



# ENVIRONMENTAL PERFORMANCE OF AGRICULTURE IN OECD COUNTRIES SINCE 1990:

## Chapter 1 Section 1.9 Farm Management

This document is an extract from Chapter 1 of the OECD publication (2008) *Environmental Performance of Agriculture in OECD countries since 1990*, which is available on the OECD website which also contains the agri-environmental indicator time series database at: [www.oecd.org/tad/env/indicators](http://www.oecd.org/tad/env/indicators)

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## 1.9. FARM MANAGEMENT

### KEY TRENDS

**A growing number of OECD farmers are adopting environmental farm management practices** as a result of voluntary private led initiatives intended to respond to consumer concerns, including those from food processors and retailers (e.g. pesticide management), and government incentives provided through payments and regulations. But only around a third to a half of OECD member countries are regularly monitoring changes in environmental farm management practices, with the notable exception of organic management where all countries are tracking changes in this indicator.

**The adoption of nutrient management practices (NMPs) is widespread** across OECD countries, with an increase in their uptake over the period 1990-2004, for around half of the OECD countries monitoring NMPs. For countries with a high and increasing uptake of NMPs they have usually experienced a reduction in nutrient surpluses (Belgium, Czech Republic, Denmark, Finland, Germany, the Netherlands, Norway, Sweden, Switzerland), but for countries where nutrient surpluses have risen or are well above the OECD average (in terms of kg nutrients per hectare of farmland) (Canada, Ireland, Japan, Korea and New Zealand), NMP adoption rates are generally lower, although increasing in Canada and Korea.

Despite the increase in adoption of **environmental integrated pest management practices (IPM)**, the level of uptake across OECD countries is modest, although only about a third of OECD countries track IPM. But for countries with a high IPM uptake or growth in organic farming they have also experienced a decrease in pesticide use (Austria, Czech Republic, Denmark, Finland, Germany, Norway, Sweden, Switzerland, United Kingdom and the United States).

**The area of farm land under soil management practices (SMPs) has remained stable over the past decade**, but only a third of OECD countries monitor changes in SMPs. Where the rate of SMP adoption has risen (Canada, United States), this has led to reduced soil erosion risks and greater provision of feed for wild species, although where SMP uptake rates are low, soil degradation problems remain (Hungary, Italy, Korea, Slovak Republic and Turkey).

**OECD countries, where water management for irrigation is important, are often applying inefficient water conservation technologies.** Uptake of the most efficient drip emitter water conservation technology is over 20% of the total irrigated area for only a few countries (Czech Republic, Greece, Italy, Spain), but for other countries where irrigated agriculture is significant and the competition for water resources more intense the uptake of drip emitters is lower (Australia, France, Turkey, United States), although for Australia, France and the United States there is widespread use of low-pressure sprinklers.

**The OECD share of agricultural land under biodiversity management plans is under 10% for most countries**, except Austria, Ireland and Switzerland, although only a third of OECD countries monitor biodiversity management. But many countries are just beginning to implement agri-biodiversity management plans as part of national biodiversity strategies, linked to commitments under the *Convention of Biological Diversity*.

**The OECD area under certified organic farming has increased substantially** between the early 1990s to 2004, even so it accounted for less than 2% of total farmland by 2002-04. However, the share is higher in most European countries (around 6% or higher in Austria, Denmark, Finland, Italy, Sweden and Switzerland) but much lower in mainly non-European OECD countries (under 1% in Canada, Japan, Korea, Mexico, New Zealand and the United States).

**Indicator definitions:***Nutrient management*

- Number (area) of farms (agricultural land area) under nutrient management plans.
- Share of farms using soil nutrient testing (agricultural land regularly sampled and analysed for nutrient content).

*Pest management*

- Arable and permanent crop area under integrated pest management.

*Soil management*

- Arable land area under soil conservation practices.
- Agricultural land area under vegetative cover all year.

*Water management*

- Irrigated land area using different irrigation technology systems.

*Biodiversity management*

- Agricultural land area under biodiversity management plans.

*Organic management*

- Agricultural land area under certified organic farm management (or in the process of conversion to an organic system).

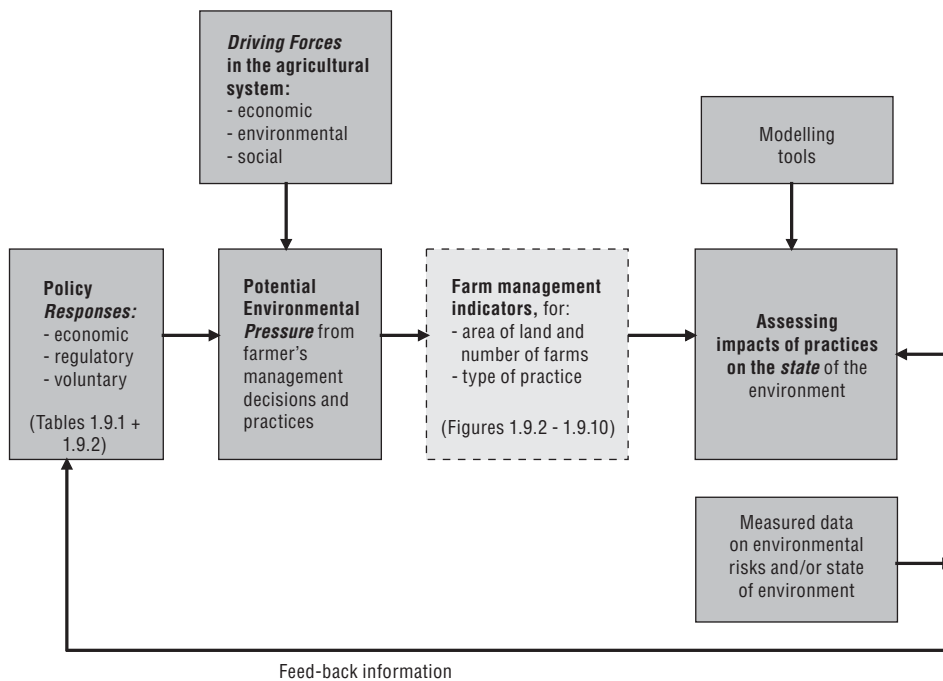
**Concepts and interpretation**


This final section of Chapter 1 highlights the linkages between the previous sections on agri-environmental **driving forces** (i.e. nutrient and pesticide use, energy consumption, and water use), the **state** of the environment as it relates to agriculture covering soil, water and air quality, and biodiversity, and the **response** to improve agriculture's environmental performance in terms of changes in farming practices and systems (Figure 1.9.1). The linkages between farm management indicators (FMIs) and other drivers and environmental outcomes associated with farming systems are highlighted in Figure II.1 in the *Background and Scope of the Report*, Section II, drawing on the Driving Force-State-Response Framework (DSR).

