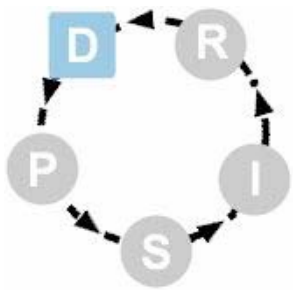
IRENA Indicator Fact Sheet
IRENA 08 – Mineral fertiliser consumption

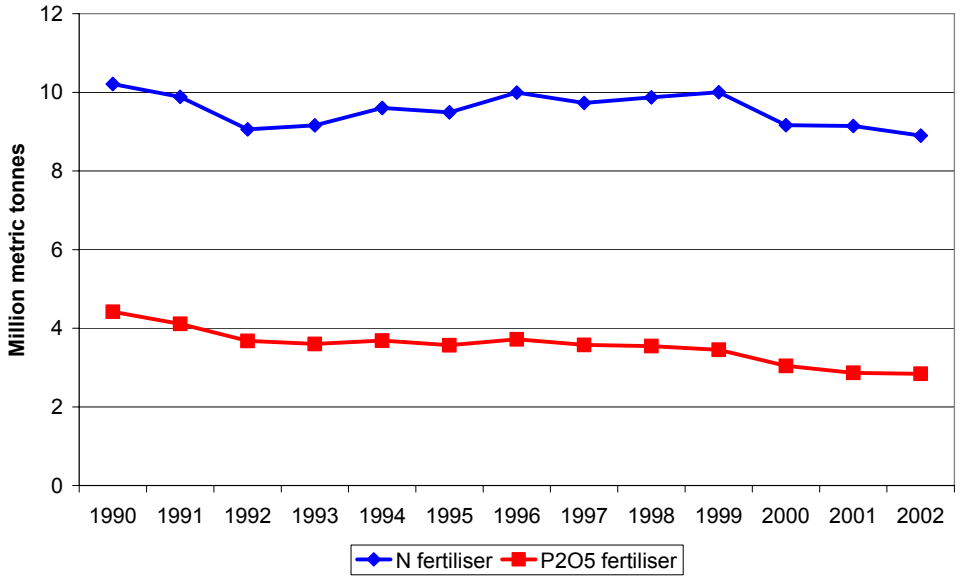
Indicator definition
Mineral fertiliser consumption is indicated by the evolution of the consumption of nitrogenous (N) and phosphate (P) mineral fertilisers over time.
Input indicator links:
IRENA 07 - Area under organic farming (R)
Output indicator links:
IRENA 18 - Soil surface nutrient balance (P)
IRENA 30 - Nitrates/pesticides in water (S)
IRENA 34.2 - Share of agriculture in nitrate contamination (I)



Key message

1. Total nitrogen (N) fertiliser consumption in EU-15 decreased by 12 % over the period 1990-2001[1]. During this period, the consumption decreased in most of the EU-15 Member States, except in Spain and Ireland. The biggest decrease (more than 30 %) took place in Denmark, The Netherlands and Greece.
2. Total phosphate (P_2O_5) fertiliser consumption in EU-15 decreased by 35 % over the period 1990-2001. During this period the consumption decreased in all EU-15 Member States, except in Spain. The biggest decrease (more than 60 %) took place in Germany, Denmark and Finland.

Figure 8.1. Evolution in total N and P_2O_5 mineral fertiliser consumption in EU-15



Source: FAOSTAT data, 2004

[1] 1990 = average of 1989, 1990 and 1991; 2001 = average of 2000, 2001 and 2002.

