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FAOSTAT ANALYTICAL BRIEF 13

Inorganic fertilizers

1961–2018

>> FAO Statistics Division

HIGHLIGHTS

- → **FAOSTAT provides statistics at country, regional and global levels on the production, trade and agricultural use of inorganic fertilizers.**
- → **World use of inorganic fertilizers has risen significantly between the 1960s and the 2010s, from about 20 to over 100 million tonnes for nitrogen (N), from about 15 to over 40 million for P_2O_5, and from about 10 to over 30 million for K_2O.**
- → **There are, nevertheless, differences by region, in the totals and in their evolution. The expansion of inorganic fertilizers use has been particularly strong in Asia. This region represented less than 20 percent of the world total in 1961–1964 and in 2015–2018 it represents over 50 percent, for all three nutrients. In the last decade, however, the use of N and P_2O_5 seems to have stabilized or even declined.**
- → **Use of inorganic fertilizers also expanded in the Americas, maintaining the second highest global share for all three nutrients. In Europe, in contrast, use levels strongly declined around 1990–1994 and have been quite flat overall since then.**
- → **In Africa, total values of inorganic fertilizers use are lower than in Asia, the Americas or Europe, but they have expanded over time and global shares have even risen, reaching over 3.5 percent for N and P_2O_5 and over 2 percent for K_2O in 2015–2018.**
- → **Oceania in 1961–1964 represented 7.5 percent of the world total in terms of P_2O_5. This share has declined over time, although the absolute levels did not vary much.**
- → **Global absolute values are dominated by a few countries with high shares of the total. For all three nutrients and for both production and agricultural use, the top ten countries in each case represent at least about 70 percent of the world total.**

FAOSTAT INORGANIC FERTILIZERS

BACKGROUND

FAOSTAT provides statistics at the country, regional and global levels on the production, trade and agricultural use of inorganic (mineral or chemical) fertilizers, by nutrient and by product.

The nutrients covered are the three *primary nutrients*: nitrogen, phosphorus and potassium, which are used in large quantities by plants. Oxygen, carbon and hydrogen are essential elements that

plants also use in large quantities, but plants obtain those directly from the air and water. Other nutrient categories are the *secondary nutrients* (calcium, magnesium and sulphur), which are required in smaller but still significant quantities, and the *micronutrients*, which are other elements that are also essential but required in very small quantities (FAO, 1984).

The data on inorganic fertilizers are organised in FAOSTAT in four domains or datasets:

- **'Fertilizers by nutrient'** (http://www.fao.org/faostat/en/#data/RFN) provides data on the production, import, export and agricultural use of inorganic fertilizers, expressed by the total content in tonnes of the primary nutrients: nitrogen (N), phosphorus (expressed in equivalent quantity of the oxide form P_2O_5) and potassium (also expressed in oxide form, as K_2O). This domain currently covers the time period 1961–2018.
- **'Fertilizers by product'** (http://www.fao.org/faostat/en/#data/RFB) and '**Fertilizers archive'** (http://www.fao.org/faostat/en/#data/RA) provide information on the production, import, export and agricultural use of different types of inorganic fertilizers products. Some of these are *straight fertilizers*, which means that they have a declarable content of only one of the three primary nutrients (e.g. N: urea, ammonium sulphate, ammonium nitrate; P: superphosphates; K: potassium chloride). Other fertilizers are *compound fertilizers*, which means that they have a declarable content of more than one of the three primary plant nutrients (e.g. NP: diammonium phosphate, NK: potassium nitrate; all three nutrients: NPK fertilizers). The domain 'Fertilizers Archive' covers the period 1961–2001 and contains data expressed in nutrients but disaggregated by product. The domain 'Fertilizers by Product' currently covers the period 2002–2018 and contains data expressed in tonnes of product. The content in nutrients of those products can be estimated using default conversion factors (concentrations), e.g. urea: 46 percent N. A list of conversion factors is provided in the 'related documents' section of the 'Fertilizers by Nutrient' domain (FAO, 2020a).
- **'Fertilizers indicators': use per area of cropland** (http://www.fao.org/faostat/en/#data/EF) provides the ratio between the agricultural use of inorganic fertilizers, in total by nutrient (for N, P_2O_5 and K_2O), and the area of cropland (i.e. the sum of arable land and permanent crops).