FMIs can provide an early indication of likely changes in the direction of environmental impacts sometimes before they can be measured by other indicators, such as those pertaining to soil and water quality (OECD, 2005a). They can assist farmers and policy makers by informing them of the linkages between farm activities and environmental impacts. FMIs can also serve as a proxy for "state" indicators where measuring actual changes in the environment are difficult or costly. But there is often a time lag, which can be many years, between the implementation of farm management plans and the consequential change in environmental conditions.

FMIs are able to highlight environmental pathways where causal links are known, such as those between nutrient use (*driving force*), nutrient concentrations in water bodies (*state*) and nutrient management practices (*response*). FMIs interpreted in this way may help make them more easily understood by decision makers. In addition, the description of such environmental pathways can help to explain to farmers the need to undertake certain

Figure 1.9.1. OECD farm management indicator framework



StatLink  <http://dx.doi.org/10.1787/288168718073>

Source: OECD Secretariat, adapted from OECD (2005a).

practices to safeguard the environment (OECD, 2005a). FMIs can be organised in terms of a three-tiered approach covering trends in:

- **farm management practices** addressing specific environmental issues, including: nutrients, pests, soil, water, and biodiversity, which are the indicators covered in this section;
- **environmental farm management plans** covering the entire range of farming systems from integrated “conventional” farming to organic operations, as well as specialised crop and livestock farming systems. Indicators of environmental farm management plans are only partially covered in this section, through organic farming, but background information is provided on the range of specific practices that countries are adopting as part of a broader environmental farm planning approach; and
- **farm management capacity** revealing impediments and incentives affecting the adoption of farming practices that can enhance agricultural sustainability, covering investment in the sector’s capacity to improve farmers’ education, farm incomes, research, farm advisory expenditure and the social institutions supporting farmers. It is beyond the scope of this report to cover these issues, but some limited discussion is provided on the incentives that OECD countries are providing to farmers to adopt a range of environmental farm management practices (also see Chapter 2).

Data availability is the main barrier to wider coverage of FMIs, as many OECD countries do not have information on the extent to which environmental management practices are adopted. But many countries are beginning to undertake surveys to measure the extent and characteristics of management practices, for example, in **Australia**, **Canada**, the **EU15** and the **United States**. A further limitation in measuring FMIs concerns definitional problems. Central concepts, such as environmental farm management plans,

integrated pesticide management and organic management, need greater consistency in definitions. Nevertheless, it should be stressed that farm management practices will vary within and across countries, even when addressing the same issue, such as pest control, reflecting differences in farming systems, agro-ecological and climatic conditions.

## Recent trends

### 1.9.1. Overview of environmental farm management

A growing number of OECD farmers are adopting environmental farm management practices (EFMPs), especially since the mid-1990s. But EFMP uptake varies across countries in terms of both the type and extent of practice adopted (Table 1.9.1). Also the national focus of EFMPs usually reflects the varying agro-ecosystems and environmental priorities across countries, for example, soil conservation in **Canada** and the **United States**, irrigation management in **Australia** and **Spain**, and nutrient management across **EU15** countries (Table 1.9.1). Many countries do not have precise information on the number (or area) of farms with EFMPs but provide descriptions of the characteristics of these practices. Moreover, only around a third to a half of OECD member countries are regularly monitoring changes in environmental farm management practices, with the notable exception of organic management where all countries are tracking changes in this indicator.

For most countries farmer incentives to adopt EFMPs are mainly provided through voluntary led and private sector initiatives, although incentives through a combination of government support payments and regulations are also important, with in many cases EFMPs regularly audited (Table 1.9.2). Financial support can be provided, for example, to cover the capital costs of installing manure storage facilities, while regulations enforced by fines are used to compel adoption of certain practices, such as limiting air polluting emissions (OECD, 2003a; 2004; 2005b). Voluntary initiatives used to encourage EFMP uptake can be led by (OECD, 2005a): farmers (*e.g.* **New Zealand's** "Project Green" for livestock); the farm input supply industry (*e.g.* International Fertilizer Industry Association); food processors (*e.g.* Sustainable Agriculture Initiative Program); and food retailers (*e.g.* supermarket chains, such as Tesco's "Nature's Choice" United Kingdom standards).

### 1.9.2. Nutrient management

The adoption of nutrient management plans (NMPs) is widespread across OECD countries, with a notable increase over the period 1990 to 2004, although only around half of OECD countries monitor NMPs (Figures 1.9.2, 1.9.3 and 1.9.4). Some countries, however, have maintained a very high uptake rate of NMPs throughout the past decade (**Belgium, Czech Republic, Denmark, Finland, Germany, Norway**), while for some others NMP adoption rates have grown rapidly (the **Netherlands, Switzerland**). All these countries have experienced a reduction in nutrient surpluses over the 1990s. Equally, in countries, such as **Canada, Ireland, Japan, Korea** and **New Zealand** where nutrient surpluses have been increasing or are well above the OECD average (in terms of kg nutrients per hectare of farmland), NMP adoption rates are generally at a low share of total farm numbers (or farmed area), although soil nutrient testing is becoming more widespread in **Canada** and **Korea** (Figure 1.9.4).

Table 1.9.1. Countries recording adoption of environmental farm management practices

Late 1990s-early 2000s

Environmental farm management type and practices	Total OECD <sup>1</sup>	Australia <sup>2</sup>	Austria	Belgium <sup>3</sup>	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Japan	Korea	Luxembourg	Netherlands	New Zealand	Norway	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States <sup>4</sup>
<b>Nutrient management plan practices</b>																												
Voluntary codes of practice	11		X			X			X			X	X		X	X		X	X		X	X		X	X			X
Obligatory codes of practice	9		X	X		X		X	X			X			X			X	X	X	X			X				X
Restriction of fertiliser application	17		X	X		X	X <sup>5</sup>	X	X	X <sup>5</sup>		X	X	X <sup>5</sup>		X		X	X	X	X	X		X	X		X <sup>5</sup>	X
Conditions for nutrient application near water	15		X	X		X	X <sup>5</sup>	X <sup>5</sup>	X <sup>5</sup>			X	X	X <sup>5</sup>		X		X	X	X	X			X	X		X <sup>5</sup>	X
Cover crops used to prevent nutrient run-off	19		X	X		X	X <sup>5</sup>	X	X	X	X	X		X <sup>5</sup>		X		X	X	X	X <sup>5</sup>		X <sup>5</sup>	X <sup>5</sup>	X	X	X <sup>5</sup>	X
Use of legumes in crop rotation	8		X			X										X			X	X		X		X				X
Soil test	14	X	X	X	X	X		X	X			X	X			X		X	X	X	X	X		X	X			X
Records of fertiliser use	12			X		X		X	X			X	X			X		X	X	X	X	X		X	X			X
Split fertiliser applications are used	10		X	X		X		X	X			X				X			X	X	X	X		X	X			X
Farm nutrient balance calculated regularly	11		X	X	X	X		X	X				X			X		X	X	X				X	X			X
Requirements on livestock manure storage facilities	14		X	X		X	X <sup>5</sup>	X <sup>5</sup>	X				X	X		X		X	X	X	X	X		X	X			X
<b>Non-chemical pest control practices</b>																												
Use of soil tillage	12		X	X	X							X	X			X		X	X	X	X		X	X	X			X
Use of crop rotations	12		X	X	X							X	X			X		X	X	X	X		X	X	X			X
Biological control methods	13		X	X	X							X	X		X	X		X	X	X	X		X	X	X			X
Use of pheromones	12		X	X	X							X	X		X	X		X	X	X	X		X	X	X			X
Pruning, hand weeding, canopy management	12		X	X	X							X	X		X	X		X	X	X		X	X	X				X
Crop residue destruction	10		X	X	X							X	X		X	X		X	X	X	X		X	X				X
Professional scouting	9		X	X	X							X						X	X					X	X			X
Strategic locations and planting times	11		X	X	X							X	X			X		X	X	X	X			X	X			X
No method but pesticide not applied	7		X			X						X			X			X	X	X				X				

Table 1.9.1. Countries recording adoption of environmental farm management practices (cont.)

