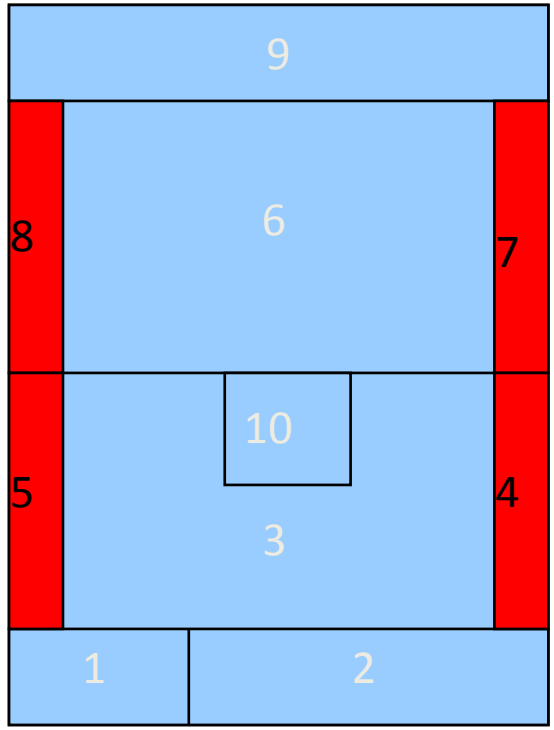


Watson et al. 2005 Soil Use & Management

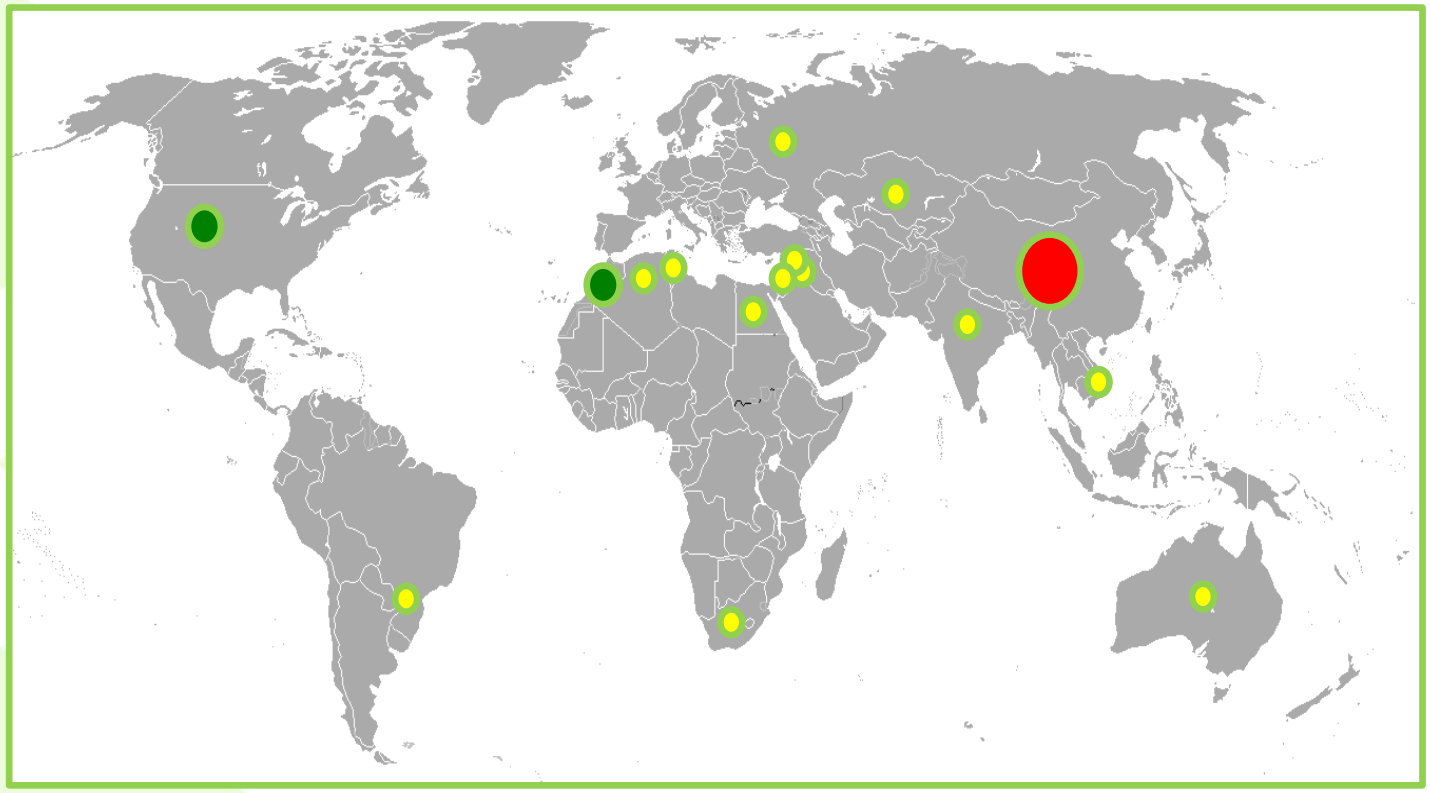


Relationship between N deposition observed and expected in outdoor pig paddocks (Watson et al. 2003)





Where in the world are our reserves of P?



16 countries produce 95% of the world's P (159 MT phosphate rock)