FAOSTAT also provides estimates of agricultural use of some organic fertilizers, which is the other main category of fertilizers and comprises the residues of plants and animals, and human wastes. In particular, estimates of nitrogen inputs from livestock manure to agricultural soils are provided in the FAOSTAT domain '**Livestock manure'** (FAO, 2020b; FAO, 2020f). These estimates are compiled using FAOSTAT statistics of animal stocks and applying the Guidelines of the Intergovernmental Panel on Climate Change (IPCC, n.d.).

This brief focuses, however, on the data on inorganic fertilizers, and therefore on the four related FAOSTAT domains mentioned above. It provides a summary of the global levels of inorganic fertilizers use in agriculture from 1961 to 2018 and their ratio by area of cropland. It also analyses use levels by region. At the country level, it shows the top producers and top consumers of inorganic fertilizers and their high share of the world total, and briefly looks at the internal heterogeneity of regions in the use of fertilizers among their countries, at both the absolute level and per area of cropland.

Data sources

The main data source for *production* and *agricultural use* in these domains is the FAO Fertilizers questionnaire (FAO, 2018a). Trade data (*import* and *export*) were also obtained via questionnaire for the period 1961–2001, but from 2002 onwards they are obtained from UN Comtrade (DESA/UNSD, 2020).

Imputations to fill gaps due to missing or non-usable data are based mainly on aggregations of data by products converted to nutrients, on balances based on the equation "production + imports = exports + agricultural use + other uses", or on additional data (from associations, research publications, etc.). References to additional information about the methodological approach and limitations are provided in the 'explanatory notes' section at the end of this report.

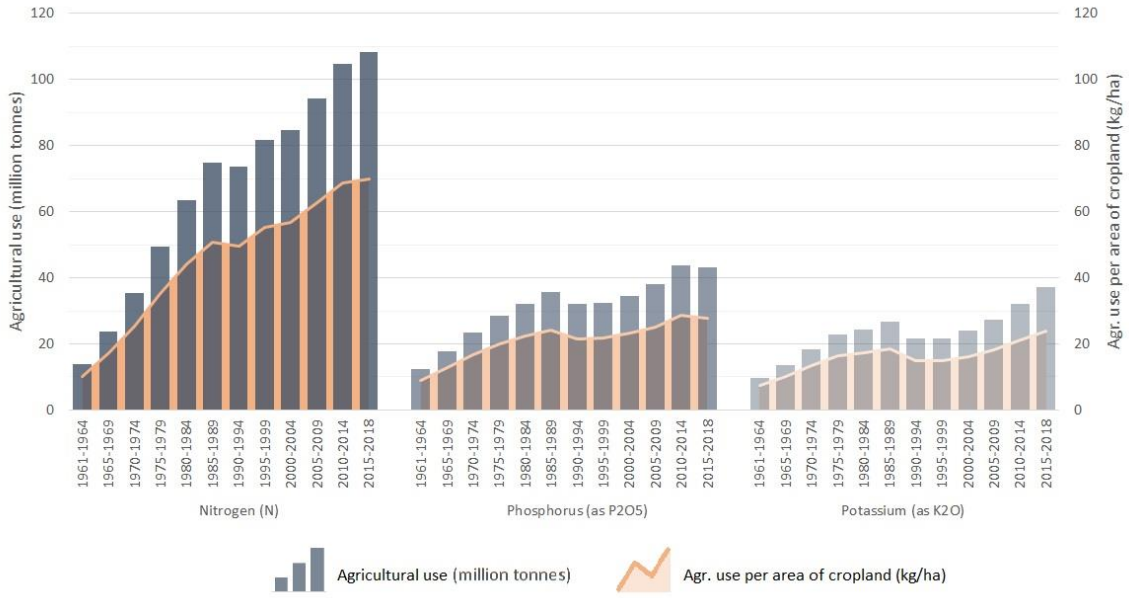
In the process of quality control and imputation, data are also discussed with industry experts. This is part of an ongoing collaboration with the International Fertilizer Association (IFA), which provides fertilizer statistics through IFASTAT (https://www.ifastat.org) within the scope allowed by its confidentiality obligations.

GLOBAL

The global path of fertilizer use in agriculture shows a strong increase from the 1960s to the 2010s. World levels of agricultural use of inorganic fertilizers were about 20 million tonnes of N in the 1960s, rising to over 100 million tonnes in the 2010s. For P_2O_5, the data show an increase from about 15 million tonnes in the 1960s to over 40 million tonnes in the 2010s, and for K_2O from about 10 to over 30 million tonnes. There has been some expansion in the area of cropland as well, but much more limited (about 15 percent) (FAO, 2020c). As a result, the ratio between inorganic fertilizers use and area of cropland has also markedly increased from the 1960s to the 2010s, as shown in Figure 1.

