

Fertilizer data collection, processing and dissemination: experiences from the new Fertilizer domain in FAOSTAT

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Abstract

During the modernization of FAOSTAT (the major FAO statistical database) the opportunity arose to review the underlying methodologies, streamline data collection devices/processes and improve user access to statistical data related to fertilizer. This paper¹ outlines the new data collection, processing and dissemination of fertilizer data in FAOSTAT and outlines current developments. These datasets will provide users with comprehensive fertilizer data for agricultural fertilizer analysis and policy making.

For over five decades, FAO has assembled data on fertilizer production, trade, consumption and disseminated up-dated time series annually in the FAO Fertilizer Yearbook and more recently in FAOSTAT. Since the 1950's, FAO has devoted substantial resources to the development, maintenance and improvement of its fertilizer database. In recent years it became apparent that further improvements in data quality could be achieved by: adopting new methodologies; statistical frameworks; aligning fertilizer statistics definitions and classifications with international classifications; working closer with industry partners and including information from additional international sources. This paper describes these experiences and highlights the major changes that have occurred.

The fertilizer dataset is part of a new Agricultural Resources domain in FAOSTAT that provides not only fertilizers data but also data for such topics as land use, irrigation, labour, agricultural machinery and plant protection products. These topics are integrated with the other domains in FAOSTAT to enable users the opportunity for input/output analysis for agriculture and food, in physical and monetary terms. This paper also provides an overview of how the fertilizer domain is integrated into the overall FAOSTAT framework and the next steps that will be undertaken in the Fertilizer domain in FAOSTAT.

1. Background to FAO Fertilizer data

International fertilizer data has been collected and published by the FAO since the 1950's, having taken over the work previously undertaken by the International Institute of Agriculture (IIA). FAO currently collects and publishes fertilizer data covering such areas as: production; trade, consumption; fertilizer use by crop; and projections of fertilizer supply and demand.

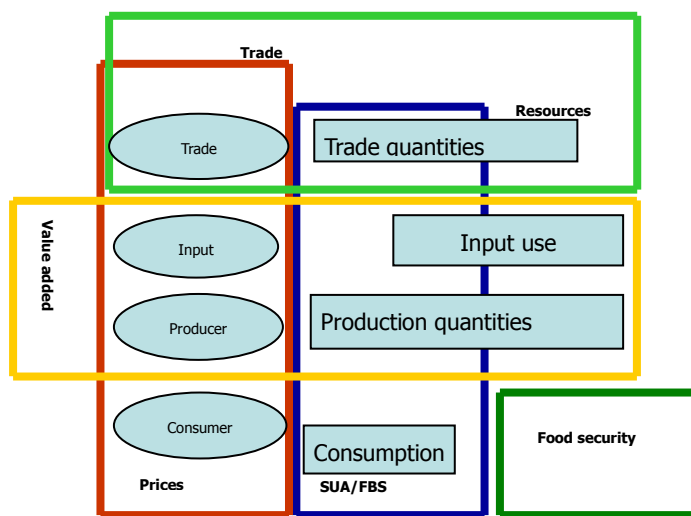
The re-development of the FAOSTAT statistical database over the past few years involved adopting new methodologies/procedures in the fertilizer domain such as: statistical frameworks, aligning fertilizer statistics definitions and classifications with international classifications, working closer with industry partners and including information from additional international sources. This work

¹ Several people have been instrumental in the development of this work on fertilizers. I would like to acknowledge the input of Mr. D. Ballayan, Statistician, FAO and Professor G. Flichman, Consultant.

had a major impact on the collection, processing and dissemination of FAO's fertilizer statistics.

2. Methodology

Within the context of the re-development of the FAOSTAT database, an Agricultural Resources Statistics module was conceptualized within the overall FAOSTAT integrated statistics framework (see figure 1). The module was conceived with the aim of producing accounting systems to analyze the performance of agriculture on multiple dimensions: economic; social; and environmental. The medium term aim is to have an Agricultural Resource Statistics module to meet the diverse needs for decision making and policy formation at national and international levels. The Agricultural Resources Statistics module will comprise sub-modules on: fertilizer; land; water; labour; capital; intermediate consumption; energy; trade; etc.



