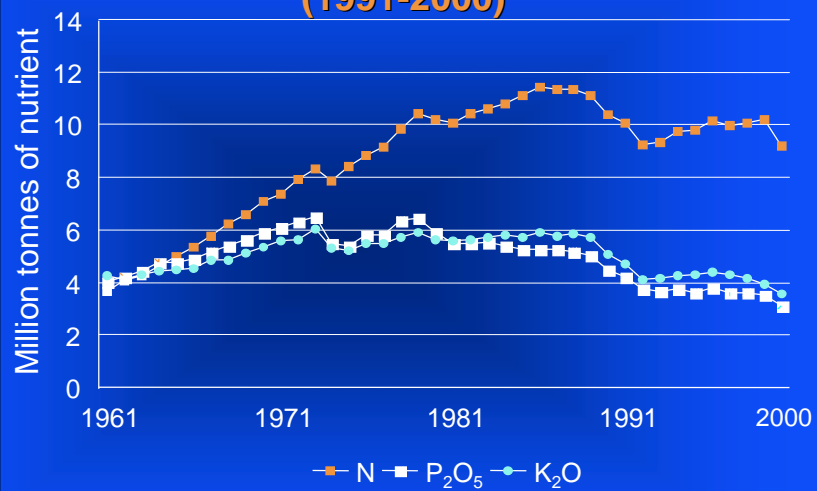


The effect of organic farming on fertilizer use in Europe

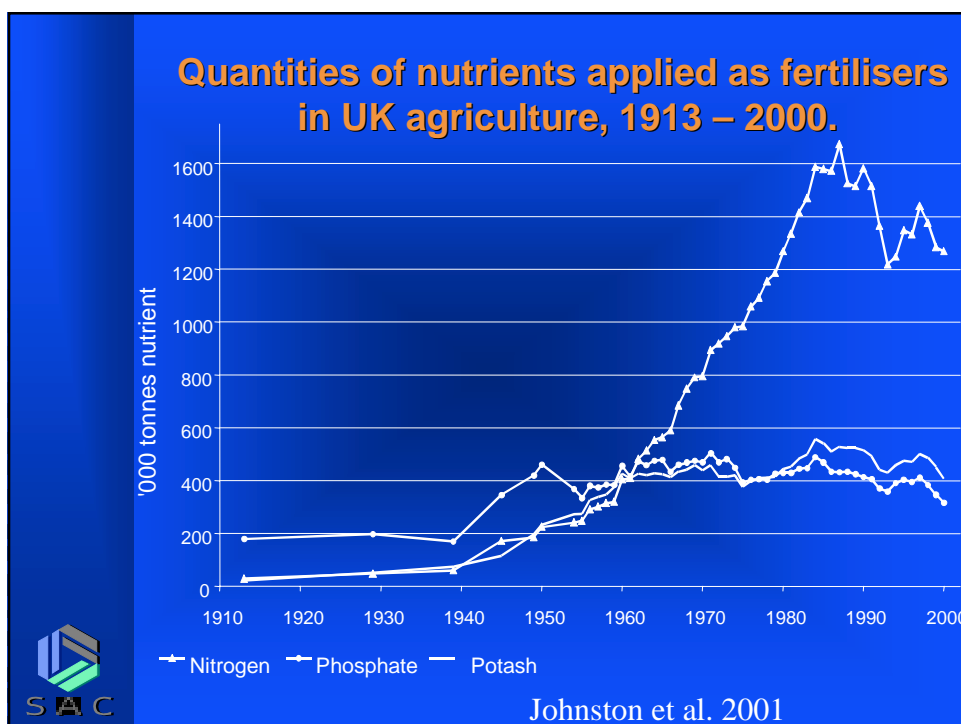
C A Watson, D Atkinson & AE Johnston



Fertiliser consumption in Western Europe (1961-2000)



Johnston et al. 2001



What is organic farming?

The only legally defined form of agriculture

- ◆ **Council regulation 2092/91**
- on organic production of agricultural products and indications referring thereto on agricultural products and foodstuffs
- ◆ **Council regulation 1804/99**
- Supplementary regulation referring to agricultural products and foodstuffs including livestock production.