Both datasets, total agricultural use and use by area of cropland are available in FAOSTAT (FAO 2020a; FAO, 2020d) at the global, regional and country levels. These data show significant differences between regions in both the levels of fertilizer use and their evolution over time, as shown in Figure 2.

Figure 1. World total agricultural use of inorganic fertilizers and use per area of cropland (by nutrient: N, P_2O_5 and K_2O)



Source: FAO (2020a, 2020d).

REGIONAL

The expansion of the agricultural use of inorganic fertilizers during the last six decades has been particularly strong in **Asia**, as shown in Figure 2. Nitrogen consumption in this region represented less than 20 percent of the world total in 1961–1964, and it has risen to almost 60 percent in 2015–2018. For phosphorus, the share of the region has risen from close to 10 percent in 1961–1964 to over 55 percent of the world total in 2015–2018, and for potassium from less than 10 percent to over 50 percent. In the last decade, however, the use of nitrogen and phosphorus seems to have stabilised or even declined in this region. This is driven mainly by the data for China, which during the last decade represented about 50 percent of the values for the region, for the two nutrients.

Data for **Europe,** in contrast, show a strong reduction in agricultural use levels around 1990–1994, the time of the dissolution of the Union of Soviet Socialist Republics (USSR).[1] The use of inorganic fertilizers in Europe has remained quite flat overall since then, at about 14 million tonnes for N and about 4 million tonnes each for P_2O_5 and K_2O. These levels represent about 14 percent, 9 percent and 11 percent of the world total in 2015–2018 for N, P_2O_5 and K_2O respectively.

The **Americas** have remained, during most of the period 1961–2018, the region with the second highest levels of consumption of inorganic fertilizers in the world (with Europe initially in the first position and currently Asia). Growth in the Americas, however, has been less intense than in Asia, and in 2015–2018 the agricultural use levels in the Americas are about 35 percent of those in Asia for nitrogen, about 50 percent for phosphorus and about 65 percent for potassium.

[1] In FAOSTAT, Armenia, Azerbaijan, Georgia, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan are classified in Asia, whereas USSR is clasified entirely in Europe. This reallocation of areas contributes to the reduction in agricultural use levels observed in the data for Europe, but it is a small part of it, about 5 percent of the decrease, per nutrient.

Africa represents a much lower share of the agricultural use of inorganic fertilizers in the world than Asia, the Americas or Europe. In 1961–1964 it represented about 3 percent of the world total for nitrogen, close to 2.5 percent for phosphorus and over 1 percent for potassium. However, fertilizer use has been rising in this region over time and Africa has increased its share in the three nutrients, reaching over 3.5 percent of the world total for nitrogen and phosphorus and over 2 percent for potassium in 2015–2018.

