Organisation for Economic Co-operation and Development
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ENVIRONMENTAL PERFORMANCE OF AGRICULTURE IN OECD COUNTRIES SINCE 1990:

Mexico Country Section

This country section is an extract from chapter 3 of the OECD publication (2008) ***Environmental Performance of Agriculture in OECD countries since 1990***, which is available at the OECD website indicated below.

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A summary version of this report is published as ***Environmental Performance of Agriculture: At a Glance***, see the OECD website which also contains the agri-environmental indicator time series database at: http://www.oecd.org/tad/env/indicators

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BACKGROUND TO THE COUNTRY SECTIONS

Structure

This chapter provides an analysis of the trends of environmental conditions related to agriculture for each of the 30 OECD member countries since 1990, including an overview of the European Union, and the supporting agri-environmental database can be accessed at *www.oecd.org/tad/env/indicators*. Valuable input for each country section was provided by member countries, in addition to other sources noted below. The country sections are introduced by a figure showing the national agri-environmental and economic profile over the period 2002-04, followed by the text, structured as follows:

- ***Agricultural sector trends and policy context:*** The policy description in this section draws on various OECD policy databases, including the *Inventory of Policy Measures Addressing Environmental Issues in Agriculture* (*www.oecd.org/tad/env*) and the Producer and Consumer Support Estimates (*www.oecd.org/tad.support/pse*).
- ***Environmental performance of agriculture:*** The review of environmental performance draws on the country responses to the OECD agri-environmental questionnaires (unpublished) provided by countries and the OECD agri-environmental database supporting Chapter 1 (see website above).
- ***Overall agri-environmental performance:*** This section gives a summary overview and concluding comments.
- ***Bibliography:*** The OECD Secretariat, with the help of member countries, has made an extensive search of the literature for each country section. While this largely draws on literature available in English and French, in many cases member countries provided translation of relevant literature in other languages.

At the end of each country section a standardised page is provided consisting of three figures. The first figure, which is the same for every country, compares respective national performance against the OECD overall average for the period since 1990. The other two figures focus on specific agri-environmental themes important to each respective country.

Additional information is also provided for each country on the OECD agri-environmental indicator website (see address above) concerning:

- Details of national agri-environmental indicator programmes.
- National databases relevant to agri-environmental indicators.
- Websites relevant to the national agri-environmental indicators (*e.g.* Ministries of Agriculture)
- A translation of the country section into the respective national language, while all 30 countries are available in English and French.

Coverage, caveats and limitations

A number of issues concerning the coverage, caveats and limitations need to be borne in mind when reading the country sections, especially in relation to making comparisons with other countries:

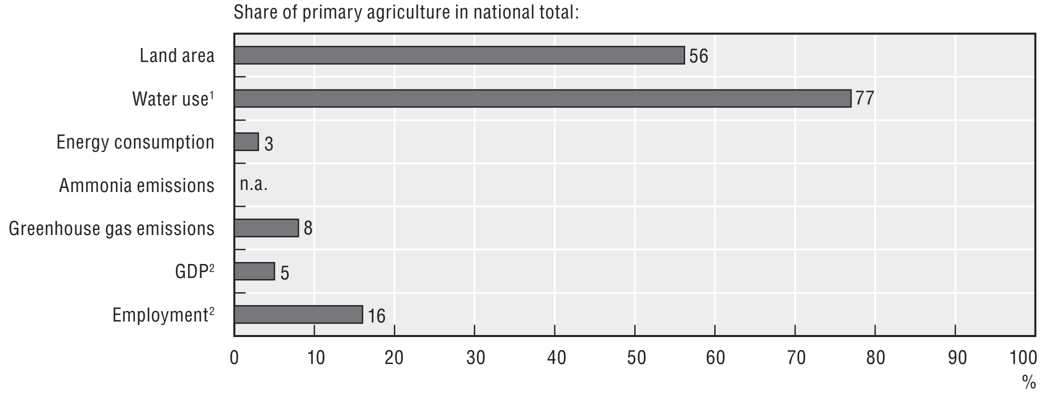
Coverage: The analysis is confined to examination of agri-environmental trends. The influence on these trends of policy and market developments, as well as structural changes in the industry, are outside the scope of these sections. Moreover, the country sections do not examine the impacts of changes in environmental conditions on agriculture (*e.g.* native and non-native wild species, droughts and floods, climate change); the impact of genetically modified organisms on the environment; or human health and welfare consequences of the interaction between agriculture and the environment.