Late 1990s-early 2000s

Environmental farm management type and practices	Total OECD <sup>1</sup>	Australia <sup>2</sup>	Austria	Belgium <sup>3</sup>	Canada	Czech Republic	Denmark	Finland	France	Germany	Greece	Hungary	Ireland	Italy	Japan	Korea	Luxembourg	Netherlands	New Zealand	Norway	Portugal	Slovak Republic	Spain	Sweden	Switzerland	Turkey	United Kingdom	United States <sup>4</sup>
<b>Soil conservation management practices</b>																												
Conservation tillage	24	X	X	X	X	X	X <sup>5</sup>	X <sup>5</sup>	X <sup>5</sup>	X <sup>5</sup>	X	X	X	X <sup>5</sup>	X	X	X <sup>5</sup>	X	X	X <sup>5</sup>	X	X <sup>5</sup>	X <sup>5</sup>	X		X <sup>5</sup>	X	
Zero tillage	10			X	X	X						X			X	X		X	X	X	X			X			X	
Crop rotations	10		X	X	X							X			X	X		X	X	X	X			X			X	
Winter cover crops	10			X	X				X						X	X		X	X	X	X			X	X		X	
Contour cultivation	4		X	X														X	X	X	X							
Grassed waterways	6		X	X	X													X	X					X			X	
Strip-cropping	4		X	X	X											X											X	
Windbreak	9		X	X	X							X			X	X			X	X	X	X			X			
<b>Irrigation management practices</b>																												
Flooding	7	X		X	X				X		X										X		X			X	X	
High pressure rainguns	12	X		X	X	X			X				X					X			X	X		X		X	X	
Low pressure sprinklers	10	X		X	X				X		X		X					X			X		X			X	X	
Drip-emitters	11	X		X	X	X			X		X		X					X			X		X			X	X	

StatLink  <http://dx.doi.org/10.1787/301763453364>

1. Total number of OECD countries adopting a specified farm management practice.
  2. Data are taken from Australian Bureau of Statistics, (2005).
  3. Presents data for Flanders and Wallonia; for Wallonia nutrient management plan characteristics are obligatory for farms where the Basic Soil link Rate (BSL) is > 1; only Wallonia indicates split fertiliser application; all soil conservation management practice data presents only Wallonia apart from winter cover crops which represents Flanders and Wallonia; high-pressure raingun practice is only applied in Flanders.
  4. Data are taken from USDA (2001), (2004).
  5. Data are taken from EEA (2005).
- Source: Australian Bureau of Statistics (2005); EEA (European Environment Agency), (2005); OECD Agri-environmental Indicators Questionnaire, unpublished; United States Department of Agriculture (2001).



Table 1.9.2. **Overview of farmer incentives to adopt environmental farm management practices (cont.)**

Late 1990s-early 2000s

	Nutrient								Pests								Soil								Water								Biodiversity and landscape								Environmental farm plans													
	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII	I	II	III	IV	V	VI	VII	VIII						
Turkey	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
United Kingdom	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
United States	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	
<b>OECD</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>8</b>	<b>5</b>	<b>4</b>	<b>8</b>	<b>5</b>	<b>0</b>	<b>2</b>	<b>1</b>	<b>5</b>	<b>5</b>	<b>3</b>	<b>6</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>3</b>	<b>2</b>	<b>5</b>	<b>3</b>	<b>0</b>	<b>1</b>	<b>1</b>	<b>6</b>	<b>2</b>	<b>0</b>	<b>3</b>	<b>1</b>	<b>2</b>	<b>1</b>	<b>1</b>	<b>8</b>	<b>6</b>	<b>1</b>	<b>6</b>	<b>4</b>	<b>2</b>	<b>4</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>2</b>	<b>4</b>						
<b>EU15</b>	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	

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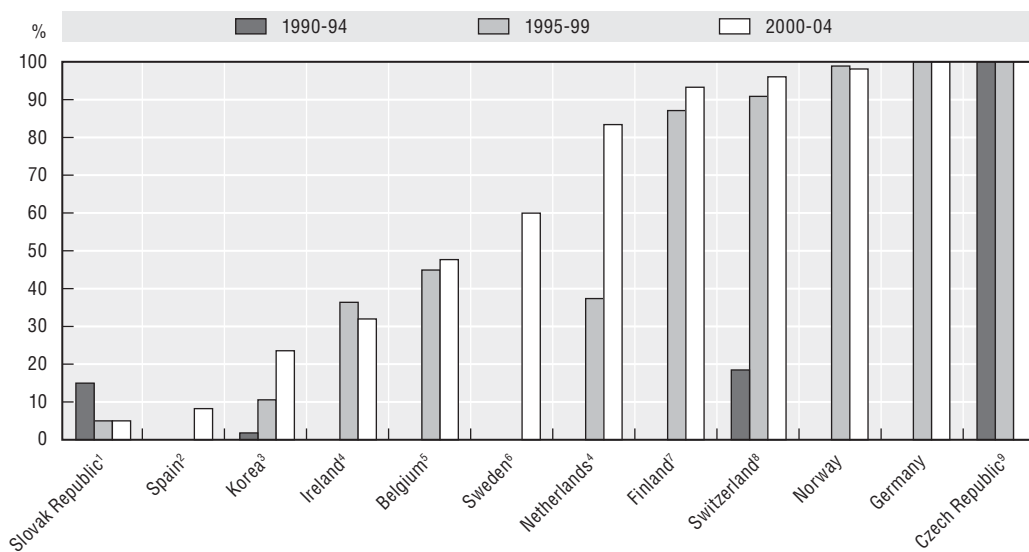
..: Not available.


*Legend:* I = farmer-led initiative, II = local community-led initiative, III = promoted by farmers' organisations, IV = promoted by the agro-food industry, V = supported or enforced by government, VI = payment is provided for adopting the practice, VII = practice is obligatory (i.e. use of a regulation or standard), VIII = practice is regularly audited.

