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FAOSTAT ANALYTICAL BRIEF 70

# Pesticides use and trade

1990–2021

## HIGHLIGHTS

- In 2021, total pesticides use in agriculture was 3.5 million tonnes of active ingredients (Mt), a 4 percent increase in a year, an 11 percent in a decade and a doubling since 1990.
- Total pesticides exports in 2021 reached 7.1 Mt of formulated products, for a total value of USD 43.2 billion. Traded volume decreased by 5 percent compared with 2020, while traded value increased by 5 percent.
- In 2021, Asia had the highest levels of pesticides exports, with 3.6 Mt in formulated products and a value of USD 17.3 billion.
- The Americas imported the largest amounts of pesticides from other regions of the world in 2021: 1.2 Mt, corresponding to a value of USD 7.6 billion.
- Asia had the highest shares of insecticides in total pesticides used (38 percent) and Europe had the lowest share (13 percent).
- Oceania increased pesticides use in agriculture by 206 percent between 1990 and 2021, the fastest among all regions, compared with 191 percent for the Americas, 175 percent for Africa, 67 percent for Asia and just 1 percent for Europe.
- Oceania applied low levels of pesticides per hectare of cropland (1.66 kg/ha) and when normalized by the value of agricultural production (0.83 kg/1000 I\$), but high levels on a per person basis (1.30 kg/cap). Conversely, the Americas applied high levels for all three indicators (3.01 kg/ha, 1.49 kg/1000 I\$, and 1.23 kg/cap, respectively).

## FAOSTAT PESTICIDES

### BACKGROUND

Pesticides are a key agricultural input needed to protect seeds and safeguard crops from unwanted plants, insects, bacteria, fungi and rodents. At the same time, pesticides can have negative health and environmental impacts through contamination of soil, water and non-target plants and animals, which can decrease biodiversity and harm living organisms including humans.

Statistics of pesticides use and trade are relevant for monitoring the sustainability of agriculture. In particular, they can help assess the global movement of pesticides and identify possible shortcomings in access to markets. The FAOSTAT [Pesticides Use](#) database contains data on pesticides use by country, in active ingredients and by major pesticide category, currently for the period 1990–2021. The domain also includes relevant indicators, such as pesticides use per hectare of cropland, per person (kg/capita) and per value of agricultural production.

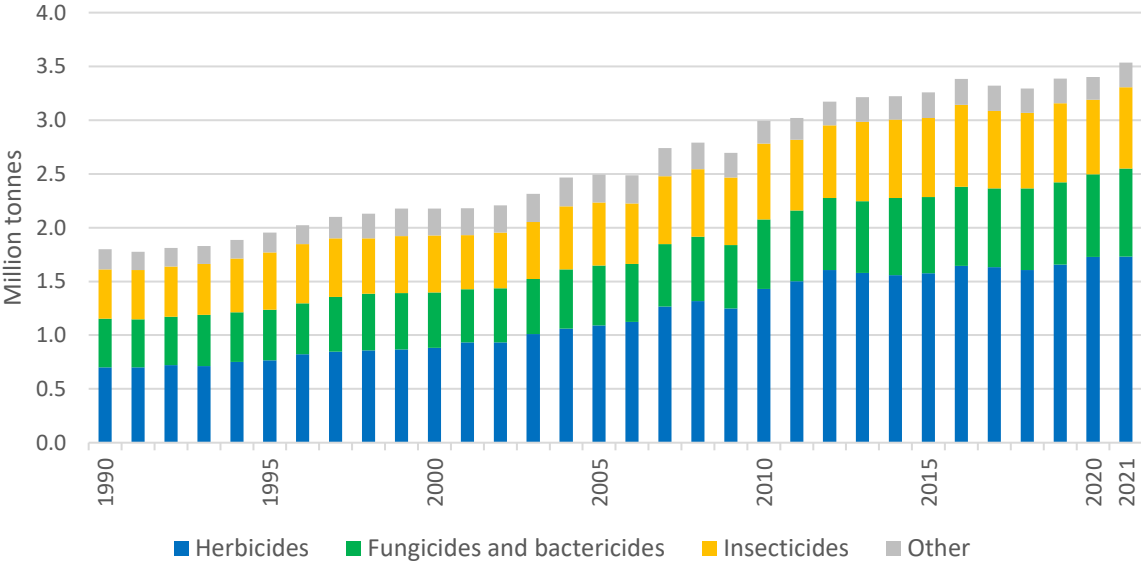
The 2023 Pesticides Use domain features a major methodological update, based on the use of net trade to impute pesticide use in cases of poor data quality. In practice, the new method was implemented to: i) impute use for over 40 new countries previously not estimated for lack of direct data from countries; ii) update times series where official data provision was older than ten years; iii) update earlier historical missing records; iv) revise estimates in specific problem cases. Although the overall revision contributed only 3 percent to the global total, there were significant contributions to Africa, resulting in an overall 29 percent increase in pesticides use for this region.