Definitions and methodologies for calculating indicators are standardised in most cases but not all, in particular those for biodiversity and farm management. For some indicators, such as greenhouse gas emissions (GHGs), the OECD and the UNFCCC are working toward further improvement, such as by incorporating agricultural carbon sequestration into a net GHG balance.

- ***Data availability, quality and comparability*** are as far as possible complete, consistent and harmonised across the various indicators and countries. But deficiencies remain such as the absence of data series (*e.g.* biodiversity), variability in coverage (*e.g.* pesticide use), and differences related to data collection methods (*e.g.* the use of surveys, census and models).
- ***Spatial aggregation*** of indicators is given at the national level, but for some indicators (*e.g.* water quality) this can mask significant variations at the regional level, although where available the text provides information on regionally disaggregated data.
- ***Trends and ranges in indicators***, rather than absolute levels, enable comparisons to be made across countries in many cases, especially as local site specific conditions can vary considerably. But absolute levels are of significance where: limits are defined by governments (*e.g.* nitrates in water); targets agreed under national and international agreements (*e.g.* ammonia emissions); or where the contribution to global pollution is important (*e.g.* greenhouse gases).
- ***Agriculture's contribution to specific environmental impacts*** is sometimes difficult to isolate, especially for areas such as soil and water quality, where the impact of other economic activities is important (*e.g.* forestry) or the "natural" state of the environment itself contributes to pollutant loadings (*e.g.* water may contain high levels of naturally occurring salts), or invasive species that may have upset the "natural" state of biodiversity.
- ***Environmental improvement or deterioration*** is in most individual indicator cases clearly revealed by the direction of change in the indicators but is more difficult when considering a set of indicators. For example, the greater uptake of conservation tillage can lower soil erosion rates and energy consumption (from less ploughing), but at the same time may result in an increase in the use of herbicides to combat weeds.
- ***Baselines, threshold levels or targets for indicators*** are generally not appropriate to assess indicator trends as these may vary between countries and regions due to difference in environmental and climatic conditions, as well as national regulations. But for some indicators threshold levels are used to assess indicator change (*e.g.* drinking water standards) or internationally agreed targets compared against indicators trends (*e.g.* ammonia emissions and methyl bromide use).

3.18. MEXICO

Figure 3.18.1. **National agri-environmental and economic profile, 2002-04: Mexico**



StatLink http://dx.doi.org/10.1787/300643416640

1. Data refer to the period 2001-03.
2. Data refer to the year 2003.

Source: OECD Secretariat. For full details of these indicators, see Chapter 1 of the *Main Report*.

3.18.1. Agricultural sector trends and policy context

Agriculture plays an important but declining role in the Mexican economy. In 2003 primary agriculture accounted for about 5% of GDP and 16% of employment compared to 8% and 27% respectively in 1990 [1] (Figure 3.18.1). Nevertheless, 25% of Mexico's 103 million population live and work in rural, largely agricultural, areas. The rural population has increased by nearly 2 million over the past decade [2].

Mexico's agricultural sector is one of the most rapidly growing among OECD countries. The volume of agricultural production rose by 34% between 1990-92 and 2002-04, with crop production increasing by 26% and livestock 51% (Figures 3.18.2 and 3.18.3). The area farmed rose by 3%; while the volume of inputs also increased by 22% for pesticides, and 21% for direct on-farm energy consumption, although the use of phosphorus fertilisers remained stable, and nitrogen fertiliser use declined (–5%), as did the use of water (–10%) (Figures 3.18.2 and 3.18.4). Production is expanding by improving efficiency and increasing use of capital-intensive technologies. Nevertheless, farming is characterised by diverse structure and production systems. Large commercial arable farms, largely in the north, are capital intensive and rely on irrigation and purchased inputs. There are also range fed cattle and intensive pig and poultry operations in the north. Subsistence farms, mainly in the centre and south, grow staples such as maize and beans. The southern tropical zone has plantations and subsistence producers of coffee, sugarcane and bananas [2, 3].

Support to agriculture is below the OECD average and has declined over the last decade. Agricultural producer support fell from around 28% of farm receipts in the early 1990s down to 21% by 2002-04 (as measured by the OECD's Producer Support Estimate). This compares to the OECD average of 31% over this period [4]. Nearly 80% of farm support is output and input linked, falling from 100% over the last decade. Agricultural policies consist mainly of market price support provided through border measures and payments to producers (PROCAMPO). The latter include payments for input use and technical assistance aimed at enhancing farm investment, especially in poor areas (*Alianza Contigo*). Border protection with Canada and the United States is being reduced within the framework of the North American Free Trade Agreement (NAFTA) [4].