- Audit every 3 years.
- Data presents only Wallonia; for the farm management practices concerning pests, payments are provided for adopting organic farming; farm management practices for soil, biodiversity and landscape are part of the "Framework of Regional Environmental Regulation"; practices for environmental farm plans are indicated as purposed in the new agro-environmental regulation that took place in the end of 2004.
- Audit every year.
- Audit every 4 years.
- Practices that are enforced by the government: nutrients, pests, water = national, soil, biodiversity and landscape, environmental farm plans = national/regional; audit for nutrients, pests, biodiversity and landscape, environmental farm plans: every year, for soil: 2-4 years depending on fields. Source: Korea Rural Economic Institute.
- Audit for nutrients, pests, biodiversity and landscape: every year.
- Practices that are enforced by the government: nutrients, pests, water = national, soil = national/regional, biodiversity and landscape, environmental farm plans = national/local; for VII pests only for organic farming and VII soil only for some areas; audit every 20 years (e.g. every year, 2, 5 years, etc.). Approx. 5% each year (part of a subsidy control).
- For VIII: diverse programmes and frameworks like "Sweden's 15 environmental quality objectives", agri-environmental programmes on nutrients, pesticides, biodiversity and landscape.
- Practices that are enforced by the government = national.

Source: OECD Agri-environmental Indicators Questionnaire, unpublished.

Figure 1.9.2. Share of agricultural land area under nutrient management plans



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Note: Nutrient management plans cover nitrogen, phosphorus and potassium, unless stated otherwise.

- Nutrients not specified.
- Average 2000-04 = average 2001-03.
- Data include only arable crops and share of arable crop area.
- Nutrient management plan covers nitrogen and phosphorus.
- Data include Flanders for 2000-03 (N, P), and Wallonia for 2003 (N).
- Average 2000-03 = average 2001-04, data cover nitrogen, phosphorus and calcium. Area of farms that get support for a crop management plan including a nutrient management plan.
- Average for 1995-99 and 2000-04 refer to year 1997 and 2002-04, data covers nitrogen, phosphorus and calcium.
- Data for the period 1990-94, 1995-99 refer to year 1993, 1999.
- Nutrient management plan covers nitrogen, phosphorus, potassium, calcium and magnesium.

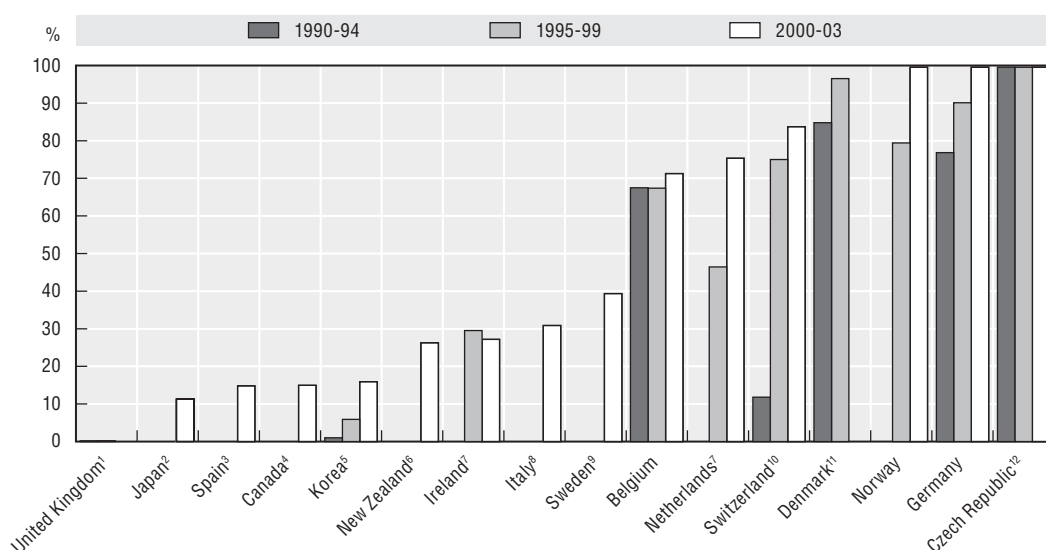
Source: OECD Agri-environmental Indicators Questionnaire, unpublished; national data sources.


In many OECD countries, NMPs are widely supported or enforced by governments, and the plans are regularly audited (Table 1.9.2). For most of these countries NMPs cover a combination of using cover crops to prevent nutrient run-off, soil tests (Figure 1.9.4), recording fertiliser use and nutrient balances, and improving manure storage facilities and livestock housing to reduce nutrient emissions, especially for the pig, poultry and dairy sectors (Table 1.9.1, EEA, 2005; OECD, 2003a; 2004). However, the practice of using legumes in crop rotations seems less widespread (Table 1.9.1). Soil nutrient tests are carried out in almost all OECD countries, with both public and private bodies involved in these tests. Most OECD countries include both nitrogen and phosphorus in soil tests, while some countries test for other soil nutrients and trace elements.

### 1.9.3. Pest management

Despite the overall increase in adoption of integrated pest management (IPM) practices, the level of uptake is modest, as measured by the share in the farmed area, although only about a third of OECD countries track IPM (Figure 1.9.5). However, the rise in the area under organic farming (Figure 1.9.10) must also be taken into account in this context, as the use of most pesticides are not usually permitted under certified organic farming. Voluntary led initiatives, especially those that are farmer led, are of importance in providing incentives to adopt IPM (Table 1.9.2).

Figure 1.9.3. Share of total number of farms under nutrient management plans



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Note: Nutrient management plans cover nitrogen, phosphorus and potassium, unless stated otherwise.

