FAO
ECONOMIC
AND SOCIAL
DEVELOPMENT
PAPER

102

Manual on fertilizer statistics

FOOD
AND
AGRICULTURE
ORGANIZATION
OF THE
UNITED NATIONS
Rome, 1991

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Food and Agriculture Organization of the United Nations concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries.

M-77 ISBN 92-5-103074-X

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form or by any means, electronic, mechanical, photocopying or otherwise, without the prior permission of the copyright owner. Applications for such permission, with a statement of the purpose and extent of the reproduction, should be addressed to the Director, Publications Division, Food and Agriculture Organization of the United Nations, Viale delle Terme di Caracalla, 00100 Rome, Italy.

©FAO 1991

FOREWORD

The preparation of a Manual on Fertilizer Statistics has been recommended at various FAO meetings. This manual is intended to give a broad description of the fertilizer market and to serve as a guide concerning the statistical methodology for the collection, compilation, processing and analysis of national statistics on mineral fertilizers.

It is hoped that the manual will be of use to national statistical offices and will contribute to the improvement of the quality and availability of fertilizer statistics in the various countries. It should be seen as a reference document for the training of national staff, in seminars, workshops, etc.

The Statistics Division of FAO and the Regional Office for the Near East collaborated in producing this document. It is based on material prepared by Mr. C. Sahai, Chief Statistician, The Fertilizer Association of India, which was further reviewed and prepared for publication by Mr. K. Isherwood, International Fertilizer Industry Association (IFA), Paris. The Manual was also reviewed by the members of the FAO/FIAC Working Party on Fertilizer Statistics.

Users of this Manual are kindly invited to communicate their comments and suggestions for the improvement of subsequent editions, to the Director, Statistics Division, FAO, Via delle Terme di Caracalla, 00100 Rome, Italy.

CONTENTS

VII. PRICES AND SUBSIDIES

VIII. FORECASTS

TABLES

APPENDIX TABLES

I. INTRODUCTION

1. Audience and objective

The manual is addressed to people responsible for assembling national statistics relating to mineral fertilizers, with the aim of improving these statistics.

The manual gives guidelines on the compilation of fertilizer statistics and the basic information necessary for an understanding of the fertilizer market. Each country's situation is different and it is impossible to give precise instructions suited to every condition. The general principles described in the manual need to be adapted to different circumstances. The underlying objective is to establish and maintain a reliable record of the supply, distribution and use of the plant nutrients, from the manufacturer or importer to the farm.

Other FAO publications giving more detailed information on certain of the subjects covered are referred to at the end of the relevant chapters.

The main contents are arranged as follows:

The Introduction (I) includes a brief review of the importance of mineral fertilizers and the need for fertilizer statistics.

Chapter II gives the basic definitions, classifications and terminology on fertilizers.

Chapter III concerns the collection of statistics on the production capacities and production of the different fertilizers and their raw materials and intermediates. The precautions to be taken to avoid double counting are explained.

Chapter IV deals with the import and export of fertilizers and their raw materials.

Chapter V concerns the collection of statistics on fertilizer consumption and stocks.

Chapter VI considers statistics on the use of fertilizers in agriculture, on the different crops.

Chapter VII is concerned with statistics relating to fertilizers prices.

Chapter VIII deals with the short-term and long-term forecasting of fertilizer demand.

2. The importance of fertilizers

"Fertilizers have become a ‘sine qua non’ of agricultural production over much of the developing countries and will become so in most other areas before the end of this century. They are no longer used exclusively for those few cash crops grown historically for exports, though this situation still predominates in some African countries". ("World Agriculture toward 2000", FAO, 1988). In India, for example, mineral fertilizers probably accounted for only 2 %t of food grain output in the early 1960's but by early 1980's the figure reached some 35 %t. Today it is no doubt even higher.

In the early 1960's the developing countries (including China) accounted for 14 % of world fertilizer consumption. By 1970/71 their share had increased to 20%. By 1988/89 the developing countries share of the total, which had more than doubled since 1970/71, had reached 42%. By the year 2000 it is estimated that their share will reach 52%.

The area of land suitable for agriculture is limited and the increasing populations of the developing countries can be fed adequately only through a more intensive use of mineral fertilizers. Field trials indicate that one tonne of fertilizer nutrients can be expected to produce, on average, 10 tonnes of grain. Efficient fertilizer use is fundamental to the well-being of developing countries.

3. The importance of fertilizer statistics

Statistics are required to record the development of production capacities, production, imports, exports, deliveries, stocks, use in agriculture and prices.