Policies addressing agri-environmental concerns are limited. Agri-environmental payments are possible under PROCAMPO, for soil and water conservation, although farmer uptake of these payments has been limited to date [3]. A number of programmes support forestry but only one is aimed specifically at the reaforestation of farmland, and eco-certification of shade-grown coffee plantations is being developed [3]. Farmers are exempt from the 15% value added tax on pesticides [5].

Economy-wide environmental and taxation policies and international environmental agreements also affect agriculture. Under the *Law on Energy for Agriculture* diesel fuel and electricity subsidies reduce farmers' energy costs. The programme to subsidise diesel for farm production, implemented since 2003, provided payments of MXN 1.2 billion (USD 106 million) in 2004 [4]. The total agricultural electricity subsidy rose from MXN 3.8 to 5.4 billion (USD 390-480 million) from 2002 to 2004 [4, 6]. Under the *Federal Law on Water Taxes* (1982), a system of water abstraction charges was established, but farmers were exempt from these charges up to 2003, although they are liable for water pollution charges introduced in 1992 under the same law. Budget transfers to the government *National Water Commission* agency reduce farmers' irrigation costs: currently farmers are paying 80% of irrigation operating and maintenance costs compared to 20% in the early 1990s, and government expenditure on irrigation infrastructure and maintenance amounted to MXN 1 468 (USD 135) million in 2006 [4].

The International Boundary and Water Commission resolves water issues at the Mexican-United States border, including allocation of water resources for irrigation, while the *North American Commission for Environmental Co-operation*, established under NAFTA in 1994, addresses regional environmental issues, for example those concerning transgenic maize [7]. The *National Environment Programme* also provides a framework for biodiversity and natural resource conservation.

3.18.2. Environmental performance of agriculture

The main agri-environmental concerns relate to water resources and deforestation, with the latter being of importance for soil conservation and biodiversity. Also of increasing concern are issues related to agricultural pesticide use, especially methyl bromide, water pollution, and greenhouse gas emissions.

Agriculture's use of the country's natural resources is significant, accounting for 56% of land use (2002-04) and nearly 80% of water use (2001-03). Over the period 1990-92 to 2002-04 the growth in the agricultural land area was amongst the highest across OECD countries (Figure 3.18.3). In excess of 75% of the country lies in semi-arid or arid zones where more than half of agricultural production takes place. While overall population density is low by OECD standards, Mexico has the highest rate of population growth across the OECD, which coupled with high rates of industrial growth, urban expansion and a growing but poor rural population, there is considerable pressure on land, water and biological resources.

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Soil erosion is one of Mexico's most serious ecological problems with agriculture identified as the major cause of soil degradation [3, 8]. Between 60-80% of the total land area is affected by erosion, with around 40% suffering high and severe erosion [3, 8]. Recent evidence reveals that agriculture is the major cause of soil degradation from erosion accounting for nearly 80% of affected areas. The soil degrading factors caused by agriculture are overgrazing, excess irrigation, tillage burning, excessive tilling [9] and inadequate adoption of soil conservation practices [8].

Water pollution from agriculture tends to be mainly confined to irrigated areas where farm chemicals are widely used [3]. But the expansion of intensive pig, poultry and dairy operations is leading to a greater incidence of water pollution from livestock effluents, even though overall cattle numbers have declined since 1990. [10]. The national nutrient surpluses of nitrogen and phosphate are very low by OECD standards, with most eutrophic pollution of water usually associated with urban and industrial sectors (Figure 3.18.1) [11]. There has been a slight decrease in nutrient surpluses, mainly because of declining cattle numbers; only a small increase in nitrogen fertiliser use; a drop in the use of phosphate fertilisers; and an increase in crop production (Figure 3.18.4). These changes have led to improvements in nutrient use efficiency (*i.e.* the ratio of nutrient outputs to nutrient inputs).

Pesticide use increased by 22% over the period 1993-95 to 2001-03 (Figures 3.18.2 and 3.18.4). Pesticide use is not widespread, partly because subsistence farmers cannot afford to use them, although total use has expanded over the 1990s. The use of two persistent organic pesticide pollutants, chlordane and DDT, has decreased over the past 20 years, and sales were prohibited as from 1998 and 2002 respectively [3]. Even so, the persistence of these pesticides, and possible continued illegal use [12], is polluting some coastal waters, with risks to human health from fish consumed from these waters [13], although there is little information on the overall impact of pesticides on ecosystems [5] and human health [14]. Recent research reveals, however, that reported incidents of pesticide poisonings have decreased by more than half between 1998 and 2002, although the incidence of poisonings is under-recorded [14].