1. Data for United Kingdom are 0.2% in 1990-94, 0.2% in 1995-99.

2. Chemical fertilisers only.

3. Nutrients not specified.

4. Source: Statistics Canada (2001), Farm Environmental Management Survey.

5. Data include only arable crops.

6. Nutrients covered by the management plan: nitrogen, phosphorus, potassium sulphur, magnesium, and other nutrients.

7. Nutrient management plan covers nitrogen and phosphorus.

8. For 2000 only and plan applies only to inorganic fertiliser.

9. Number of farms that get support for a crop management plan including a nutrient management plan.

10. Data for period 1990-94 and 1995-99 refer to year 1993 and 1999.

11. Data for 1994 and 1995-98.

12. Nutrient management plan covers nitrogen, phosphorus, potassium, calcium and magnesium.

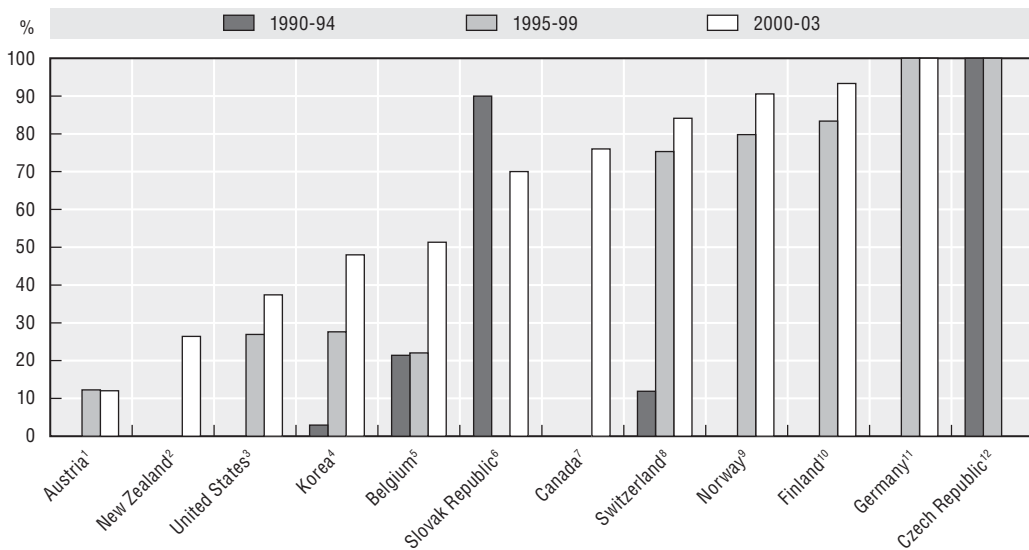
Source: OECD Agri-environmental Indicators Questionnaire, unpublished; OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France; national data sources.


For most countries with a high level or increasing uptake of IPM or organic farming (**Austria, Czech Republic, Denmark, Finland, Germany, Norway, Sweden, Switzerland, United Kingdom**) they have also experienced a reduction in pesticide use over the past decade (Section 1.3). In the **United States**, where pesticide use also decreased during the 1990s, there has been an expansion in the area sown to genetically engineered herbicide-tolerant crop varieties (Section 1.8), together with government programmes that encourage IPM uptake (Figure 1.9.5). In **Canada**, a 2001 survey of farm environmental practices found that most pesticides are applied by a certified operator, and that almost half of producers calibrate their sprayers at the beginning of the season, although only 14% re-calibrate spraying equipment before using a different pesticide. The optimal practice is used for the timing of insecticide applications, but some improvements can be made in the timing of herbicide applications (Lefebvre et al., 2005).

#### 1.9.4. Soil management

The area of OECD farm land under soil management practices (SMPs) has remained stable since 1990 for many countries. But in some cases where adoption rates have increased, this has brought benefits in terms of reducing soil erosion risks, though only

Figure 1.9.4. Share of total number of farms using soil nutrient testing



StatLink  <http://dx.doi.org/10.1787/288228567322>

Note: Soil nutrient testing covers nitrogen, phosphorus and potassium, unless stated otherwise.

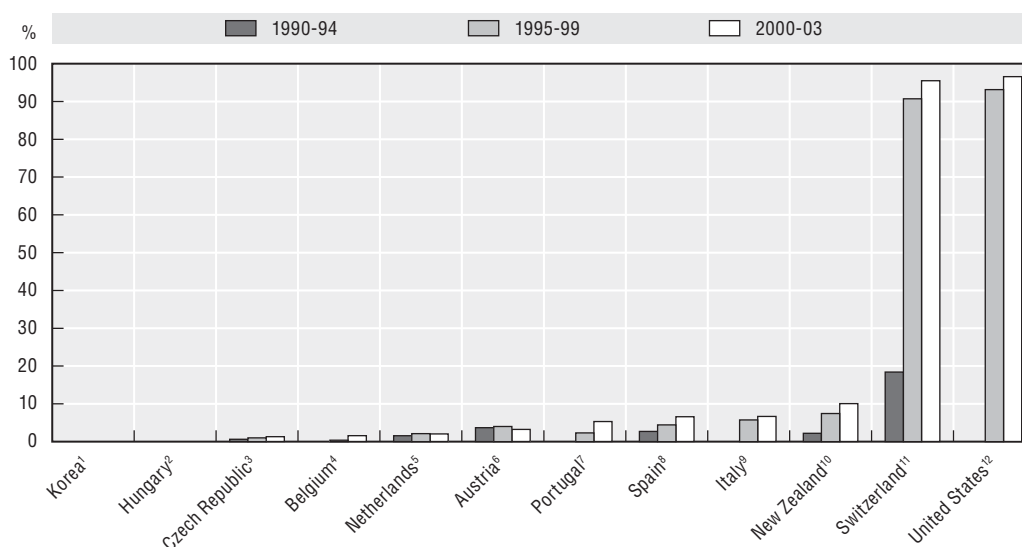
1. Soil tests cover phosphorus and potassium, tests are conducted every 4-5 years.
2. Nutrients covered by the management plan: nitrogen, phosphorus, potassium sulphur, magnesium, and other nutrients. Tests are conducted every 2-3 years; number of farms are estimated by the country.
3. Represents survey data (not directly comparable from year to year) for wheat, cotton, maize and sorghum.
4. Tests were conducted in 1993 every 2-3 years and in 1997 and 2002 every year.
5. Soil test covers phosphorus, potassium, magnesium, calcium and sodium for Flanders and nitrogen, potassium and phosphorus for Wallonia, the standard test for Flanders does not include nitrogen, nitrogen is tested in the N-index which is not shown here but is available for the same years; data include 2000-03 value of Flanders and 2003 value of Wallonia.
6. Data for the period 1990-94 refer to 1985-89.
7. Data represent farms with sales > USD 10 000, with nutrient tests every year up to every 5 years or more.
8. Data for the period 1990-94 and 1995-99 refer to year 1993 and 1999.
9. Soil tests cover phosphorus, potassium, magnesium and calcium. Nitrogen tests are conducted in spring, but the number of farms for nitrogen are not given. Soil tests are mostly conducted every 5-8 years.
10. Soil tests cover nitrogen, phosphorus, potassium, calcium and magnesium, tests are conducted every 4-5 years.
11. Tests are conducted every year, phosphorus and potassium tests are conducted after more than 5 years.
12. Soil test covers phosphorus, potassium, calcium and magnesium, tests are conducted every 3 and 6 years, respectively.


Source: OECD Agri-environmental Indicator Questionnaire, unpublished; OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France; national data sources.

around a third of OECD countries are monitoring changes in SMPs (Figures 1.9.6 and 1.9.7). Countries are using a range of practices to help improve soil conservation (Table 1.9.1), although key amongst these are moving towards no-till or conservation tillage and, to a lesser extent an increase in soil vegetative cover, especially using green cover over winter months rather than leaving bare soil (Figure 1.9.7). These practices can also bring benefits to wild species by providing winter feed (Section 1.8). For some countries soil conservation efforts are mainly focused on arable crop areas (e.g. **Canada, United States**), but for others a very high share of the entire agricultural area is under SMPs (e.g. **Austria, Belgium, Norway, Switzerland**). Most SMPs are supported or enforced by government, with few SMPs farmer led initiatives or promoted by the agro-food industry (Table 1.9.2).