Principles of organic production

- ◆ Working with natural processes rather than seeking to dominate them
- ◆ The encouragement of biological cycles at all levels
- ◆ Maintenance and development of valuable existing landscape features and adequate habitats for the production of wildlife
- ◆ Careful attention to animal welfare
- ◆ Avoidance of pollution
- ◆ Consideration for the wider social and ecological impact of farming



Maintaining and increasing soil fertility and biological activity

- ◆ Use of appropriate multi-annual rotations including legumes
- ◆ incorporation of livestock manure from organic livestock production (limited quantities)
- ◆ incorporation of other organic material, composted or not, from approved holdings

AND

- ◆ limited use of non-synthetic fertilizers and conditioners of low solubility

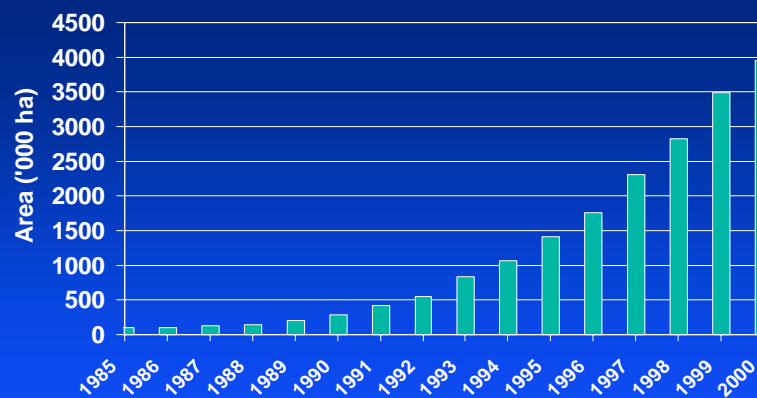


Why is there a move to organic farming in Europe?

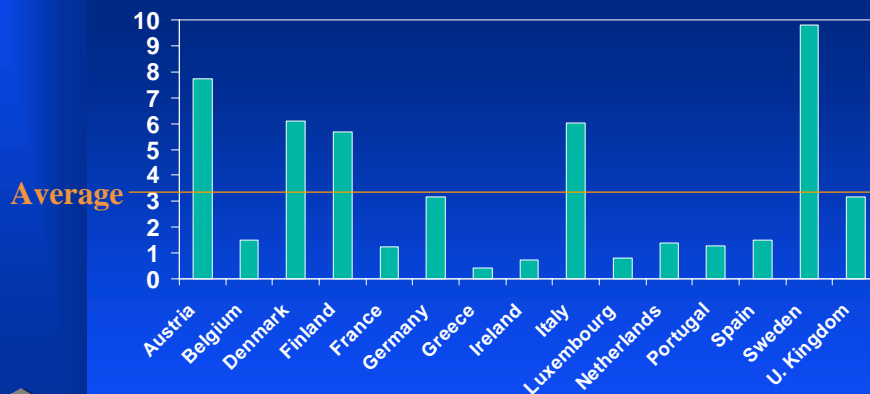
- ◆ **Agricultural subsidies**
- ◆ **Consumer pressure**
 - pesticides
 - food scares
 - health
 - environment
 - animal welfare
- ◆ **Legislation**
 - water framework directive



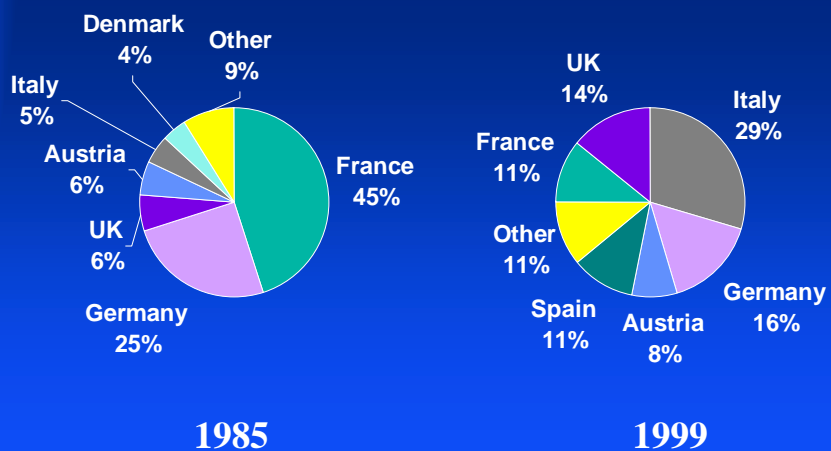
Certified and policy-supported organic and in-conversion land area in Europe