(1) Figure FAOSTAT integrated core database

The Fertilizer module within the Agricultural Resources module aims to provide the data to be able to answer the following sort of questions:

- What is the contribution of fertilizers to agricultural production (factor productivity)?
- What is the relationship between fertilizer use and maintenance of soil productivity?
- What is the relationship between fertilizer use and environment (negative externalities)?
- What is the relationship between fertilizers and the national economy, production, imports, exports, consumption?

The basic information needed on the supply side to answer the above questions, are the quantities of resources and the prices of these resources. In order to provide this, we needed to quantify the amount of resources in physical homogeneous units and quantify the amount of resources in monetary homogeneous units. Major changes in the FAO fertilizer domain in the way data is collected, processed and organized were namely:

- Adopting a Fertilizer Resource Utilization Account framework (FRUA);
- Estimating and deriving data using trade matrices and the Fertilizer Resource Utilization

Account framework;

- A change to collecting data on fertilizer products, not on nutrients, thus facilitating the work of country correspondents;
- Reviewing the list of fertilizer products, eliminating those that are of very small relevance and adding those that were absent in the previous list;
- Ensuring all fertilizer products were defined consistent with World Customs Organization classification - *The Harmonized Commodity Description and Coding System* which was adopted throughout the new FAOSTAT system.

2.2 Fertilizer trade flow matrix:

A Trade flow matrix is a statistical cross tabulation of all trade flows (imports and exports) between trading partners. For example, the imports of mineral fertilizers for a country are equal to the exports of countries that export mineral fertilizers to it. When data is missing for imports or exports for a country, then the counterpart country trade flow data (imports or exports) are used as estimates.

Mirror trade information is used as proxy in order to adjust imports or exports data for those countries reporting figures that are inconsistent, low or high and missing data. Mirror imports (mM) is the estimation of mirror imports for any particular commodity, for example, all countries exports figures for such a commodity to country X are analyzed and summed as a proxy for country X total imports. Mirror exports (mX) - the estimation of mirror exports for any particular commodity - for example, all countries imports figures for such a commodity to country X are analyzed and summed as a proxy for country X total exports. The derived mirror imports figures or exports figures are used to adjust the actual imports or actual exports data for a country or to fill in missing gaps for trade information in the Fertilizer Resource Utilization Accounts.

2.3 Fertilizer Resource Utilization Account

The FAO Statistics Division has adopted the Fertilizer Resource Utilization Account (FRUA) as the basis for accounting of fertilizers. The FRUA format provides a summary of: Production, Imports, Exports, Non-Fertilizer use and Consumption for the three plant nutrients: nitrogenous (N); phosphate (P₂O₅); and potash (K₂O). The standard equation used in the accounting format can be seen in figure 2.

$$P + M - X - NF = C$$

$$\text{Production (P) + Imports (M) - Exports (X) - Non-Fertilizer use (NF) = Consumption (C)}$$

(2) Figure Fertilizer consumption

When data is not known for either fertilizer production or consumption, then the other items are used to derive the residual data. When this occurs, the data is labelled as apparent (e.g. apparent production). When the import or export data are not available, then mirror trade flows are used to estimate the data. The summary N, P₂O₅, and K₂O totals for the items in the Fertilizer Resource Utilization Account are based on the following scenarios.

When the data of a country are all available then P = the country actual production; M = actual imports, X = actual exports, C = actual consumption and NF = actual non fertilizer use (see figure 3).

$$P = (-M) + X + NF + C$$

$$\text{Production (P)} = - \text{Imports (M)} + \text{Exports (X)} + \text{Non fertilizer use (NF)} + \text{Consumption (C)}$$

(3) Figure Fertilizer production

The concept of mirror imports is applied as proxy for a country actual import figures, for example, when all the characteristics of the variables satisfying the equation are official data (as is formulated in figure 3) but the reported information on a given year for imports is not in harmony with current trend. In such a case, all countries exporting such a commodity to that country will be recorded, reviewed and analyzed. The result is referred to as mirror imports (mM) (see figure 4).

$$P = (-mM) + X + NF + C$$

$$\text{Production (P)} = - \text{Mirror imports (mM)} + \text{Exports (X)} + \text{Non fertilizer use (NF)} + \text{Consumption (C)}$$

(4) Figure Fertilizer production with mirror imports

The concept of mirror exports is applied as a proxy for a country actual exports figures, for example, when all the characteristics of the variables satisfying the equation are official data (as is formulated in equation 2) but the reported information on a given year for exports is not in harmony with current trend. In such a case, all countries importing such a commodity from that country will be recorded, reviewed and analysed. The results of such analysis are referred to as mirror exports (mX) (see figure 5).