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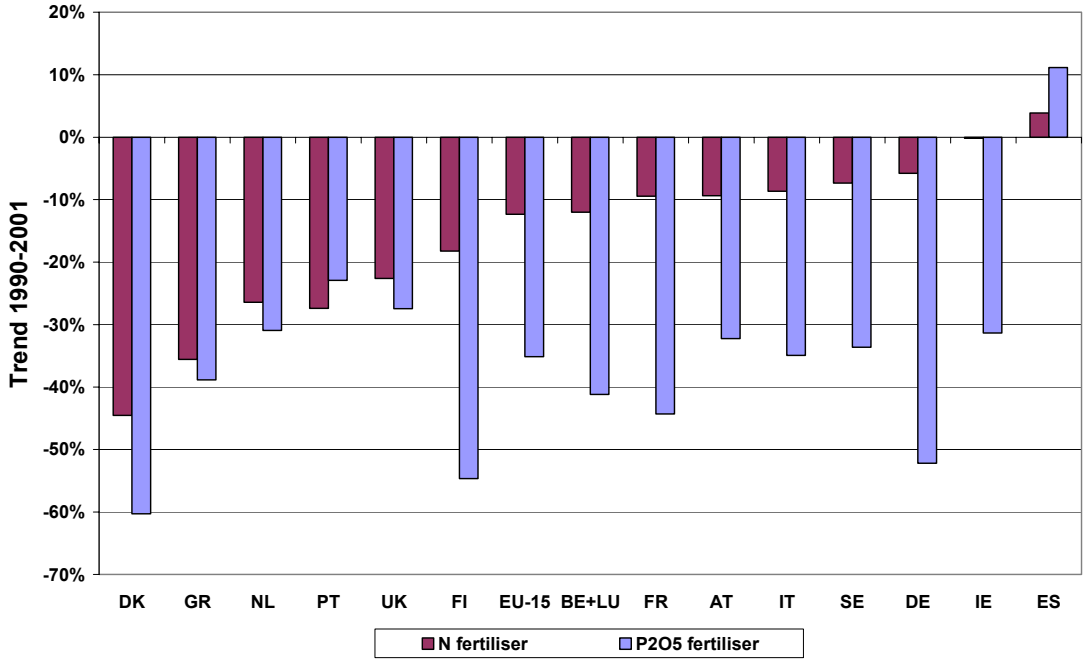
Figure 8.2 Evolution in total N and P_2O_5 mineral fertiliser consumption in the Member States and EU-15, 1990–2001 (*)



Note: (*) 1990 = average of 1989, 1990 and 1991; 2001 = average of 2000, 2001 and 2002
Source: FAOSTAT data, 2004

Results and assessment

Introduction

Nutrients, such as nitrogen (N) and phosphorus (P), are absorbed from the soil by plants for their growth. Mineral (inorganic) fertilisers are widely used in agriculture to optimise production, and organic fertilisers are a significant additional source of nutrient input. Organic farming does not apply mineral fertilisers and has as such an impact on mineral fertiliser consumption.

N and P behave differently in terms of their availability for loss from the agricultural system. N is highly soluble and research shows a positive relationship between application rate and nitrate lost from the soil root zone. For P, losses from land can be in organic as well as in inorganic forms. Historic over-fertilisation can build up soil P reserves to high levels and under such conditions it is possible for significant pollution to take place even with negligible new fertiliser inputs. However, the main focus of losses is related to the timing and loading of inputs of N and P either from fertiliser or organic manure applications.

The FAO national mineral fertiliser consumption data allow an analysis of the trend in fertiliser consumption for the EU and by Member State. This could also be broken down into regional data using as a first approximation the national mineral fertiliser application rates for different crops (provided by EFMA/IFA) and the FSS regional data on areas under such crops. The latter method would allow the calculation of mineral fertiliser consumption by region and crop, albeit with shortcomings since national application rates do not take into account regional farming practices, soil moisture and type, and climate. More accurate data on regional fertiliser application rates from Member States and complementary sources of information (like fertiliser expenditure from FADN, fertiliser production data, regional yield data) would improve the initial calculation method.

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Policy relevance and context

Application of fertilisers is a major contributory factor to increased losses of nutrients such as nitrate and phosphate from agricultural soils into ground and surface water bodies. This loss can occur via run-off along the soil surface or as subsurface loss via leaching and drainflow. As a consequence, legislative initiatives through the EC Nitrates Directive (91/676/EEC) and more recently the Water Framework Directive (61/2000/EC) have sought to limit nutrient losses to water bodies through more careful management of agricultural land. In the case of the EC Nitrates Directive, this has included the designation of nitrate vulnerable zones where Member States have imposed regulatory limits on the loadings and timings of fertiliser (and manure) applications to agricultural land.

Agri-environmental context

The intensity of fertiliser use has implications for agricultural production and the potential environmental impacts of nutrient run-off from farmland. Agricultural research shows that nutrient requirements (and hence consumption) vary for different crop types and are influenced by previous land management, soil type and climatic factors. The fertiliser consumption indicator represents partial nutrient inputs to the agricultural system (the other main inputs being applications of manures and slurries, nitrogen fixation and atmospheric nitrogen deposition, which is taken into account in IRENA indicator 18).