For the short-term these statistics are required to ensure that the types of fertilizers required by the farmer are available to him when and where they are needed. If fertilizers arrive too late in the season, they are useless to him, their food production potential is lost and in many cases some of the fertilizer will be lost or damaged before the next season. Statistics on fertilizer usage and stocks are needed for the organization of the acquisition, transport and storage of the supplies required by the farmer. Stock level statistics help the manufacturer to plan his production.

As the use of fertilizers develops, large quantities of material are involved. Fertilizers represent a major investment for the national economy and they must be distributed and used efficiently. They must be supplied where and when required, but at the same time stocks must be minimized. They should be made available at the lowest economic prices, with highly efficient systems for production, transport, distribution and use. This can only be achieved if there are reliable statistics to guide the manufacturer, importer, distributor and those responsible for planning agricultural production.

If a country has to import fertilizers, the cost can be high and it is important to plan the imports as efficiently as possible. This can only be done if reliable production, stock, trade and use statistics are available.

Statistics on the quantities of fertilizers imported and exported, with their country of source/destination, and prices are of crucial importance for the prospective importer/exporter.

Information on fertilizer use at farm level, on the different crops, is important not only for assessing requirements but also for planning advisory and research activities.

Several categories of statistics are required in order to be able to forecast fertilizer demand effectively.

Statistics on fertilizer prices, in particular their relationship with the prices of agricultural products, are required in order to give warning signals to the authorities of imbalances which require correction if fertilizer usage is not to be endangered.

Statistics are important for long-term planning. The fertilizer industry is necessarily international since the raw materials are located in different geographical areas. Both domestic suppliers and exporters require reliable statistics for the planning of their investments in production, storage and transport facilities. New fertilizer plants are expensive and so is the infrastructure required for the distribution of the product. Errors in the appreciation of the market can have disastrous consequences, whether in the direction of over-supply or under-supply, with the poorest countries suffering first.

References:

FAO, 1987, Fertilizer Strategies. Rome

FAO, 1988, World Agriculture toward 2000.

II. DEFINITIONS AND CLASSIFICATIONS

1. Essential nutrients

In common with all living organisms, plants need food for their growth and development. They live, grow and reproduce by taking up water and mineral substances from the soil, carbon dioxide from the air and energy from the sun.

Sixteen elements have been found to be indispensable for plant growth. They are referred to as "nutrients". The essential elements are carbon, hydrogen and oxygen, which are derived from the atmosphere, soil and water, and nitrogen, phosphorus, potassium, calcium, magnesium, sulphur, iron, zinc, manganese, copper, boron, molybdenum and chlorine, which are supplied from the reserves in the soil or through application of manures and fertilizers. Leguminous plants and certain bacteria and algae have the ability to fix atmospheric nitrogen.

Plants use six of the nutrients in relatively large amounts: nitrogen, phosphorus, potassium, sulphur, calcium and magnesium. Nitrogen, phosphorus and potassium are used in large quantities and are often referred to as the "primary" nutrients". Calcium, magnesium and sulphur are required in smaller but appreciable quantities and are classified as "secondary" nutrients. Iron, zinc, manganese, copper, boron, molybdenum and chlorine are required by plants in very small quantities and are referred to as "micronutrients" or "trace elements". This manual deals essentially with the primary nutrients.

A productive ecosystem should provide all the essential plant nutrients in sufficient quantity and in balanced proportions. The nutrients must also be present in an available form before plants can use them. Inadequacy of any one of these elements inhibits plants from growing to their full potential.

Nutrients are lost from the ecosystem as a result of removal in the crops, erosion, leaching, soil fixation, etc. These losses are inevitable even under the most natural conditions. If the losses exceed the natural addition of nutrients (e.g. from rain, dust, floods etc.), the soil nutrient reserves become depleted and plant growth is adversely affected. The nutrient balance is negative in almost all agricultural systems due to the quantities removed in harvested crops, and, in order to maintain and improve plant productivity, nutrients have to be added to the soil in the form of "fertilizers".

Fertilizers may be organic or inorganic. This manual concerns only inorganic or mineral fertilizers. Organic fertilizers, such as animal manure, provide not only nutrients but also organic matter, which improves the condition of the soil. However, the percentage content of nutrients in manures is relatively low and their release is difficult to control. Solid and liquid manures are difficult, unpleasant and comparatively expensive to store, transport and apply - and often there are losses to the environment in the process. Furthermore, although livestock wastes are in over-supply and pose a disposal problem in some highly developed regions, in most regions of the world they can provide only a small proportion of crop requirements. But, where they are available and used correctly, organic fertilizers and manures play a most important role in crop production. Inorganic and organic fertilizers in fact complement each other.