$$P = -M + mX + NF + C$$

$$\text{Production (P)} = - \text{Imports (M)} + \text{Mirror exports (X)} + \text{Non fertilizer use} + \text{Consumption}$$

(5) Figure Fertilizer production with mirror exports

Apparent consumption figures are developed based on the underlying assumption that supply equals consumption (see figure 6). However, actual apparent consumption may be underestimated due to the following:

- Non-fertilizer use assumed to be zero in the absence of data;
- Stocks of fertilizer assumed to be zero or stable;
- Country imports or exports of fertilizer data not available and assumed to be zero.

$$AC = P + M - (NF + X)$$

$$\text{Apparent Consumption (AC)} = \text{Production (P)} + \text{Imports (M)} - (\text{Non fertilizer use (NF)} + \text{Exports (X)})$$

(6) Figure Apparent fertilizer consumption

Due to diverse country practices on the collection, compilation and reporting of fertilizer data, the application of the apparent consumption equation in the FRUA may occasionally produce a negative balance. In such cases it is assumed that country consumption depended on available fertilizer stocks. If country consumption results into a negative balance, the negative balance is set to zero with a note attached indicating the adjustment. It is normal practice for countries not to disclose data on stocks, so they are assumed to be stable. For example, a non producing country imports for a calendar year may be of a low magnitude but at the same time reporting high consumption. In such a scenario, it is assumed that country consumption is depended on stock of some mineral fertilizers that have not been used previously.

When consumption data is available for a country, but actual production is not available or is not considered reliable, the apparent production data is derived (see figure 7).

$$AP = X + C - (NF + M)$$

$$\text{Apparent Production (AP)} = \text{Exports (X)} + \text{Consumption used for crop production (C)} - (\text{Non fertilizer use (NF)} + \text{Imports (M)})$$

(7) Figure Apparent fertilizer production

Apparent consumption figures are developed based on the underlying assumption that actual consumption and movement in trade equals the availability of domestic production. Reasons for distortion in the actual apparent production calculated may be due to the following:

- Non-fertilizer use assumed to be zero (in the absence of data);
- Stock assumed to be zero or stable;
- Production data for the years under review not available.

3. Fertilizer data collection, processing and dissemination

The main source FAO fertilizer data are the annual questionnaires sent to countries (see <http://www.fao.org/es/ess/questionnaires/default.asp>). Additional data sources include: national statistical publications; country project reports; studies available in other FAO Divisions; economic journals; national statistics internet websites; country trade data received from custom departments and industry experts. A new questionnaire format was adopted in 2006, which collects data on a fertilizer product basis, which are then converted to nutrients and validated for consistency regarding summary totals of production, imports, exports, consumption and including domestic availability for the three types of straight fertilizers: nitrogenous (N); phosphates (P₂O₅); potash

(K₂O), and as well as complex fertilizers (NP, NPK). The fertilizer data is reviewed with regard to the quantities allocated for non-fertilizer use, fertilizer used for crop production, fertilizer used to manufacture other NPK compounds or blends among others. The main sources of fertilizer trade data are the questionnaires and the United Nations Statistics Division Comtrade database <<http://comtrade.un.org/>>. The United Nations COMTRADE database is used to obtain imports and exports information when available.

The most recent fertilizer dataset published covers a period of four years (2002-2005), with the next update currently being prepared for release in June 2008. The new Fertilizer datasets in FAOSTAT <<http://www.fao.org/faostat/>> have been prepared using the revised methodology (described in this paper) and new dissemination formats. The work of the FAO Statistics Division in the fertilizer domain has been disseminated primarily through FAOSTAT database and the FAO Fertilizer Yearbook. The various FAO Statistics Division Yearbooks were consolidated in 2004 and now the FAO Fertilizer Yearbook is included in the FAO Statistical Yearbook, volume 1 (by domain) and volume 2 (country profiles).

A proposal to undertake a new round of data collection and dissemination on fertilizer use by crop dataset is currently being prepared. This work would build on previously studies by FAO and joint FAO – Industry groups and the more recent county studies undertaken by the FAO <<ftp://ftp.fao.org/agl/agll/docs/fertusebycrop.pdf>>. It is hoped that this work will begin in 2008.

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