An increase in the consumption of mineral fertilisers increases the risk of an impact on the environment. Excessive use of nitrogen fertiliser can lead to an increase of nitrate levels in water and hereby cause eutrophication, which can lead to toxic algal blooms and fish kills (see IRENA indicator 30). Also the share of agriculture in nitrate contamination will be affected by the degree of fertiliser use (IRENA indicator 34.2). The indicator is one component of IRENA indicator 18 (gross nutrient balance).

Assessment

Total nitrogen fertiliser consumption in EU-15 has decreased by 15 % over the period 1990-2001. Total phosphorus fertiliser consumption in EU-15 has decreased by 42 % over the period 1990-2001. Over the period 1990-2001, consumption of N as well as P fertilisers has decreased in most of the Member States. Only Spain saw an increase in N as well as P consumption, while Ireland increased its N consumption but reduced its P consumption over the same period.

The Member States have different application rates of N and P_2O_5 fertiliser for different crops. In particular, wheat, barley, grain maize, potato, sugar beet, oilseed rape, vegetables and industrial crops have high application rates of N fertiliser.

There is a broad recognition in many countries that above-optimal applications of fertiliser nutrients such as N and P lead to an enhanced risk of pollution to watercourses, and associated problems with water quality. Within the Member States, legislative pressure (described under ‘Agri-environmental context’ above) has led to codes of good agricultural practice, nitrate vulnerable zones, and recently to the development of river basin management plans. Together with earlier publicity regarding proposals for, or even introduction of, a fertiliser tax in several EU Member States, these factors have together raised awareness among farmers of the risk of environmental pollution associated with high and/or poorly timed fertiliser applications. As a result, mineral fertiliser use for EU-15 has declined as described above.

The European Fertiliser Manufacturers Association (EFMA) predicts that consumption of fertiliser nitrogen will decline by 6 % between 2001 and 2011 and phosphorus consumption will decline by 14 %, in part due to improved precision of fertiliser applications and their timing, mechanisation, and the continued development of higher-yielding crop varieties.

Past and future trends in fertiliser consumption indicate an easing of nutrient leaching risk associated with mineral fertiliser use in agriculture. However, the full scale of nutrient leaching potential can only be assessed in conjunction with data on organic fertiliser application rates (see

IRENA 18). Furthermore, it is regional or even farm level application rates that determine the actual nutrient leaching (risk) associated with inorganic fertiliser consumption patterns. It is currently not possible, therefore, to fully assess the environmental impact of fertiliser consumption in agriculture, or whether recent trends have alleviated this significantly.

References

EFMA (2000). *Forecast of food, farming and fertiliser use in the European Union: 2000 to 2010*. EFMA: Brussels. http://www.efma.org/

FAO (2002). *Fertiliser use by crop*. 45 pp.

FAOSTAT (2004). http://faostat.fao.org/faostat/default.jsp.

Data

IRENA08_FINAL.xls

Table 8.1. (Figure 8.1.). Absolute volumes of N and P_2O_5 fertiliser consumption for EU-15

Unit: Metric tonnes	N fertiliser	P_2O_5 fertiliser
1989	10940448	4967553
1990	10211790	4416475
1991	9883934	4109517
1992	9054295	3676299
1993	9160220	3597644
1994	9602435	3685505
1995	9491587	3567096
1996	9992772	3719005
1997	9727385	3574336
1998	9871117	3545878
1999	10001410	3449563
2000	9164633	3042459
2001	9143731	2867760
2002	8896627	2840326

Source: FAOSTAT data, 2004

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Table 8.2. (Figure 8.2.). Absolute volumes of, and evolution over, the period 1990-2001 (*) in N fertiliser consumption

N fertiliser (metric tonnes)	1989	1990	1991	2000	2001	2002	Trend 1990-2001
BE+LU	190000	186000	182000	162000	165000	164000	-12.0%
DK	400400	394900	370000	234000	210629	201559	-44.5%
DE	2253000	1787300	1720000	1847507	1792212	1787654	-5.8%
GR	404200	427500	408400	285000	261000	253000	-35.6%
ES	1109395	1063114	998705	1113700	1110700	1070100	3.9%
FR	2660000	2492000	2569000	2316300	2397000	2279000	-9.4%
IE	378500	370000	347900	368410	366000	360000	-0.2%
IT	827279	878960	906720	828000	773161	785314	-8.7%
NL	412356	392000	391759	300000	296000	284000	-26.4%
AT	125100	135700	132000	118000	120000	118000	-9.4%
PT	145400	150200	141000	113000	103000	101000	-27.4%
FI	231361	206400	166450	167000	165000	162000	-18.2%
SE	221457	211716	185000	196716	187029	189000	-7.3%
UK	1582000	1516000	1365000	1115000	1197000	1142000	-22.6%
EU-15	10940448	10211790	9883934	9164633	9143731	8896627	-12.3%