The FAOSTAT Pesticides Trade domain additionally provides information on internationally traded pesticides, in formulated products, over the period 1961–2021. Trade data for 1961–1989 cover only monetary values, while data for 1990–2021 also include physical quantities. The 2023 Pesticides Trade domain features intra-regional and inter-regional aggregates to highlight trade within and between different regions of the world. Figures for pesticides trade can exceed in some cases those of pesticides use for a combination of reasons that include: non-agricultural uses for imported pesticides such as those in the public health sector, storage of imported pesticides for use in subsequent years, and imports of pesticide formulations including adjuvants to increase efficacy and shelf life.

**GLOBAL**

Total pesticides use in agriculture in 2021 was 3.54 million tonnes of active ingredients (Mt), a 4 percent increase with respect to 2020, a 11 percent increase in a decade, and a doubling since 1990 (Figure 1). Comparing the most recent decade with the 1990s, the global application of pesticides increased by 53 percent for herbicides, 111 percent for fungicides and bactericides, and 44 percent for insecticides, with increases in the share of herbicides (from 40 percent to 49 percent of total pesticides use) and reductions in the share of insecticides (from 26 percent to 22 percent), and of fungicides and bactericides (from 25 percent to 22 percent).

**Figure 1: Global pesticides use by category**

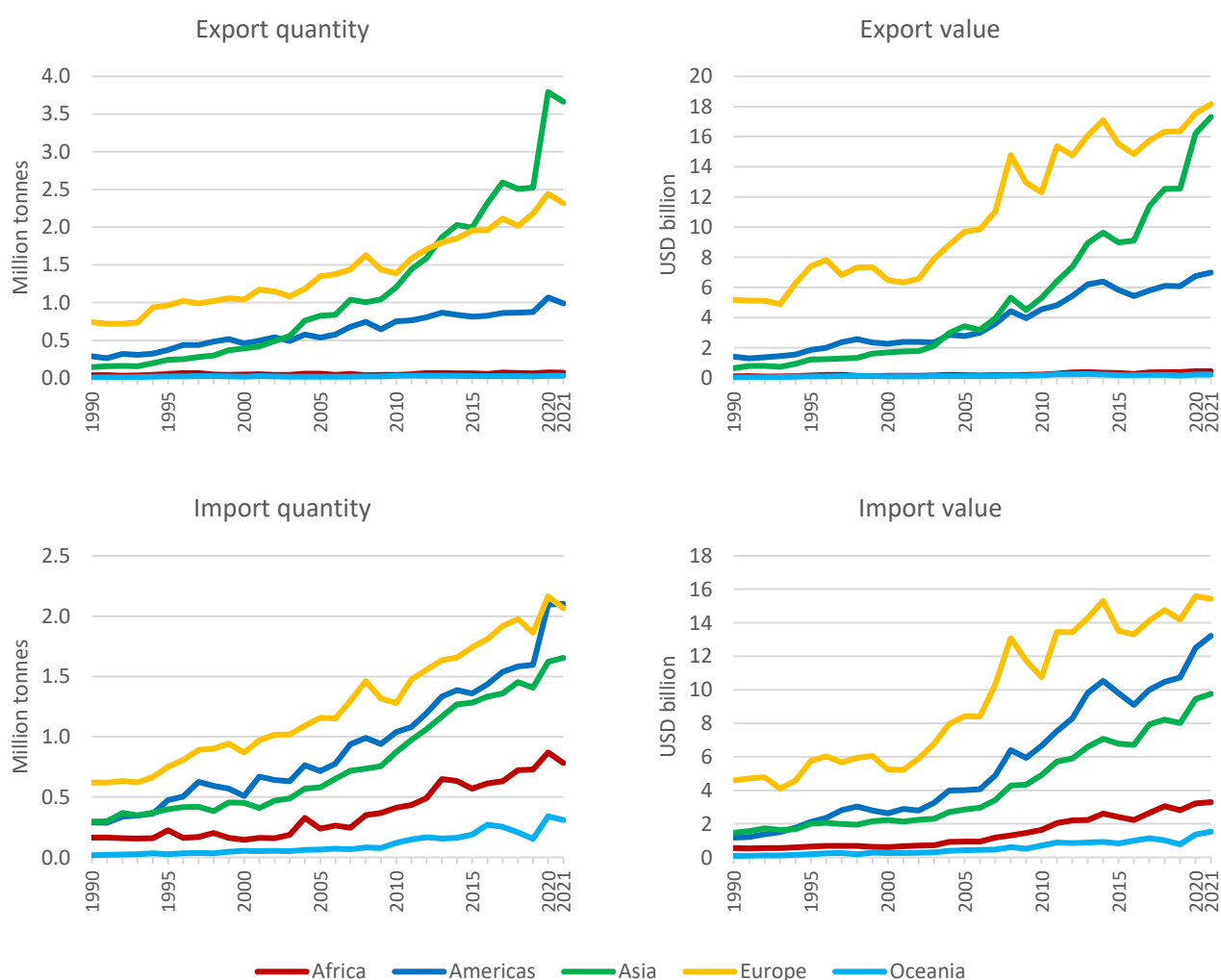


**Source:** FAO. 2023. Pesticides Use. In: FAOSTAT. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

In 2021, the volume of total pesticides exports (used here as a proxy for trade) decreased by 5 percent compared with 2020 to approximately 7.1 Mt of formulated products,<sup>1</sup> but their value increased by 5 percent to USD 43.2 billion. Over the 2012–2021 decade, the volume of pesticides exports went up 68 percent, while their value went up 53 percent.

Pesticides use per area of cropland in 2021 was 2.26 kg per hectare (kg/ha), an increase of 4 percent with respect to 2020; use per value of agricultural production was 0.86 kg per thousand international dollar (kg/1000 I\$) (+2 percent); and use per person was 0.45 kg per capita (kg/cap) (+3 percent). Between 1990 and 2021, these indicators increased by 85 percent, 3 percent, and 33 percent, respectively (Figures 4, 5 and 6).

**Figure 2: Total pesticides export and import quantities and values by region**



**Note:** Includes intra-regional trade.

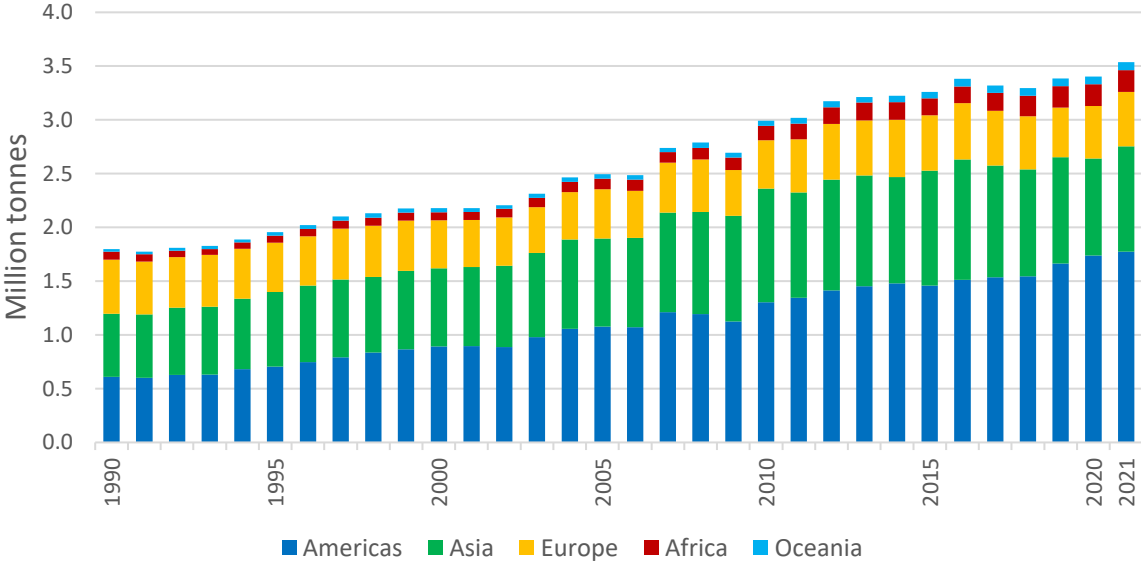
**Source:** FAO. 2023. Pesticides Trade. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RT>

<sup>1</sup> Non-agricultural uses, the use of adjuvants to increase shelf life and efficacy, and storage of imported pesticides contribute to the difference between traded pesticides quantities and use in agriculture.

