Dataset Information:

Title	Pesticides Use
Data description	The FAOSTAT Pesticides Use domain contains statistics on the agricultural use of major pesticide groups and of relevant chemical families. Data are disseminated by country, with global coverage, over the period 1990-2022, with annual updates.

The FAOSTAT Pesticides Use domain contains information on the use of major pesticide groups:
1. Insecticides (Chlorinated hydrocarbons, Organo–phosphates, Carbamates–insecticides, Pyrethroids, Botanical and biological products and Others not elsewhere classified);
2. Mineral Oils;
3. Herbicides (Phenoxy hormone products, Triazines, Amides, Carbamates–herbicides, Dinitroanilines, Urea derivatives, Sulfonyl urea, Bipiridils, Uracil, Others not elsewhere classified);
4. Fungicides and Bactericides (Inorganic, Dithiocarbamates, Benzimidazoles, Triazoles Diazoles, Diazines Morpholines, Others not elsewhere classified);
5. Plant Growth Regulators;
6. Rodenticides (Anti–coagulants, Cyanide Generators, Hypercalcaemics, Narcotics, Others not elsewhere classified);
7. Other Pesticides NES (not elsewhere specified).

The indicator *Use per area of cropland* is calculated as:

$$U_{(C,Y)} = \frac{PT_{(C,Y)}}{Area_{(C,Y)}}$$

Where:

$U_{(C,Y)}$ Use per area of cropland in country *C* and year *Y* (in kg/ha)

$PT_{(C,Y)}$ Pesticides (in total active ingredients) in country *C* and year *Y* (in tonnes)

$Area_{(C,Y)}$ Cropland area (corresponding to the sum of Arable land and Permanent crops) in country *C* and year *Y* (in 1 000 ha)

The indicator *Use per capita* is calculated as:

$$U_{(C,Y)} = \frac{PT_{(C,Y)}}{POP_{(C,Y)}}$$

Where:

$U_{(C,Y)}$ Use per capita in country *C* and year *Y* (in kg/ha)

$PT_{(C,Y)}$ Pesticides (in total active ingredients) in country *C* and year *Y* (in tonnes)

$POP_{(C,Y)}$ Estimated and projected population in country C and year I

The indicator *Use per value AP (Agricultural Production)* is calculated

as:

$$U_{(C,Y)} = \frac{PT_{(C,Y)}}{VAP_{(C,Y)}}$$

Where:

$U_{(C,Y)}$ Use per capita in country *C* and year *Y* (in kg/ha)

$PT_{(C,Y)}$ Pesticides (in total active ingredients) in country *C* and year *Y* (in tonnes)

$VAP_{(C,Y)}$ Gross Production Value (constant 2014-2016 thousand I$) of crop and livestock products in country C and year I

Documentation on methodology	In 2023, there was a revision to the Pesticides Use Questionnaire. The modifications were the following: • Inclusion of the pesticides total (code 1357) in the Questionnaire itself • Merging of seed treatments with Fungicides and Insecticides and deletion of 11 codes and rows from the Questionnaire. • Addition of botanical products and biologicals to the Herbicides, and Fungicides & Bactericides pesticides types. This involved the recoding of the previous code *1338: Seed Treat Fung - Botanical products and biologicals* to now be named 1338: *Fung & Bact - Botanical products and biologicals*, and the creation of a new code (1308 assigned by Amanda) for *Herbicides - Botanical products and biologicals.* This information was already recorded separately for Insecticides. • Modification of the instructions and additional information tab for more detailed recording of antimicrobials. We have included in the instruction to use the already-existing FAO Code *1335 Fung & Bact - Triazoles, diazoles* for recording the list of azole-based antimicrobials (Triazole, Bromuconazole, Difenoconazole, Epoxiconazole, Propiconazole, Tebuconazole, or others - please provide name). We will use the already-existing FAO Code 1337 - *Fung & Bact – Other* for recording the list of other antimicrobials of interest used as bactericides (Amoxicillin, Aureofungin, Cefadroxil, Gentamicin, Kasugamycin, Ningnanmycin, Oxonilic acid, Oxytetracycline, Streptomycin, Tetracycline, and Validamycin or others - please provide name).
Classification system	The FAOSTAT Pesticides Use domain is compliant with the **System of Environmental-**Economic Accounting for Agriculture Forestry and Fisheries (SEEA AFF) in terms of: i) Definitions; ii) Classifications; and iii) Applicability: the FAOSTAT Pesticides Use data can be used to compile SEEA AFF Table 4.7 "*Physical flow account for pesticides*". The FAOSTAT Pesticides Use domain is compliant with the Framework for the Development of Environmental Statistics (FDES 2013), FDES Component 1. *Environmental Conditions and Quality*; Component 2. *Environmental Resources and their use* and in Component 3. *Residuals* and FDES, Table 4.2 "*Core Set of Environmental Statistics*".
Unit of measure	metric tonnes of active ingredients

Metadata last Update	2024
Statistical concepts and definitions	Pesticides use statistics Pesticides (total) is the sum of active ingredients in the following categories of pesticides: Fungicides & Bactericides, Herbicides, Insecticides, Plant Growth Regulators, Seed Treatment Fungicides, Seed Treatment Insecticides, Mineral Oils, Rodenticides, and Disinfectants and Other pesticides, *nes* (not elsewhere specified.
Sector coverage	Agriculture; Forestry
Time coverage	1990–2022
Reference period	Calendar year
Reference area	World of which the database covers 176 countries and territories.