Note: (*) 1990 = average of 1989, 1990 and 1991; 2001 = average of 2000, 2001 and 2002
Source: FAOSTAT data, 2004

Table 8.3. (Figure 8.2). Absolute volumes of, and evolution over, the period 1990-2001 (*) in P_2O_5 fertiliser consumption

P_2O_5 fertiliser (metric tonnes)	1989	1990	1991	2000	2001	2002	Trend 1990-2001
BE+LU	86500	78000	65000	45000	45000	45000	-41.2%
DK	94800	88600	76000	36000	34000	33000	-60.3%
DE	950700	609000	519000	351317	315339	327000	-52.2%
GR	176500	191800	176200	113000	113000	107000	-38.8%
ES	559437	534163	501655	568100	603800	601300	11.2%
FR	1494800	1348900	1255000	795000	759000	729000	-44.3%
IE	145500	138500	138300	96000	97000	97000	-31.3%
IT	607927	644660	661970	504000	369621	372026	-34.9%
NL	82700	74000	75000	54000	54000	52000	-30.9%
AT	64100	73600	70400	47000	47000	47000	-32.2%
PT	81100	80300	76000	63000	62000	58000	-22.9%
FI	143089	117150	83900	52000	52000	52000	-54.7%
SE	66400	57802	46092	39042	37000	37000	-33.6%
UK	414000	380000	365000	279000	279000	283000	-27.4%
EU-15	4967553	4416475	4109517	3042459	2867760	2840326	-35.2%

Note: (*) 1985 = average of 1989, 1990 and 1991; 2001 = average of 2000, 2001 and 2002
Source: FAOSTAT data, 2004

Table 8.4. N fertiliser application rates for EFMA crop categories in 1999/2000

EFMA - kg N/ha - 1999/2000	BE/LU	DK	DE	EL	ES	FR	IE	IT	NL	AT	PT	FI	SE	UK	EU-15
Wheat	155	148	165	70	98	164	160	80	190	105	80	85	125	188	139
Barley	100	78	150	75	93	118	110	70	85	95	60	72	78	127	107
Rye, oats, rice	90	80	120	85	82	105	96	95	85	63	60	70	68	107	96
Grain maize, incl. corn cob maize	70	-	150	190	231	170	-	200	44	107	160	-	-	-	179
Potato	160	120	140	200	142	150	120	110	168	105	100	70	83	158	142
Sugar beet	125	100	145	140	178	130	180	90	110	88	150	120	100	104	126
Oilseed rape	150	100	170	-	109	145	150	80	180	125	100	80	110	190	153
Sunflower, soya, linseed	20	70	50	50	14	45	0	40	0	45	-	-	60	52	33
Pulses (peas, beans)	20	-	25	40	9	0	0	30	20	2	5	40	-	4	8
Vegetables	110	140	165	170	205	80	60	110	130	100	130	80	100	125	138
Fodder (legumes)	15	110	30	10	19	0	0	5	0	0	80	-	-	-	18
Fodder (other)	80	150	150	-	32	53	120	10	32	50	80	-	85	80	59
Silage maize	80	30	85	80	80	45	105	150	35	105	80	-	-	58	70
Other (incl. tobacco)	20	100	80	130	158	50	60	45	93	55	40	40	-	41	77
Perm. crops (fruit, vineyard)	50	100	40	57	56	35	-	58	60	36	50	40	-	57	54
Grassland fertilised	146	125	103	40	39	70	122	15	243	35	42	112	60	102	90
Set-aside, industrial crops	20	40	100	-	30	145	-	20	-	70	100	-	10	170	108
Fertilised forests	-	50	-	-	20	-	-	-	-	-	25	62	150	50	49

Source: EFMA

Table 8.5. P_2O_5 fertiliser application rates for EFMA crop categories in 1999/2000