**REGIONAL**

The Americas has been the largest user of pesticides since the mid-1990s among all regions, ahead of Asia, Europe, Africa and Oceania. There, pesticides use in agriculture increased by 2 percent from 1.74 Mt in 2020 to 1.78 Mt in 2021. The growth rate between 1990 and 2021 was 191 percent, with a 26 percent increase in the most recent decade. Over the whole period, the Americas applied the highest levels of pesticides in agriculture, averaging approximately 1.12 Mt per year. Between 1990–1999 and 2012–2021, the mix of pesticides used saw a shift to a larger share of herbicides (from 50 percent to 64 percent), fungicides and bactericides (from 13 percent to 15 percent) and a smaller share of insecticides (from 22 percent to 14 percent). The Americas imported the highest amounts of pesticides from other regions of the world in 2021: 1.2 Mt by volume of formulated products, corresponding to a value of USD 7.6 billion. The region also applied the highest levels of pesticides on average between 1990 and 2021 per area of cropland (3.01 kg/ha), per value of agricultural production (1.49 kg/1000 I\$), and per capita (1.23 kg/cap).

**Figure 3: Total pesticides use by region**



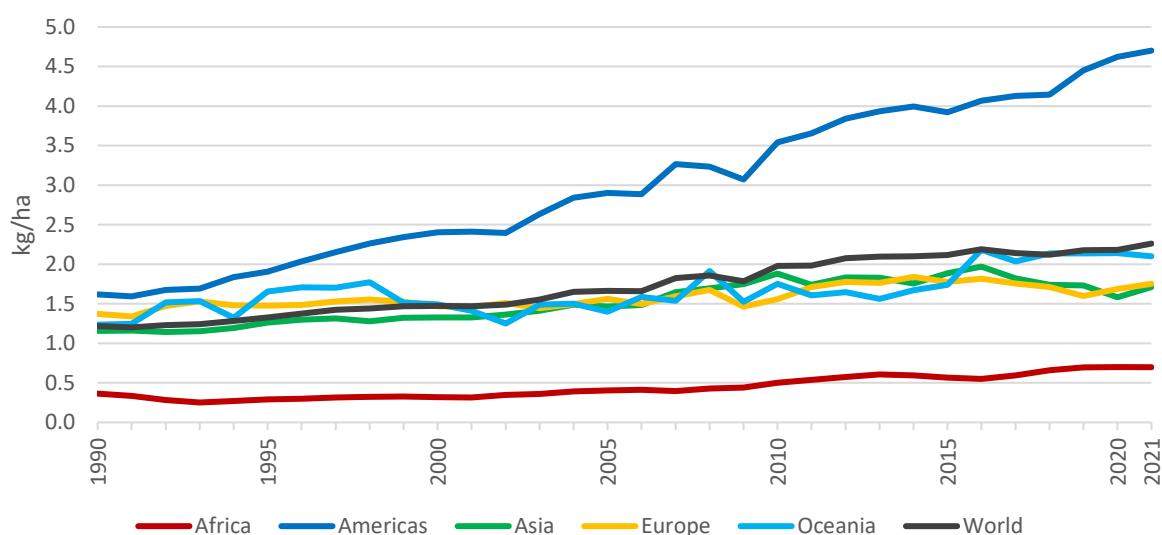
**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

Asia used 980 kt of pesticides in 2021, an 8 percent increase with respect to 2020 and a 67 percent increase since 1990 (Figure 3). In 2021, the region exported the largest quantities of pesticides (3.6 Mt, corresponding to a value of USD 17.3 billion) (Figure 2). It also exported the most pesticides to other regions with quantities and values of 2.3 Mt and USD 11.5 billion, for the same year. Asia was below the world average on a per hectare, per value of agricultural production and per person basis over the whole period, averaging 1.52 kg/ha, 0.59 kg/1000 I\$, and 0.22 kg/capita, respectively (Figures 4, 5 and 6).

In Europe, pesticides use in agriculture increased from 486 kt in 2020 to 505 kt in 2021 (+4 percent). Since 1990, the growth rate was just 1 percent, with a reduction in the most recent decade by 2 percent. Europe had the lowest proportion of pesticides use derived from insecticides (13 percent), most likely due to the stringent European Common Agricultural Policy, which monitors and controls the use of

pesticides. Including intra-regional trade, European countries imported 1.25 Mt of pesticides on average per year between 1990 and 2021 (Figure 2), highlighting the trade partnerships within the region. The region’s pesticides use per area of cropland was 1.75 kg/ha in 2021, below the world average. Over the whole period, Europe’s application of pesticides was slightly above the world average on a per hectare (1.58 kg/ha), per value of agriculture (0.92 kg/1000 I\$), and per person (0.65 kg/capita) basis.