Where improvements in reducing soil erosion rates have been greatest, such as in **Canada** and the **United States** (Section 1.5), this has been associated with an increase in the area or relatively high share of arable land under soil management practices, notably greater use of low till/conservation tillage and an increase in soil green cover

Figure 1.9.5. **Share of total arable and permanent crop area under integrated pest management**



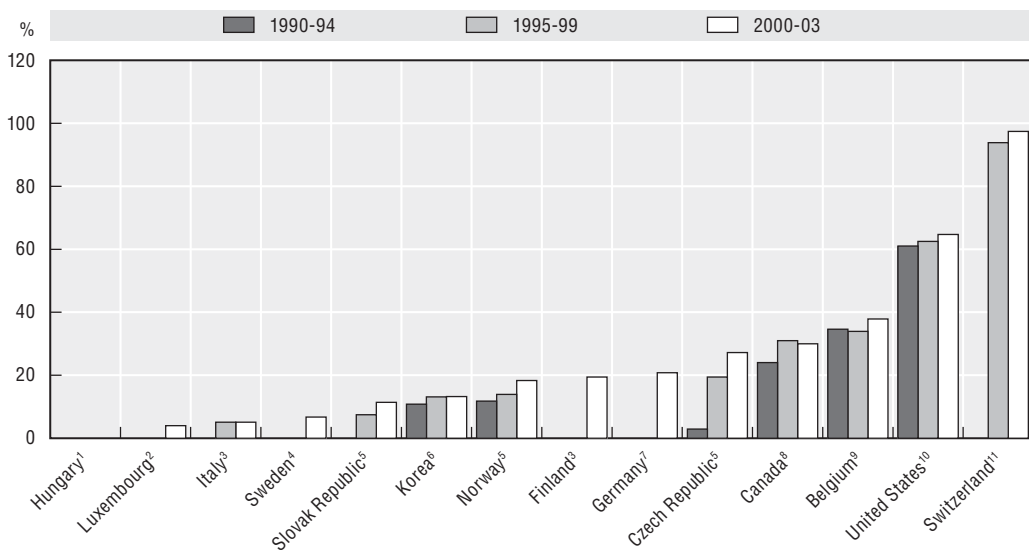
StatLink  <http://dx.doi.org/10.1787/288258134111>


1. Values are 0.17% for 1995-99 and 0.02% for 2000-03. Data for 1995-99 are for 1998, taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France. Data include only crop area.
2. Value for 2000-03 is 0.13%, for other years n.a., data includes total agricultural area and share of total agricultural area.
3. Values are 0.6%, 1990, 1.0% for 1994 and 1.3% for 2003.
4. Data refer to Flanders and Wallonia, data for Flanders include only permanent crops, data for Wallonia include arable and permanent crops; data for 1996 represent the sum of 1996 for Flanders and 1998 for Wallonia. Values are 0.38% for 1995-99 and 1.54% for 2000-03.
5. Arable area and permanent crops (only fruit) with environmental certificate.
6. Values are 3.7% 1995, 4% 1999 and 3.2% for 2000-03.
7. Values are 0.09%, 1995, 2.3% for 1999 and 5.3% for 2002.
8. Data represent only cultivated crops.
9. Values represent data for 1995, 1999 and 2002.
10. Data show values for 1990-94 which include permanent crops (e.g. kiwifruit), for 1995-99 which include vegetable crops (e.g. outdoor tomatoes) and permanent crops (e.g. kiwifruit, winegrapes, apples), and for 2000-03 which include vegetable crops (e.g. outdoor tomatoes, brassicas, potatoes) and permanent crops (e.g. kiwifruit, winegrapes, apples, avocados, persimmons and stonefruit). Values are 2.21% for 1990-94, 7.45% for 1995-99 and 10.05% for 2000-03.
11. Data for the periods 1990-94, 1995-99 and 2000-03 refer to years 1993, 1999 and 2003.
12. Data from Survey data (not directly comparable from year to year) for wheat, cotton, maize and soyabeans.

Source: OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France; OECD Agri-environmental Indicators Questionnaire, unpublished; national data sources.

(Figures 1.9.6 and 1.9.7). In other countries, such as the **Czech and Slovak Republics**, the relatively low uptake of soil management practices may be aggravating soil erosion risks (Section 1.5). The poor uptake of soil conservation practices where soil erosion remains an important agri-environmental issue is also reported for **Hungary, Italy, Korea, Slovak Republic and Turkey** (Section 1.5 and Chapter 3).

Figure 1.9.6. Share of arable crop area under soil conservation practices



StatLink  <http://dx.doi.org/10.1787/288265066700>

- Value for 2000-03 is 0.1%, other years not available, includes total agricultural land and share of total agricultural land.
- National data. Value for 2000-03 is 4%.
- Includes total agricultural land and share of total agricultural land.
- Data include arable crops (e.g. catchcrops, postponed autumn tillage and protection zones).
- Data include only arable crops.
- Data include permanent crops and pasture and share of permanent crops and pasture.
- Data include only arable crops, data refer to 2003/04.
- Share of cropland area in conservation tillage practices (%).
- Data includes arable crops (e.g. winter wheat and barley for all years and green cover in winter for 1995 and 2000) for Flanders; the 1990-94 value is the sum of 1990 data for Flanders and 1994 data for Wallonia, the 1995-99 value is the sum of 1995 data for Flanders and 1999 data for Wallonia, the 2000-03 value is the sum of 2000 data for Flanders and 2003 data for Wallonia.
- Data from USDA (2004), data for the period 1990-94 equal 1994; data represent cropland under crop residue management (e.g. no-till, conservation management) in US major agriculture productive areas.
- Data for the period 1995-99 refer to year 1999. Data not available for the period 1990-94.

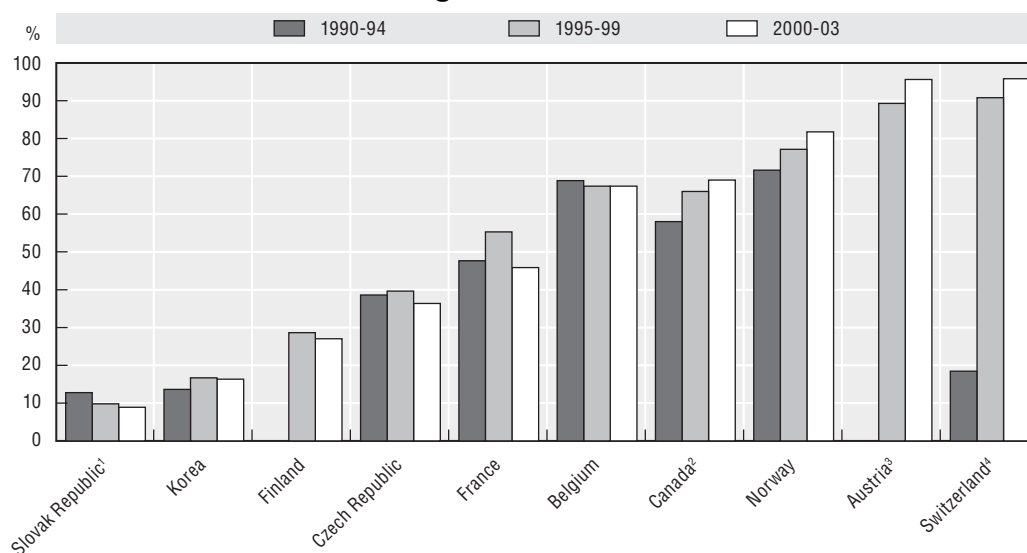
Source: USDA (2004); OECD Agri-environmental Indicators Questionnaire, unpublished.