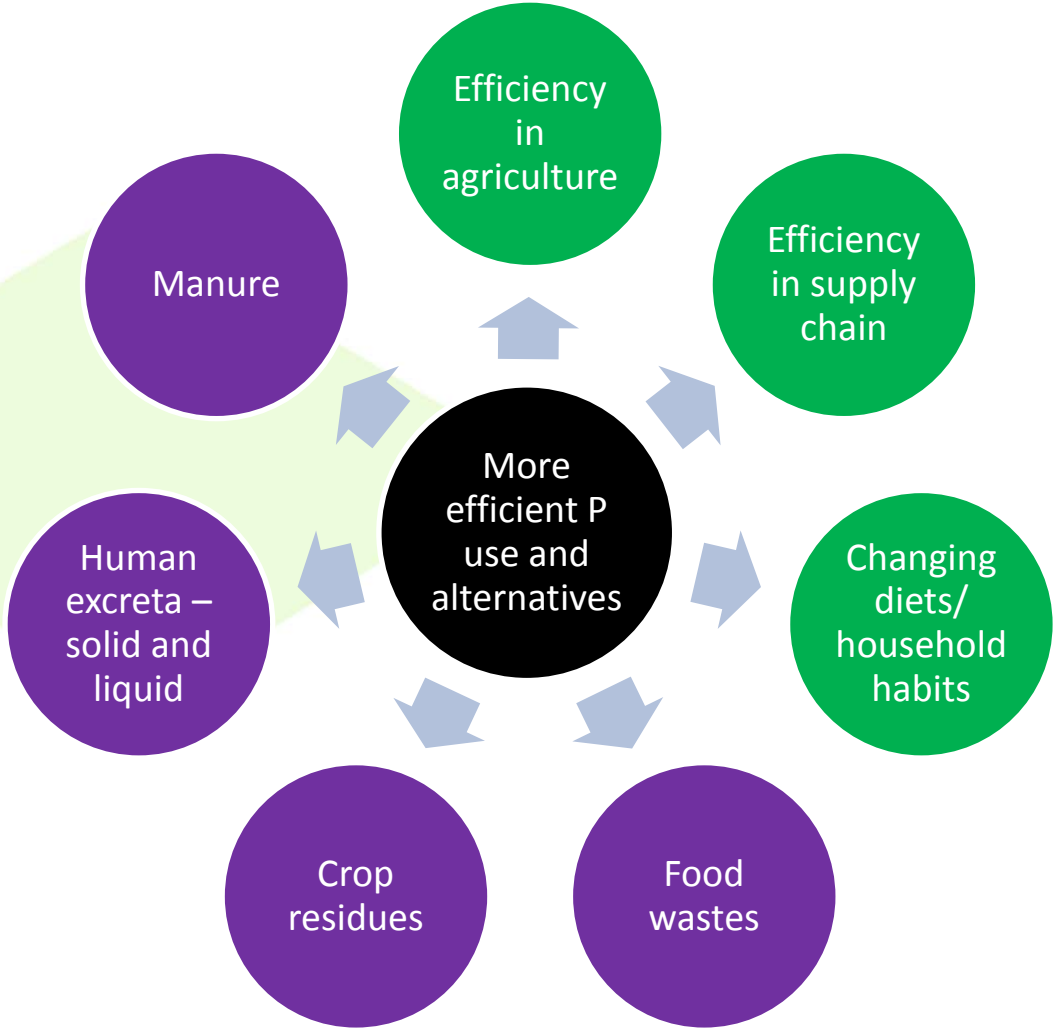
30% global production

10-20% global production

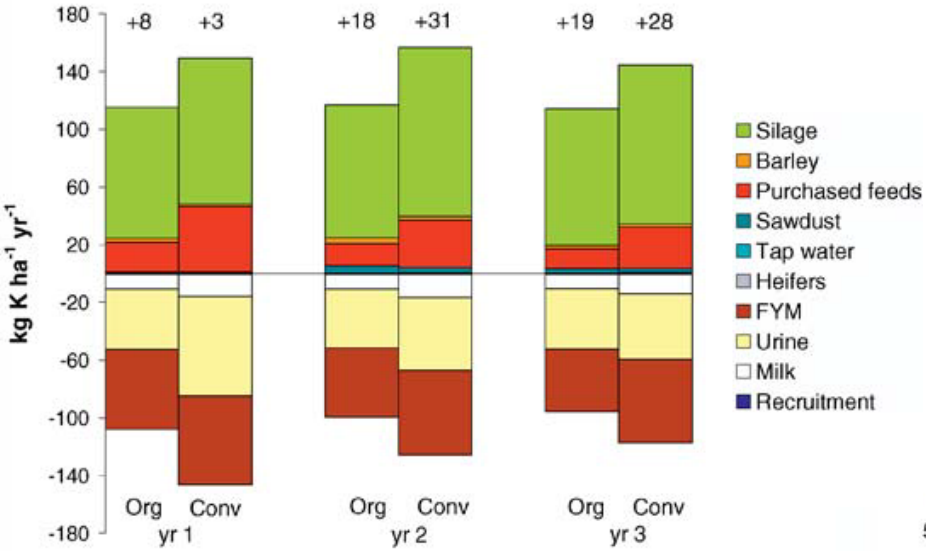