**Figure 4: Pesticides use per area of cropland by region**

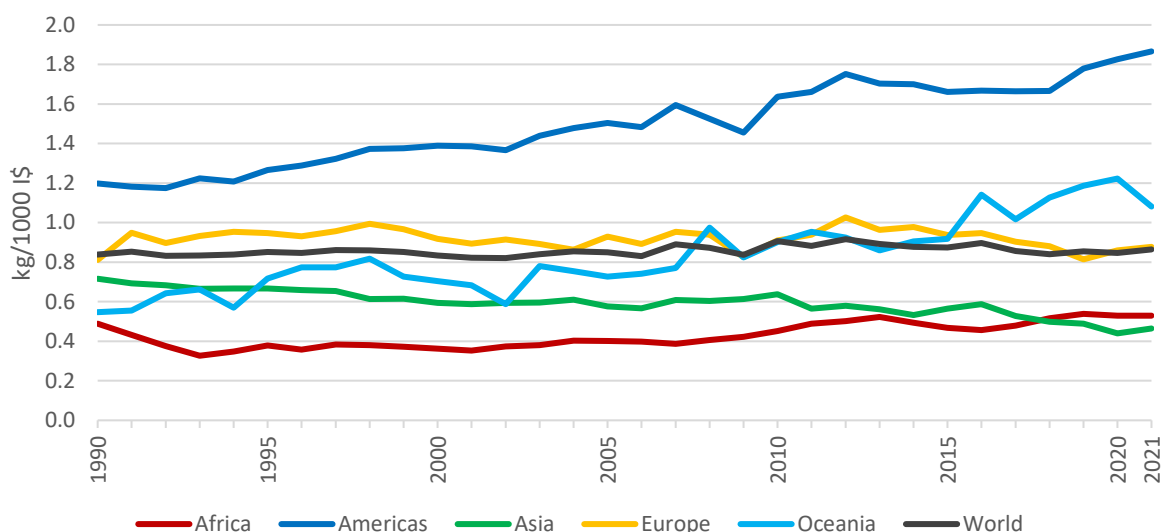


**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

Pesticides use in Africa increased only marginally between 2020 and 2021, from 203 kt to 204 kt, but much faster during the most recent decade (31 percent); the increase between 1990 and 2021 stands at 175 percent. Africa uses low levels of pesticides, contributing only 5 percent to the global total between 2012 and 2021. Between 1990–1999 and 2012–2021, the share of fungicides and bactericides in total pesticides use increased from 29 percent to 33 percent, and that of herbicides from 23 percent to 31 percent, while the share of insecticides dropped from 38 percent to 28 percent. Most of Africa’s pesticides imports come from countries outside the region, and the majority of exported pesticides remain in the region. In 2021, total pesticides imports reached 781 kt (USD 3.3 million), of which 712 kt (USD 3.0 million) came from other regions; and total pesticides exports were 71 kt (USD 0.45 million) of which only 14 kt were exported to non-African countries (USD 0.11 million). Compared with 2020, exported quantities decreased by 4 percent, and imports decreased by 10 percent. The region applied the lowest levels of pesticides per area of cropland, per value of agricultural production, and per person between 1990 and 2021 (0.44 kg/ha, 0.11 kg/cap, and 0.43 kg/1000 I\$, respectively).