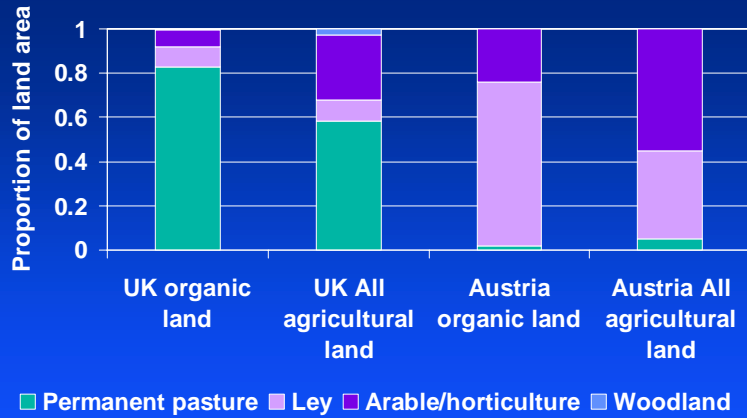
% utilised agricultural area which is certified organic or in-conversion



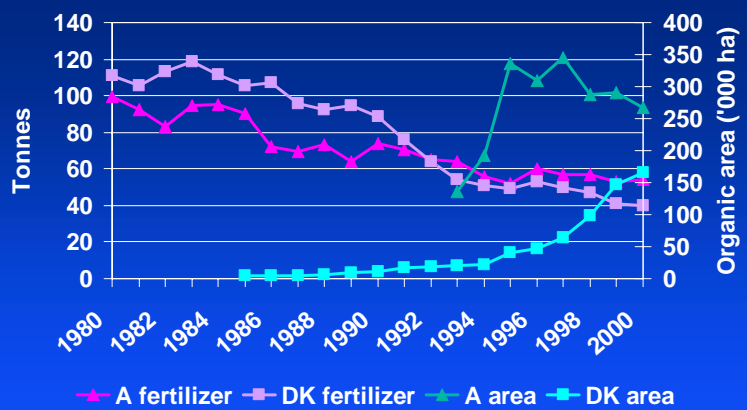
Share of organic land by EU Member State



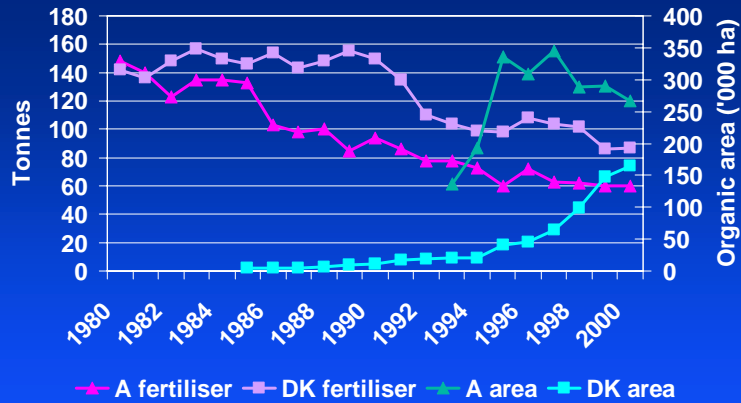
What is the influence of conversion to organic farming on cropping patterns?



Growth of organic land area and P₂O₅ use in Austria and Denmark



Growth of organic land area and K₂O use in Austria and Denmark



Case study: UK mixed farm

Freely draining sandy loam
720 mm annual rainfall

♦ Organic (actual cropping)

Spring cereals (12.8ha)
Potatoes (3.2 ha)
Swedes (3.2ha)
Grass/clover (20.2 ha)
Perm grass (13.7 ha)

♦ Conventional (based on max economic return)

Spring cereals (16.6 ha)
W wheat (6.5 ha)
Potatoes (6.5 ha)
Carrots (6.5 ha)
Set-aside (3.3 ha)
Perm grass (13.7 ha)



Organic farm - fertilizer use

- ◆ Rock phosphate applied once every 5 years (on a rotational basis)
- ◆ Other nutrients where permission granted by certifying body



Conventional farm - average fertilizer use per annum

- ◆ 83 kg N/ha
- ◆ 93 kg P₂O₅/ha
- ◆ 123 kg K₂O/ha



Based on MAFF 2000 (RB 209)

P sources in organic farming

PERMITTED	RESTRICTED	PROHIBITED
Rock phosphate	Basic slag	Super phosphate/ TSP
	Bone meal	Fibrophos
	Fish meal	