Demand for water by agriculture is exceeding renewable supply and aquifers are being depleted [10]. Competition for water resources, especially in north-central regions, is intensifying because of the growth in population; economic activity; and water demand from irrigated agriculture. Irrigation accounts for nearly 80% of total water use and 50% of farm output, with 70% of farm exports dependent on irrigation (2001-03) [3]. About a third of agricultural water is from groundwater, with agriculture accounting for 70% of groundwater use (1997) [6]. The overexploitation of aquifers is a growing problem, with 32 overexploited aquifers reported in 1975 rising to 102 in 2005. Nearly 60% of groundwater for all uses is extracted from aquifers above recharge rates [6]. The unsustainable use of groundwater resources has raised concerns for the depletion of water to support aquatic ecosystems, especially wetlands, and a consequent increase in the salinity of soils [6]. Projections to 2010 suggest that water demand may rise sharply and further intensify competition for water between agriculture and other consumers [15].

Competition for water resources is especially acute on the Mexican-United States border, because of the over exploitation of water, notably by agriculture, from the border Rio Bravo river, called the Rio Grande in the US [16, 17]. Only around 45% to 50% of water extracted reaches irrigated fields [3, 6], because of insufficient investment in irrigation infrastructure and the relatively low share of irrigation water and energy costs in farmers total input expenditure [18]. Even so, there has been some improvement in irrigation water application rates (megalitres per hectare of irrigated land) declining by 12% between 1990-92 and 2001-03. The electricity subsidy for agriculture has lowered pumping costs for irrigators, with horticultural producers the main beneficiaries [4].

Trends in agricultural air emissions have shown mixed results since 1990. Agricultural ***ammonia emissions*** may have increased between 1990 and 2004, but ammonia emission data are not regularly collected and Mexico is not a signatory to the *Gothenburg Protocol* to limit emissions. The likely increase in ammonia emissions are from the increase in livestock production since 1990 partly offset by the reduction in the use of nitrogen fertiliser. For ***methyl bromide*** (an ozone depleting pesticide, particularly used in the horticultural sector as a soil fumigant) Mexico along with most OECD countries has substantially reduced its use over the period 1995 to 2004. Under the *Montreal Protocol on Substances that Deplete the Ozone Layer*, Mexico, which is classified as a developing country under the *Protocol*, agreed to reduce methyl bromide use by 2002 to 1995-98 levels, which it has achieved, with a further 20% reduction in 2002-05 and elimination by 2015, except for limited purposes [3].

The over 40% increase in agricultural greenhouse gas (GHG) emissions between 1990 and 1996 was among the highest across OECD countries (Figure 3.18.2). The increase in agricultural GHGs is largely attributed to rising livestock numbers, and agriculture contributes around 8% of national total GHGs. Methane emissions account for nearly 80% of agricultural GHGs (in CO_2 equivalents), mainly from livestock and to a lesser extent rice production, while nitrous oxide accounts for much of the remainder through fertiliser use [3, 19]. Considerable stocks of ***terrestrial carbon*** are being lost with the conversion of forests to agricultural land, but little data exist on the level of these losses [21]. However, there are opportunities for Mexican agriculture to sequester carbon, as carbon accumulated in some agricultural ecosystems is higher than carbon in the soil of secondary degraded forests [20].

Direct on-farm energy consumption rose by 21% compared to an increase of 10% across the economy, over the period 1990-92 to 2002-04, has also contributed to the increase in GHGs (Figure 3.18.4). Agriculture accounted for 3% of total energy consumption in 2002-04. Much of the increase in energy consumption is explained by the expansion in use and size of machinery as a substitute for labour since 1990.

Agricultural expansion over the past decade has resulted in growing pressure on wild species and natural habitats. This is significant because Mexico is identified as one of the world's megadiverse countries, with around 10% of the world's flora and fauna species [3]. The rate of deforestation is amongst the highest in the world at over 1% per annum over the 1990s, with clearing for agricultural purposes identified as the major cause for the lost of temperate and tropical forests. This is closely linked to the growth in the rural population; rural poverty [3]; and an increase in beef production, leading to the conversion of forests into grazing land [22]. Agriculture is also exerting pressure on aquatic environments (rivers, lakes, wetlands and coastal zones), from increasing levels of livestock effluents and diffuse pollution through the use of chemicals in arable farming [3].