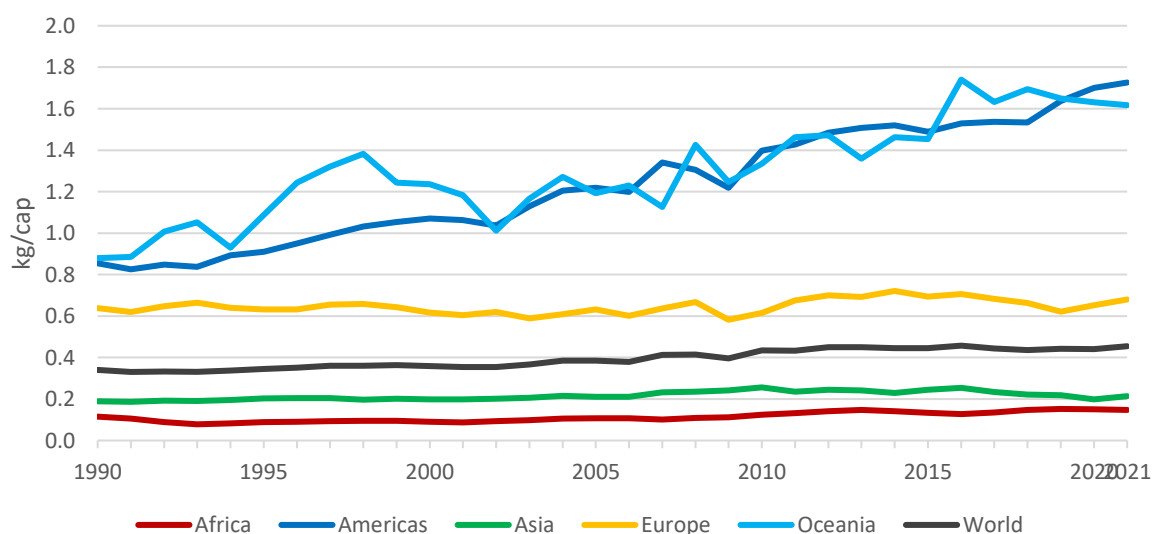


**Figure 5: Pesticides use per value of agricultural production by region**



**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

**Figure 6: Pesticides use per capita by region**

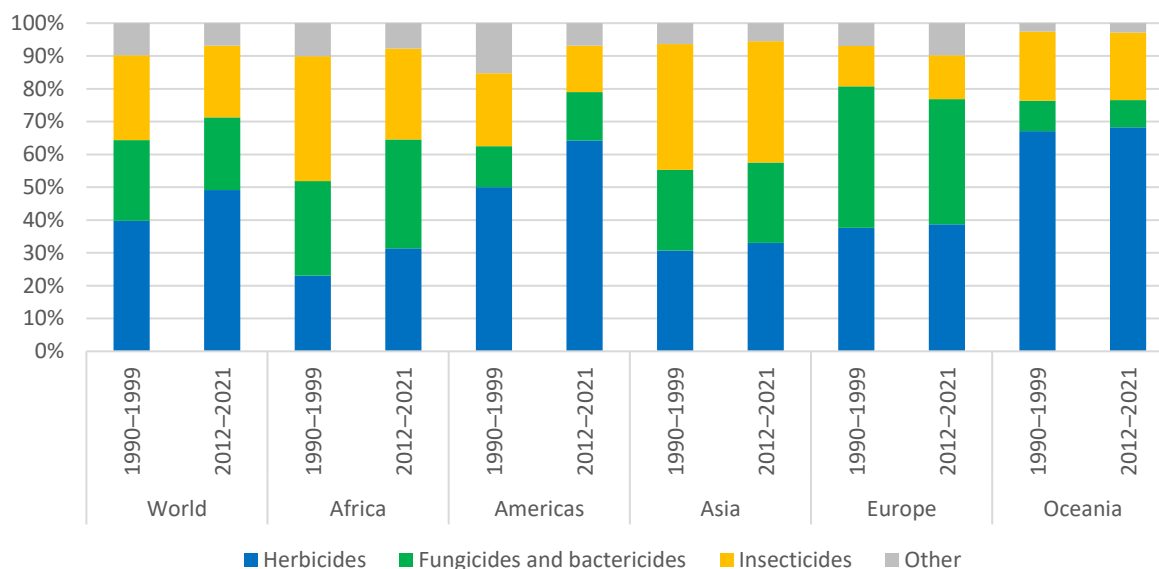


**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

Pesticides use in agriculture in Oceania remained stable from 2020 to 2021, at 72 kt. However, pesticides use more than tripled between 1990 and 2021, although from a very low base. The growth rate over the 2012–2021 decade was 27 percent; during that period, the region represented only 2 percent of global use. The mix of pesticides used in Oceania stayed the same between the 1990s and 2012–2021. The region traded low levels of pesticides, with most of the exports occurring between countries within the region. In 2021, total imports within the region reached 294 kt, with a value of

USD 1.4 million. Of these, most were traded internally, and more than 60 percent of pesticides exports stayed within the region. Oceania applied low levels of pesticides on a per hectare of cropland basis (1.66 kg/ha) and when normalized by the value of agricultural production (0.83 kg/1000 I\$), but high levels on a per person basis (1.30 kg/cap).