Note: Also manure/slurry and green waste compost from acceptable sources
No sewage sludge



K Sources in organic farming

PERMITTED	RESTRICTED	PROHIBITED
Kali vinasse	Sulphate of potash	Muriate of potash
Wood ash	Sylvinite	Kainit
	Rock potash	Guano

Note: Also manure/slurry and green waste compost from acceptable sources



P Surplus on European Organic Farms (Input-Output) kg ha⁻¹ year⁻¹

	n	Mean	SE	Range
Arable	1	-6.0		
Beef	4	-1.8	1.4	-6 - 0
Dairy	56	+3.1	0.9	-6.5 - +36.0
Horticulture	3	+38.9	26.0	1.7 - +89.0
Mixed	6	-2.4	1.3	-6.9 - + 4.0
Mean		+3.6		



Watson et al. (2002)

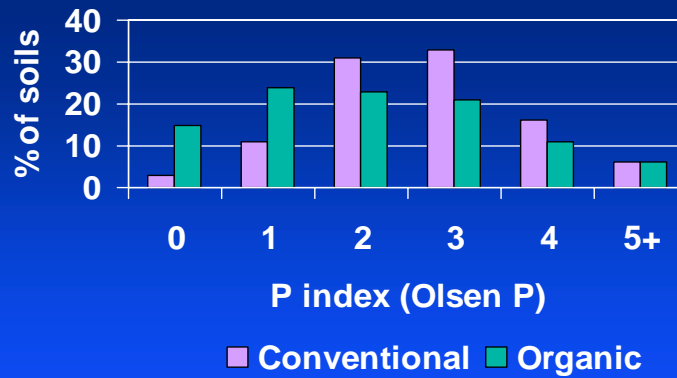
P budgets on UK organic farms (kg ha⁻¹ yr⁻¹)

	Farm 1 ¹	Farm 2 ²	Farm 3 ³
INPUTS			
Stock purchases	0.4		0.2
Bought-in feed	9.0	9.6	3.7
Rain		0.03	0.1
Seed	0.2		0.6
Poultry manure	20.5		
OUTPUTS			
Stock sales	1.3	0.6	1.6
Stock death			0.3
Animal produce	3.9	5.4	2.8
Grain	4.2		4.1
Vegetables	0.3		
Outputs-Inputs	+21.4	+3.9	-4.3



1 Fowler et al. (1993) 2. Cuttle & Bowling (1997) 3. Unpublished data Stockdale 1998

P status of conventionally and organically farmed UK soils



DOC trial - Switzerland

Soil chemical properties after two rotations

	ORG	MIN	CON
pH	6.5b	6.1a	6.2a
TOC (g C _{org} kg ⁻¹)	16.4b	14.5a	16.1b
Total N (gN kg ⁻¹)	1.50b	1.41ab	1.47ab
Extr P (mgPkg ⁻¹)	25b	24b	38d
Extr K (mgKkg ⁻¹)	58b	73c	101d



Mader et al. 1999

What is the future for organic farming?

Influenced by:

- ◆ Support payments
- ◆ Environmental legislation
- ◆ Consumer demand



Government support measures in EU member states (Soil Association 2001)

	Conversion payments	Post-conversion payments	Target	Action plan
Austria	■	■	✓	■
Belgium	■	■	✓	✓
Denmark	■	■	10% by 2003	■
Finland	■	■	10% by 2006	■
France	■	✓	3% by 2005	limited
Germany	■	■	20% by 2010	■
Greece	■	■	✓	✓
Ireland	■	■	✓	✓
Italy	■	■	✓	✓
Luxembourg	■	✓	✓	✓
Netherlands	■	✓	various	■
Portugal	■	■	✓	✓
Spain	■	■	✓	✓
Sweden	■	■	20% by 2005*	■
UK	■	✓	Wales only	Wales only



European environmental legislation

- ◆ Water Framework Directive
 - Urban Wastewater Treatment Directive
 - Nitrates Directive
 - Integrated Pollution Prevention and Control



What is the future for fertilizer use on organic farms?

- ◆ Need to balance export in produce with P, K and other nutrients in acceptable forms
- ◆ Aim of organic farming is to build or maintain soil fertility levels in the long-term
- ◆ Declining soil fertility may show up long after conversion as residues from conventional agriculture are used-up





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