There are environmental and economic risks associated with the loss of agricultural genetic resources, especially for crops. Mexico is recognised as a "Vavilov" centre, which is an area where crops, such as maize, were first domesticated and have evolved over several thousand years [23, 24]. Genetic erosion of maize varieties, shows a loss of 80% of local varieties compared to the 1930s [23], and more recently possible contamination of domesticated landraces and wild relatives from transgenic maize [24, 25]. The environmental and socio-economic costs and benefits associated with the use of transgenic maize (many subsistence farmers grow maize as a staple crop), and the loss of genetic resources, are complex and not fully understood, but are the subject of much ongoing research in Mexico and internationally, such as by the *North American Commission for Environmental Co-operation* [7].

3.18.3. Overall agri-environmental performance

Deforestation and conservation of water resources are the two key agri-environmental challenges in Mexico. Agriculture has been identified as a major cause of deforestation, which has adverse environmental implications for biodiversity, soil erosion and loss of carbon stocks. With growing competition for water in the drier regions of the country, agriculture, as the major user of water resources, is under increasing pressure to improve its efficiency of water use.

Mexico will require time and resources to establish adequate monitoring systems to deal with the environmental challenges it needs to address [3]. A start has been made with environmental monitoring, including efforts related to agriculture, such as the 2001 national soil inventory [8]; and the 1998 national survey of biodiversity by the National Commission for Biodiversity. However, these efforts require strengthening if they are to provide useful data for policy makers.

Limiting the adverse impacts of agriculture on the environment poses a formidable challenge. Recent developments suggest, however, some progress is being made toward reducing agriculture's adverse environmental impacts and increasing environmental services. A number of persistent organic pesticide pollutants have been prohibited, and the soil and water conservation infrastructure is being rehabilitated. A new programme on Water Rights has provided MXN 460 (USD 43) million in 2003, and MXN 227 (USD 20) million in 2004, to purchase water rights in areas where aquifers are overexploited, with an estimated 170 million cubic metres of water bought from producers in 2004 [4]. Mexico has a high percentage of "shade grown" coffee compared to other countries, which offers a higher quality habitat for biodiversity, and introduced an eco-certification system to provide incentives to "shade grown" and organic coffee production [3, 26, 27].

The North American Commission for Environmental Co-operation has recommended that Mexico should minimise the impact of growing transgenic maize and also mill transgenic grains immediately they are imported [7]. The government also amended its law on genetically modified crops in 2005 by limiting the release of genetically modified maize in centres of origin such as Oaxaca, Veracruz and Yucatan, in order to safeguard the diversity of domestic maize.

Pressure on the environment from agriculture has increased considerably since 1990. This trend is expected to continue over the next decade as projections indicate further expansion of the agricultural sector [28]. The adverse impacts of agriculture on the environment are attributed to the expansion in the area cultivated and grazed at the expense of forested land; poor soil conservation practices and deforestation resulting in major areas of land subject to elevated levels of erosion; and, also the high rates of water loss in irrigated areas through inefficient irrigation practices. Agricultural water and electricity charges are low by comparison with those paid by industrial and urban consumers, but reforms from 2003 have reduced the level of support [3, 11].

Water policy reforms have helped toward improving water use efficiency and reducing losses and there has been some improvement in irrigation water application rates per hectare irrigated [3, 29]. But subsidies for water charges and electricity for pumping are undermining the efforts to achieve sustainable agricultural water use and, in the case of energy, reduce greenhouse gas emissions. There is also concern that the subsidy to electricity is also exacerbating the pumping of groundwater and the growing overexploitation of this resource above recharge rates [6]. Moreover, the irrigation and electricity subsidy appears to be in contradiction to the new programme to purchase water rights from farmers, raising the costs to the government of achieving their environmental objectives [4].