**Figure 7: Pesticides use by region and category, 1990–1999 and 2012–2021**



**Source:** FAO. 2023. Pesticides Use. In: FAOSTAT. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

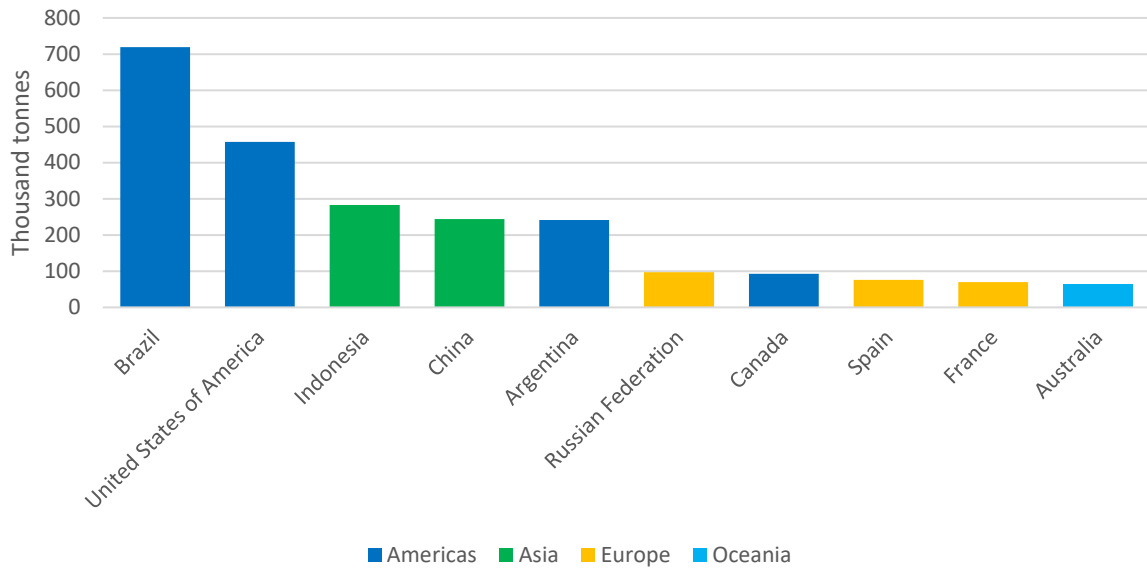
## COUNTRY

Figure 6 shows that Brazil was the world’s largest user of pesticides in 2021, with 720 kt of pesticides applications for agricultural use. This was close to 60 percent higher than the United States of America (457 kt), the second largest user. The next three users – Indonesia (283 kt), China (245 kt), Argentina (242 kt) – all had similar applications levels. The next five users were the Russian Federation (97 kt), Canada (92 kt), Spain (76 kt), France (70 kt) and Australia (63 kt), all of which with comparable amounts used. Importantly, the 2023 update includes major upward revisions of pesticides use data for Brazil from 2010 (due to new data provision from the country, representing a 37 percent increase on average compared to previously disseminated data) and Indonesia (after a complete data revision).

Applications per cropland area varied widely among the top pesticides users, from 10.9 kg/ha in Brazil to 0.8 kg/ha in the Russian Federation (Figure 7). The level in Brazil was about twice as high as in Argentina (5.6 kg/ha) and Indonesia (5.3 kg/ha).