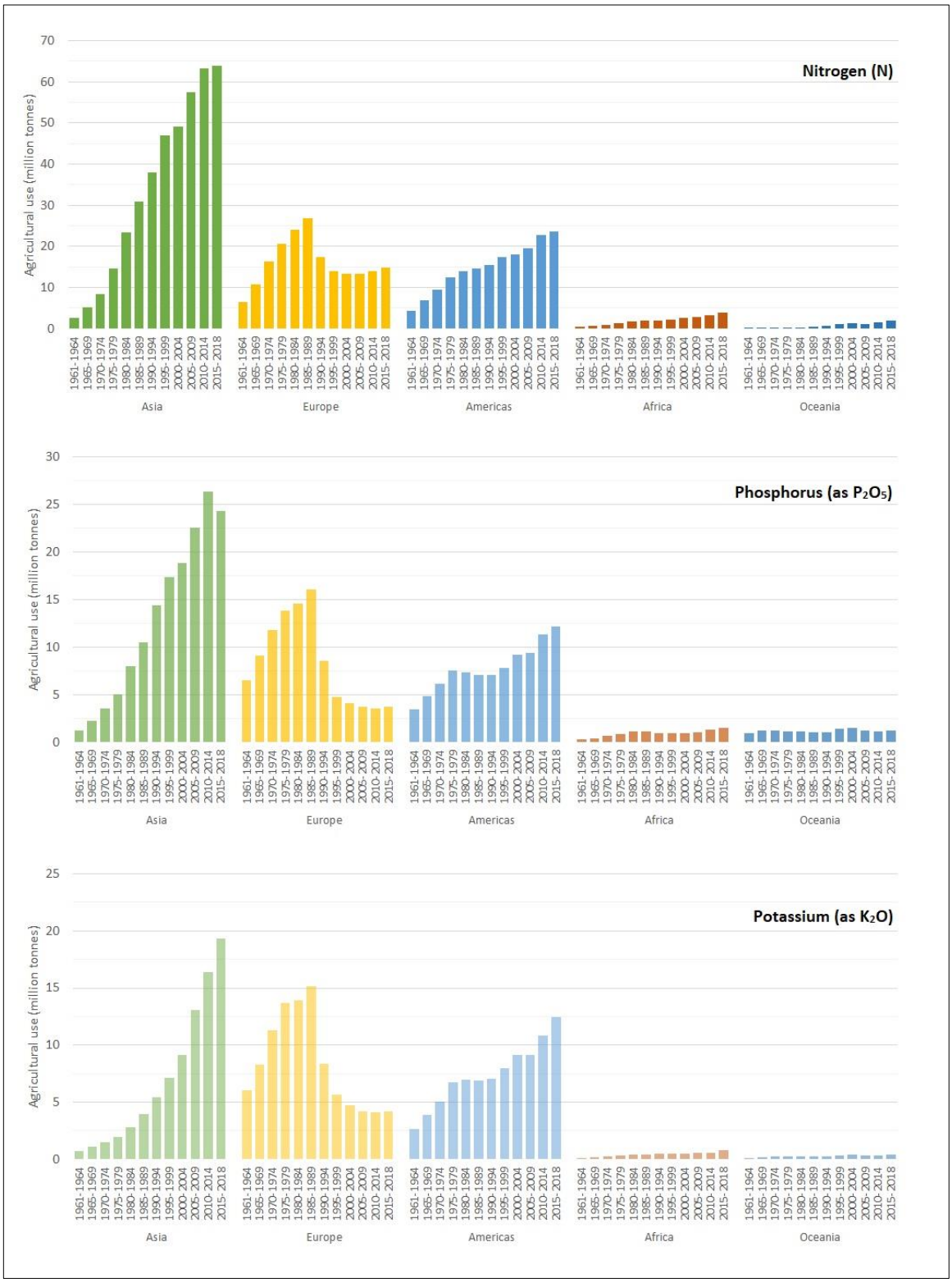
Oceania in 1961–1964 represented less than 0.5 percent of the global use of inorganic fertilizers in terms of nitrogen and less than 1.5 percent in terms of potassium. For phosphorus, in contrast, data show a much higher share at the time, about 7.5 percent of the world total. The levels of use of phosphorus have remained quite stable over time, which in terms of global share implies a decline, to below 3 percent of global agricultural use in 2015–2018. The share for nitrogen has risen instead, to over 1.5 percent of the world total in 2015–2018. For potassium, there has been been some increase in use levels in Oceania but its global share has declined slightly, although remaining over 1 percent in 2015–2018.

COUNTRIES

The global trends observed in Figure 1 are dominated by a few countries that represent a high share of the total. Figure 3 shows that, for all three nutrients and for both production and agricultural use, the top ten countries in each case represent at least about 70 percent of the world total.

At present, China, India, the United States of America and the Russian Federation are the largest producers of inorganic fertilizers for nitrogen and phosphorus, and Canada, the Russian Federation, Belarus and China are the largest producers for potassium.

Figure 2. Agricultural use of inorganic fertilizers by region (tonnes of N, P_2O_5 and K_2O)



Source: FAO (2020a).

Regarding agricultural use, China, India, the United States of America and Brazil are the largest consumers of inorganic fertilizers for all three nutrients, representing more than 50 percent of the world total.

The difference between production and use in their distribution by countries provides an indication of the magnitude of trade. In Figure 3, these differences are largest for potassium, and indeed potassium is the nutrient with the highest share of trade over total agricultural use. These data on production, agricultural use and trade by country are available in the 'Fertilizers by Nutrient' domain in FAOSTAT (FAO, 2020a).

Figure 3. Countries that jointly represent about 70 percent of the world total, for production and agricultural use and by nutrient, and variation from 1970–1979 to 2010–2018.[2]