EFMA - kg P_2O_5/ha - 1999/2000	BE/LU	DK	DE	EL	ES	FR	IE	IT	NL	AT	PT	FI	SE	UK	EU-15
Wheat	25	17	32	19	57	43	60	60	9	24	55	23	20	42	42
Barley	25	16	30	18	54	46	60	50	9	22	50	20	19	45	40
Rye, oats, rice	20	13	25	33	35	46	60	70	7	20	35	23	15	45	32
Grain maize, incl. corn cob maize	30	-	50	45	115	60	-	80	35	50	60	-	-	-	68
Potato	50	35	70	115	85	85	220	70	70	50	80	115	75	157	86
Sugar beet	50	35	70	65	105	80	130	60	50	50	90	80	40	39	67
Oilseed rape	50	16	45	-	75	45	70	40	25	55	70	30	36	41	44
Sunflower, soya, linseed	30	10	30	30	6	40	0	50	0	33	-	-	20	24	28
Pulses (peas, beans)	50	16	30	20	12	40	40	40	56	7	35	25	40	28	27
Vegetables	50	40	40	90	99	80	110	70	80	60	80	80	70	53	77
Fodder (legumes)	10	10	30	35	48	50	-	-	25	17	30	-	10	-	22
Fodder (other)	10	22	35	-	21	30	50	5	10	27	30	-	17	56	20
Silage maize	30	26	30	50	54	22	80	-	28	50	30	-	-	42	26
Other (incl. tobacco)	20	16	30	50	107	20	50	35	30	32	120	30	-	20	40
Perm. crops (fruit, vineyard)	30	35	25	34	25	35	-	40	37	18	25	50	-	14	31
Grassland fertilised	35	15	7	20	30	25	29	5	23	27	26	25	14	18	19
Set-aside, industrial crops	70	-	35	-	20	40	-	5	-	15	70	-	10	37	32
Fertilised forests	-	20	-	-	10	-	-	-	-	-	60	21	-	80	38

Source: EFMA

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Meta data

Technical information

1. Data source:
   FAOSTAT - Agriculture data - Means of production - Fertilisers.
   FAOSTAT is an online and multilingual database currently containing over 3 million time-series records covering international statistics in the following areas: production, trade, food balance sheets, producer prices, forestry trade flow, land use and irrigation, forest products, fishery products, population, Codex Alimentarius food quality control, fertiliser and pesticides, agricultural machinery, food aid shipments and exports by destination.
2. Description of data:
   Fertiliser consumption data. Data refer to the fertiliser year 1 July–30 June. For countries that report their fertiliser statistics on a calendar-year basis, data are shown under the fertiliser year that begins in that calendar year; for example, 1991 data are under 1991/92. All figures are given in metric tonnes (MT) of plant nutrients (N, P_2O_5 and K_2O) except for production and trade of rock phosphate, where figures refer to metric tonnes of product.
   The item 'nitrogenous fertilisers' is the sum of the consumption of ammonium sulphate, ammonium nitrate, ammonium sulphate nitrate, sodium nitrate, calcium nitrate, calcium cyanamide, urea, ammonium phosphate (N), other straight fertilisers (N), other complex fertilisers (N) and calcium ammonium nitrate.
   The item 'phosphate fertilisers' is the sum of the consumption of single superphosphate, concentrated superphosphate, basic slag, ammonium phosphate (P_2O_5), other straight fertilisers (P_2O_5), other complex fertilisers (P_2O_5) and ground rock phosphate.
3. Geographical coverage:
   Member States, candidate countries, EFTA countries and other UN member nations.
4. Temporal coverage:
   1961–2001.
5. Methodology and frequency of data collection:
   Yearly questionnaire to FAO member nations.
6. Methodology of data manipulation:
   FAO Ad Hoc Working Party on Fertiliser Statistics.

Qualitative information

7. Strengths and weaknesses (at data level):
   Weaknesses: data for Belgium and Luxembourg are combined. Regionalisation of data for large Member Nations is prone to errors.
   Strengths: long time-series available. FAO data are in line with industry data.
8. Reliability, accuracy, robustness, uncertainty (at data level): good quality data.
9. Overall scoring (give 1 to 3 points: 1 = no major problems, 3 = major reservations):
   Accuracy: 2
   Comparability over time: 1
   Comparability over space: 1