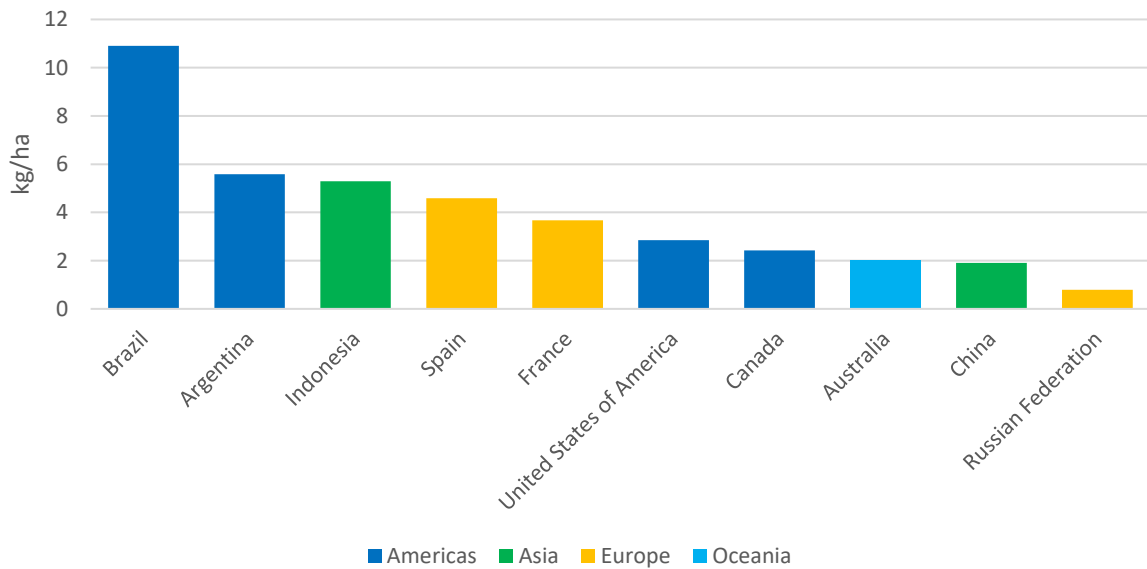


**Figure 8: Pesticides use, top countries (2021)**



**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

**Figure 9: Pesticides use per area of cropland in top users (2021)**

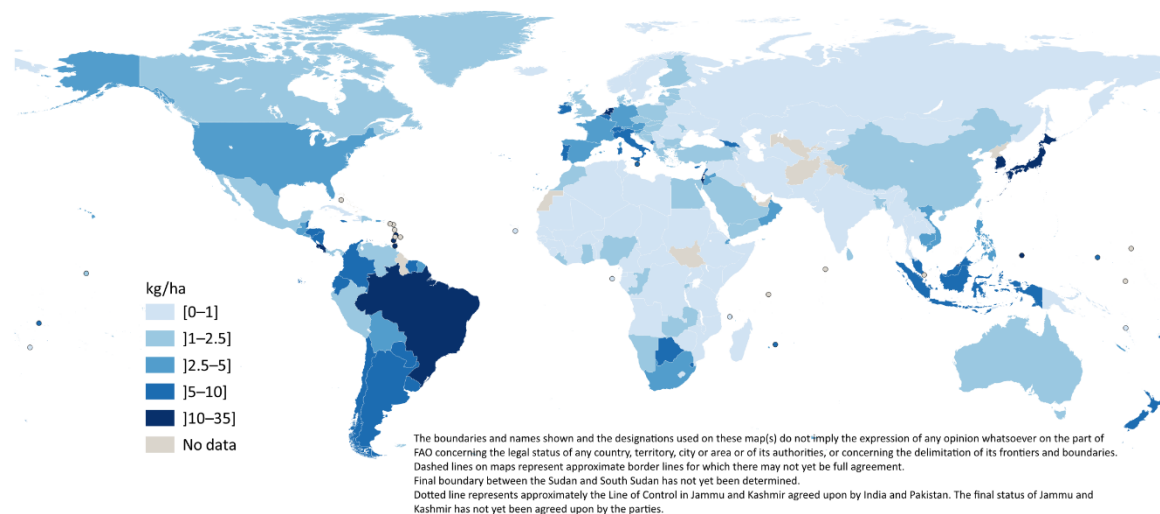


**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP>

The data show large disparities between the pesticides application rates within regions in 2021 (Figure 10). For example, in the Americas, while some countries applied high levels of pesticides (for example in the Caribbean), others, including Mexico, Panama, the Bolivarian Republic of Venezuela, Guyana, Haiti and El Salvador all applied levels below the global average. In Africa, which generally has

low levels of pesticides use per area of cropland, a few countries, such as Mauritius, Botswana and South Africa were exceptions. The less industrialized countries in Eastern Europe applied lower levels than the rest of the region. In Asia, most of the countries with the highest application rates in were in Western Asia.

Figure 10: Pesticides use per cropland area (2021)



**Source:** FAO. 2023. Pesticides Use. In: *FAOSTAT*. Rome. [Cited July 2023]. <http://www.fao.org/faostat/en/#data/RP> based on UN Geospatial. 2020. Map geodata [Shapefiles]. New York, USA, United Nations (UN).

## EXPLANATORY NOTES

- > 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. Seed treatment-fungicides (Dithiocarbamates, Benzimidazoles, Triazoles Diazoles, Diazines Morpholines, Botanical products and biological, Others not elsewhere classified);
  - 6. Seed treatment-insecticides (Organo-phosphates, Carbamates–insecticides, Pyrethroids, Others not elsewhere classified);
  - 7. Plant growth regulators;
  - 8. Rodenticides (Anti-coagulants, Cyanide Generators, Hypercalcaemics, Narcotics, Others not elsewhere classified);
  - 9. Other pesticides not elsewhere specified;
  - 10. Disinfectants.
- > Conversion factors 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 be considered representative of their regions, we used global conversion factors only, by pesticides type where possible, and a global generic conversion factor when not possible (see country notes for actual values used). Gap-filled pesticides subcategories for the 10 categories listed above are disseminated along with the Pesticides (total) category.
- > The Pesticides Use domain has as a primary source of data questionnaires annually dispatched by FAO to the focal points indicated by the governments of the different countries and territories. Data are supplemented with international sources such as [Eurostat](#) pesticides sales data.
- > The FAOSTAT Pesticides Trade domain contains information on the trade of pesticides products in either: a) finished forms and/or packaged products; or b) separate chemically-defined compounds relevant to the Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade.
- > The FAOSTAT Pesticides Trade domain contains information on the trade of pesticides classified under code 38.08 of the International Convention on the Harmonized Commodity Description.



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