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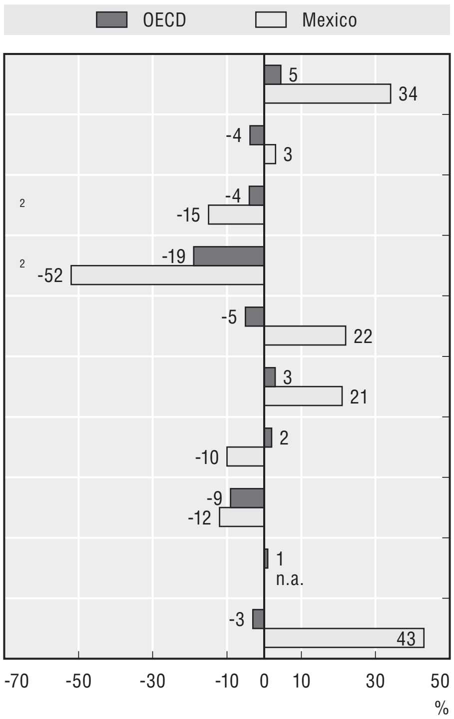
Figure 3.18.2. **National agri-environmental performance compared to the OECD average**

Percentage change 1990-92 to 2002-04[1]



Absolute and economy-wide change/level

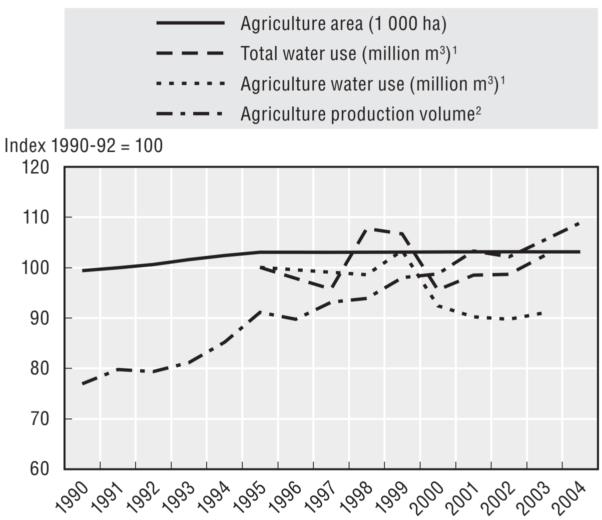
Variable	Unit		Mexico	OECD
Agricultural production volume	Index (1999-01 = 100)	1990-92 to 2002-04	134	105
Agricultural land area	000 hectares	1990-92 to 2002-04	3 267	–48 901
Agricultural nitrogen (N) balance	Kg N/hectare	2002-04	22	74
Agricultural phosphorus (P) balance	Kg P/hectare	2002-04	1	10
Agricultural pesticide use	Tonnes	1990-92 to 2001-03	+7 070	–46 762
Direct on-farm energy consumption	000 tonnes of oil equivalent	1990-92 to 2002-04	+476	+1 997
Agricultural water use	Million m^3	1990-92 to 2001-03	–6 049	+8 102
Irrigation water application rates	Megalitres/ha of irrigated land	2001-03	8.7	8.4
Agricultural ammonia emissions	000 tonnes	1990-92 to 2001-03	n.a.	+115
Agricultural greenhouse gas emissions	000 tonnes CO_2 equivalent	1990-92 to 2002-04	+16 811	–30 462

n.a.: Data not available. Zero equals value between –0.5% to < +0.5%.

1. For agricultural water use, pesticide use, irrigation water application rates, and agricultural ammonia emissions the % change is over the period 1990-92 to 2001-03.
2. Percentage change in nitrogen and phosphorus balances in tonnes.

Source: OECD Secretariat. For full details of these indicators, see Chapter 1 of the *Main Report*.

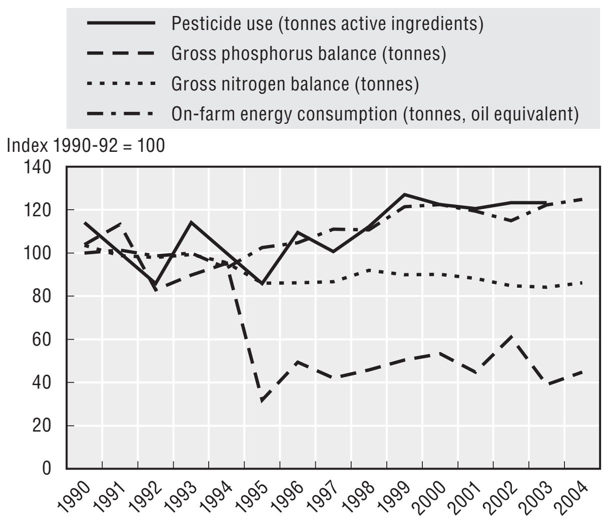
Figure 3.18.3. **Trends in key agri-environmental indicators**



1. Index 1995 = 100.
2. Index 1999-2001 = 100.

Source: OECD Secretariat.

Figure 3.18.4. **Trends in key agri-environmental indicators**



Source: OECD Secretariat.

StatLink http://dx.doi.org/10.1787/300683601738

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