### 1.9.5. Water management

For those OECD countries where irrigated agriculture is important, they are generally applying irrigation technologies that are poor in terms of water conservation (Figure 1.9.8). Crop irrigation in most countries involves flooding or high pressure raingun technologies, which use considerably greater quantities of water than the more efficient low pressure sprinklers and drip emitters. As in common with many other EFMPs water management practices are typically supported by government, but rarely obligatory or promoted voluntarily (Table 1.9.2).

The uptake of more efficient water management technologies (i.e. drip emitters) covers over 20% of the total irrigated area for only a few countries (**Czech Republic, Greece, Italy, Spain**). But for certain countries where irrigated agriculture contributes an important share in total agricultural output and value, and the pressure to conserve water resources is high in certain regions, the share of the more efficient drip emitter water application technology in irrigated areas is under 10% for **Australia, France, Turkey**, and the **United States**. However, for **Australia, France** and the **United States** there is more widespread use of low-pressure sprinklers (Figure 1.9.8).

Figure 1.9.7. **Share of total arable and permanent crop area under all-year vegetative cover**



StatLink  <http://dx.doi.org/10.1787/288274883027>

1. Data for the period 1990-94, 1995-99 and 2000-03 refer to the year 1992 (12.8%), 1997 (9.8%) and 2002 (8.9%).
2. The percentages show the share of Cropland in Different Soil Cover Classes (%). The percentages shown include the following soil cover classes: very high ( $\geq 325$  days coverage), high (300-324 days coverage) and moderate (275-299 days coverage).
3. Data for the period 1995-99 refer to the year 1999, and for 2000-03 refer to the year 2003.
4. Data for the period 1990-94, 1995-99 refer to year 1993 and 1999.

Source: OECD Agri-environmental Indicators Questionnaire, unpublished; Lefebvre et al. (2005); national data sources.

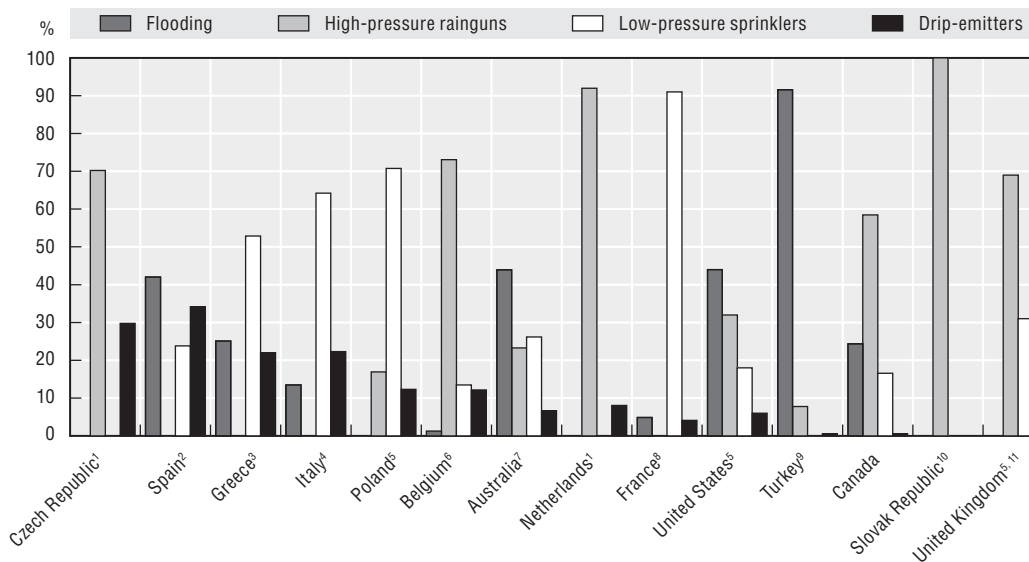

### 1.9.6. Biodiversity management

The share of agricultural land under biodiversity management plans (BMPs) is low for most OECD countries, except for **Austria, Ireland, Sweden** and **Switzerland** (Figure 1.9.9), although this conclusion should be treated with caution. Most countries are just beginning, or are in the process, of implementing biodiversity management plans in agriculture as part of their broader biodiversity action plans developed under the national implementation of the *Convention of Biological Diversity* (Section 1.8). In addition, many countries are only just starting to monitor the uptake by farmers of biodiversity management plans (about a third of OECD countries in 2003), which in many cases are supported or enforced by governments and regularly audited (Table 1.9.2).

Information on the characteristics of BMPs is currently lacking, but in some cases they cover, for example, conservation of endangered species (Section 1.8) and practices aimed at establishing and managing field margins and riparian buffers. As biodiversity and landscape management practices can be closely linked, it can be difficult to separate the two in a number of countries, such as in many European OECD countries.

Figure 1.9.8. **Share of irrigated land area using different irrigation technology systems**

2000-03

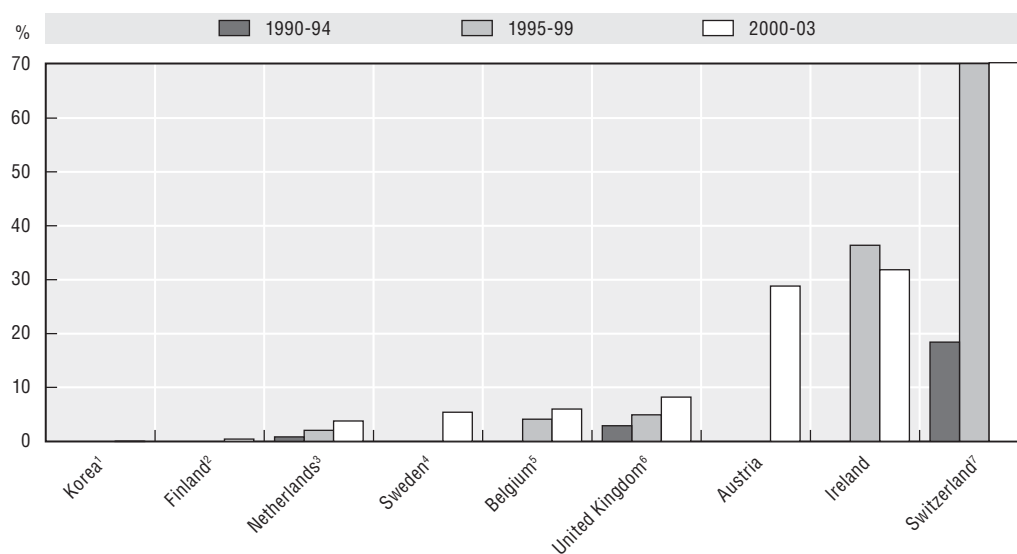
StatLink  <http://dx.doi.org/10.1787/288280262782>