1-10% global production

Source: David Manning Newcastle University

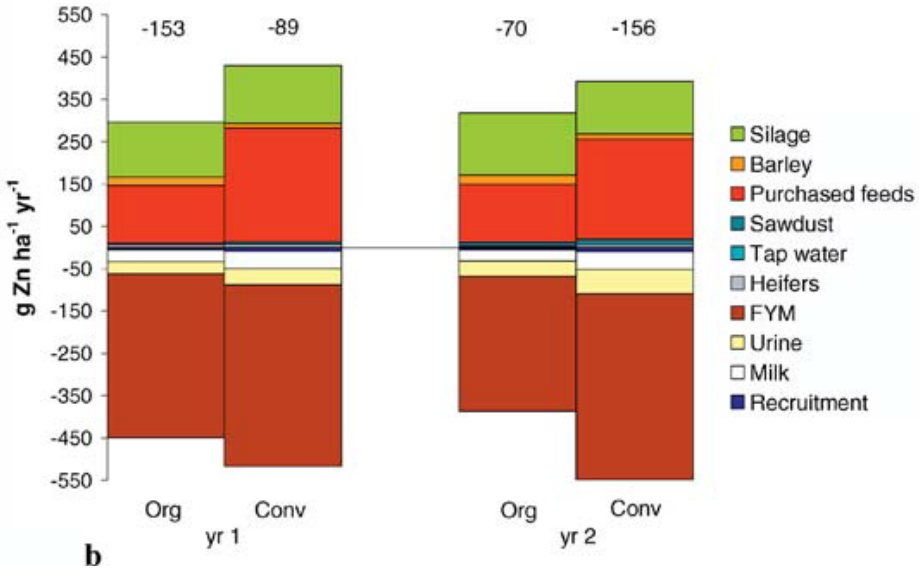
What can we do about P?