Methodology and Data Quality Information:

Source data	National data are collected from 200 countries and territories via the FAO Pesticides Use Questionnaire https://www.fao.org/statistics/data-collection/agriculture. The data collected via questionnaire may be complemented with official government data sources, for instance from national statistical yearbooks and ministerial data portals, as well as with secondary data sources, such as country studies from other International Organizations. Data are flagged in the domain according to source. Several countries may report pesticides sales data or pesticides trade imports data in the Questionnaire, as a proxy for pesticides use. No data adjustments are made in such instances, albeit they may impact time series occasionally. Use of proxies are recorded in the ''Country Notes'' available on the FAOSTAT Pesticides Use domain.

Overall accuracy

Below is the reporting rate (defined as the number of countries who provide data) for the 2023 dispatch of the FAO Pesticides Use Questionnaire:

Region	Reporting Rate
Africa	9%
Americas	32%
Asia	39%
Europe	80%
Oceania	10%
World	**32%**

Below is the official rate (defined as the number of imputations over the total number of records) for the Pesticides Use database:

Region	Imputation Rate
Africa	67%
Americas	56%
Asia	47%
Europe	15%
Oceania	75%
World	**46%**

Data collection method	The FAO Questionnaire is sent to National Focal Points in National Institutions, typically National Statistical Offices, Ministries of Agriculture or other relevant Agencies. Complimentary official data sources identified by focal points such as country statistical yearbooks and data portals are integrated.
Adjustment	The following gap-filling methodology was applied to reported statistics in connection with: 1. Data errors (data reported in formulated products, rather than in active ingredients; and 2. Incomplete time series of subcomponents, for the purpose of computing aggregates of pesticides totals by country.

Data in formulated products (FP) was adjusted to active ingredients (AI) in the following manner.

In cases of a temporary break in time series at time points i and k, i.e., for series of the kind {AI_i, FP_{i+1}, …, FP_{k-1}, AI_k}, the average of the relative rate of change before and after the more recent break occurrence was applied to the break point (1), and th<u>e time series was adjusted backwards (or forward, in cases when the final end point in the complete </u>time-series was in FP), using the relative growth rate of the FP data in the series (2):

$$\widehat{AI}_{k-1} = AI_k + \frac{1}{2}\left(\frac{AI_k - AI_{k+1}}{AI_k} + \frac{FP_{k-2} - FP_{k-1}}{FP_{k-1}}\right) * \Delta t * AI_k$$
(1)

where:

$\widehat{AI}_{k-1}$ is the reconstructed AI value at time k-1;
Δt is the time interval in years (for this work, $\Delta t = 1$);
and:

$$\widehat{AI}_j = \widehat{AI}_{j+1} + \left(\frac{FP_{j+1} - FP_j}{FP_{j+1}}\right) * \Delta t * \widehat{AI}_{j+1}$$
(2)

where j = k-2, k-3, … , i
The above equations were not applied in cases where the country reported statistics in formulated products were lower than those in active ingredients. In such cases, data in formulated products were not considered valid, and a simple linear interpolation between available points was performed, similarly to what done in point 2 below.

In all cases, mean country conversion factors, CF, from FP to AI were calculated as the average of the AI / FP ratios of available values after time series reparation:

$$CF = \frac{1}{k-i-1} \sum_{j=1}^{k-i} \frac{\widehat{AI}}{FP_j}$$

Regional and global conversion factors were calculated by pesticide type, using the weighted average of the country conversion factors, with the average value of $\widehat{AI}$ across the repaired time series break as weighting variable.

CFs were used to convert data in formulated products to active ingredients in those cases where only data in formulated products were reported. Because the subset of countries where data repair into AI was performed could not

Imputation

Pesticides totals by country were estimated by filling gaps in countries time series of relevant pesticides sub-components and then summing them up. Gap filling was performed by linearly interpolating between available values, or by carrying forward or backward last available values in a time series. Gap-filled values by pesticides sub-components are not disseminated.

As part of the 2023 release, for countries with gaps in reporting of a timespan of 10 years historically or recently, the entire time series was replaced with net trade converted to formulated products. Net trade was also used for countries currently missing entirely from the database. As a general rule, net trade was used as a proxy only when the balance was never negative, and it was only applied to non-pesticides-producing countries. The list of pesticides producing countries was derived from the INDSTAT database of UNIDO. In general, the database has coverage for all pesticides producers, with the exception of Singapore and Uzbekistan. Mirror trade, implemented as a gap-filling routine for non-reporting countries, was used with the net-trade imputation for the following 4 countries: Chad, Cook Islands, Haiti, and Libya. https://stat.unido.org/

Although the overall revision contributed only 3% to the global total, there were significant contributions to Africa. Below is a table showing the regional contributions of the revisions to the pesticides total, for new and updated countries.

Updated Countries		New Countries			Cumulative Contribution	
Africa	10%	Africa	19%		Africa	29%
Americas	1%	Americas	1%		Americas	2%
Asia	1%	Asia	0%		Asia	1%
Europe	0%	Europe	0%		Europe	1%
Oceania	3%	Oceania	0%		Oceania	3%
World	1%	World	1%		World	3%

Recommended uses and limitations

Data for the following countries are currently not displayed for the indicator Use per area of cropland because quality checks are being conducted on their data series: Antigua and Barbuda, Bahamas, Barbados, Bermuda, Aruba, Cayman Islands, Faroe Islands, Kuwait, Maldives, Nauru, Northern Mariana Islands, Qatar, Saint Kits and Nevis, Saint Vincent and the Grenadines, Seychelles, Tokelau, Turks and Caicos Islands, British Virgin Islands.