1. Data for 2003.
2. The data are for 2002-03 and represent the area for flooding, sprinklers and drip emitters that are irrigable but not necessarily irrigated.
3. Data for 1999, which show different irrigation technologies' share of total irrigation water use.
4. Data for 2000.
5. National data.
6. Data for Flanders refer to 2002. Flooding data include Wallonia and Flanders data, but for Flanders only ornamental plant cultivation in greenhouses are included; high-pressure raingun data refer only to Flanders; data for low-pressure sprinklers and drip emitters are the sum of Flanders and Wallonia data.
7. Data are taken from the Australian Bureau of Statistics (2005), *Irrigation Methods 2002-03*; flooding refers to surface, low-pressure sprinklers refer to microspray, drip-emitters refers to drip or trickle, and high-pressure rainguns refers to portable irrigators, hose irrigators, large mobile machines and solid set.
8. Values are an average of data for 2000 and 2003.
9. Data for 2000, value for high-pressure rainguns include area irrigated by low-pressure sprinklers.
10. Data for 2000-03.
11. Data for England.

Source: Australian Bureau of Statistics (2005); OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France, OECD Agri-environmental Indicators Questionnaire, unpublished.

### 1.9.7. Organic management

The OECD area under certified organic farming has increased substantially, especially since 1993-95, but accounted for less than 2% of total OECD farmland by 2002-04 (Figure 1.9.10). However, there is considerable variation in the importance of organic farming across countries, with the share in the total agricultural area higher in OECD European countries (e.g. around 6% or higher in **Austria, Denmark, Finland, Italy** and **Switzerland**) but much lower in non-European OECD countries (e.g. under 1% in **Canada, Japan, Korea, Mexico, New Zealand** and the **United States**), except notably **Australia** where it is over 2%, and in **Greece, Iceland, Ireland, Poland** and **Turkey** where it is also very low.

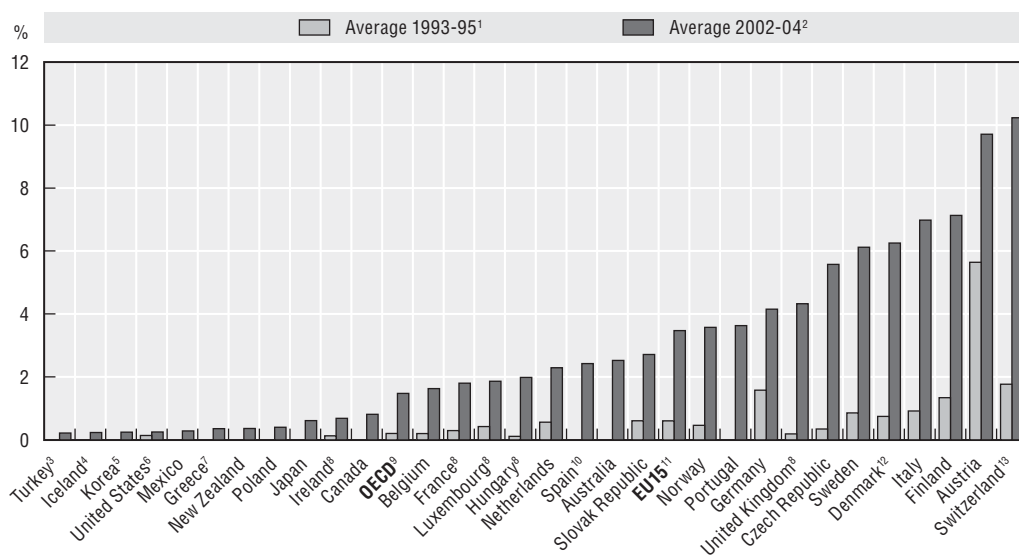
Figure 1.9.9. **Share of agricultural land area under biodiversity management plans**

StatLink  <http://dx.doi.org/10.1787/288303510537>

1. Value is 0.02% for 2000-03, data for other years are not available.
2. Value for 2000-03 is 0.42%, other years are not available.
3. Value for 1990-94 is 0.8%, data for 2003 are an estimate by the Netherlands.
4. Data include only pasture and share of pasture area.
5. Data represent Flanders and Wallonia; value of 2001 is the sum of Flanders (2001) and Wallonia (2003).
6. Includes area under the "Wildlife Enhancement Scheme" and "Agri-environment Schemes".
7. Data for the period 1990-94 and 1995-99 refer to the year 1993 and 1999.

Source: OECD Agri-environmental Indicators Questionnaire, unpublished.

The importance of organic farming varies not only between countries, but also between different commodities within countries. In **France**, for example, pasture is largely under organic systems compared to arable land, while amongst arable crops the share of fruit and vegetables produced organically tends to be higher than for cereals, sugar and oilseed crops. For livestock products growth in organic production has been most rapid for milk and poultry meat. In terms of the share of organic foods in total retail food sales the share varies across countries, but it is also small, for example, around 2% (2003) in the **United States**. Milk, fruit and vegetables account for the major part of organic production and retail sales in both the **United States** and **EU15** (EEA, 2005; OECD, 2003b; USDA, 2005).

Figure 1.9.10. **Share of agricultural land area under certified organic farm management**

StatLink  <http://dx.doi.org/10.1787/288310605203>

1. Data for 1993-95 are unavailable for Australia, Canada, Japan, Mexico, New Zealand, Poland and Portugal.
2. Data for 2002-04 are taken from IFOAM (2007).
3. Value for 1993-95 is 0.01. Data for 1994 are taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France.
4. Value for 1993-95 is 0.004. Data for 1993-95 are taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3.
5. Value for 1993-95 is 0.001. Data for 1995 are taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3.
6. Value for 1993-95 equals data for 1997 (0.14%) and value for 2003 equals data 2001 (0.25%). Data from national source.
7. Value for 1993-95 is 0.02; data are taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3.
8. Data for 1993-95 are taken from IFOAM, other data are taken from OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3.
9. Australia, Canada, Japan, Mexico, New Zealand, Poland and Portugal are not included in the OECD for 1993-95.
10. Data for the period 1993-95 refer to year 1993, the value is 0%.
11. Portugal is not included in the EU15 for 1993-95.
12. Data for 1994 equal 1993-95 average.
13. Data for the period 1993-95 refer to the year 1993.

Source: OECD (2001), *Environmental Indicators for Agriculture*, Vol. 3, Paris, France; OECD Agri-environmental Indicators Questionnaire, unpublished; IFOAM (2007).

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