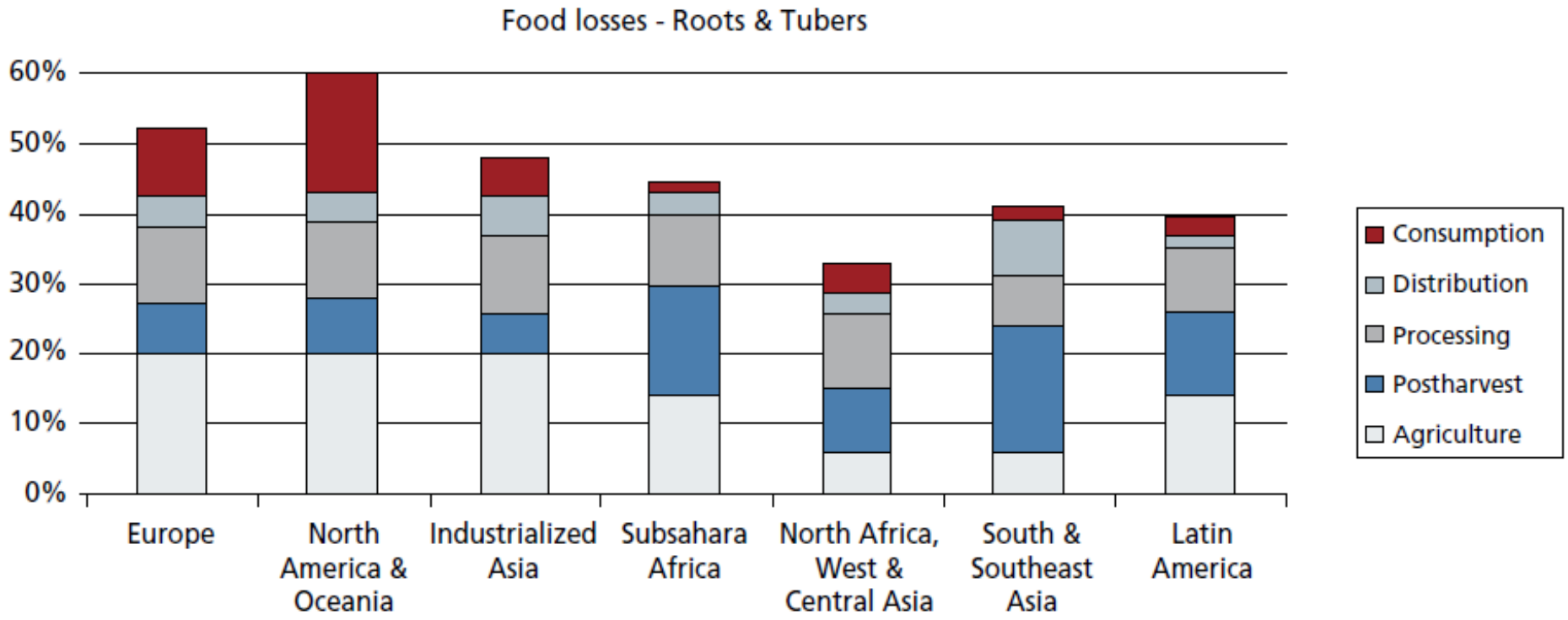
Macro and micro elements are important!



Farm gate K and Zn balances for Öjebyn organic and conventional dairy farm in N Sweden.
Öborn et al. 2005 Ambio.



Where do wastes originate in the production chain ?



Global food losses and food waste. FAO 2011

Nutrients per t fresh weight

	Kg N/t	Kg P/t	Kg K/t
Cereal	13	3.4	4.6
Cereal straw	4	0.5	7.9
Peas dried	54	3.9	8.3
Potatoes	3	0.5	4.8
Cauliflower	6	0.6	4.0

NUTRIENT ~~AIR~~ MILES

Some topics for discussion

- Scale

- Resource availability will be a major constraint going forward e.g. land, water, nutrients, soils, “waste” management, genetics

- Our ability to adapt to changes and challenges!
  - knowledge, technology, agricultural and environmental policy, ethics, economics and ORGANIC REGULATIONS?

- Principles and practice – does organic farming meet our own expectations?