The nutrient contents of some common manures and fertilizers of animal or plant origin are given in appendix tables (1) to (4).

2. Terminology: expression of plant nutrients in oxide or elemental form.

Among the three primary nutrients, nitrogen is generally expressed in the elemental form, N. Phosphates and potash may be expressed either as the oxide form (P_20_5, K_20) or as the element (P, K). Calcium and magnesium are normally expressed in their oxide form (CaO, MgO), but are sometimes expressed as the element Ca, Mg or even the carbonate $CaC0_3$, $MgC0_3$. All other plant nutrients are generally expressed in

the elemental form.

For the purposes of this manual phosphate and potash are expressed in their oxide forms, P_20_5 and K_20. The same applies to calcium and magnesium (CaO, MgO).

A list of the essential nutrients and the units of measurement used in this manual, plus the conversion factors from other units, are given in table (1)

3. Classification

A classification of fertilizers is given in International Standard ISO 7851. This standard defines inorganic fertilizers as "fertilizers in which the declared nutrients are as inorganic salts obtained by extraction and/or by industrial physical and/or chemical processes".

They are classified into:

Straight fertilizers: these fertilizers have a declarable content of only one of the three primary nutrients, N, P or K.

Compound fertilizers: these fertilizers have a declarable content of more than one of the three primary nutrients. They may be:
NP compounds
NK compounds
PK compounds
NPK compounds

The inorganic, or mineral, fertilizers commonly used are listed in table (2). It should be noted that nutrient contents might vary and the percentages given in the table are indicative only.

Ca, Mg, Na, S fertilizers: these fertilizers contain one or more of these elements and do not have declarable nitrogen, phosphorus or potassium contents and therefore they are not classified as straight or compound fertilizers. They differ from Ca, Mg, S soil conditioners in that their principal function is the nutrition of plants.

The secondary nutrient content of some commonly used fertilizers and soil conditioners is given in appendix table (5).

Trace element fertilizers : these fertilizers have declarable contents of one or more trace elements but do not have declarable nitrogen, phosphorus, potassium, calcium, magnesium, sodium or sulphur contents. Some common micronutrient fertilizers are listed in appendix table (6).

Inorganic soil conditioners (or amendments): liming materials (Ca, Mg). These materials contain one or both of the elements calcium and magnesium and are intended principally to maintain or raise the soil pH (a measure of acidity or alkalinity). Gypsum and sulphur may be used as soil conditioners to correct saline and alkali soils.

Secondary and trace element fertilizers, liming materials and other soil amendments and conditioners are not dealt with in this manual.

TABLE 1

THE ESSENTIAL ELEMENTS

ELEMENT	EXPRESSED AS
1. Carbon	C
2. Hydrogen	H
3. Oxygen	O
Primary nutrients	
4. Nitrogen	N
5. Phosphorus	P_20_5
6. Potassium	K_20
Secondary nutrients	
7. Sulphur	S
8. Calcium	CaO
9. Magnesium	MgO
Micronutrients	
10. Boron	B
11. Copper	Cu
12. Iron	Fe
13. Zinc	Zn
14. Manganese	Mn
15. Molybdenum	Mo
16. Chlorine	Cl

CONVERSION FACTORS FOR MAJOR NUTRIENTS

P_20_5 x 0.4364 = P
K_20 x 0.8302 = K
CaO x 0.7147 = Ca
Mgo x 0.6030 = Mg

P x 2.2919 = P_20_5
K x 1.2046 = K_20
Ca x 1.3992 = CaO
Mg x 1.6582 = MgO

TABLE 2

SOME COMMONLY USED FERTILIZERS

FERTILIZERS	NUTRIENT CONTENT	
	Typical	Range
Straight Nitrogenous Fertilizers	% N	% N
Ammonium sulphate	21	20 - 21
Ammonium nitrate	33.5	30 - 35
Ammonium sulphate nitrate	26	
Calcium ammonium nitrate	26	20.5 - 30
Sodium nitrate	16	
Calcium nitrate	15.5	
Urea	46	44 - 46
Anhydrous ammonia (direct application) (1)	82	
Aqua ammonia (1)	20.5	10 - 30
Urea ammonium nitrate (1)	32	26 - 32
Ammonium chloride	25	
Straight Phosphatic Fertilizers	% $P_2 0_5$	% $P_2 0_5$
Single superphosphate	18	16 - 22
Concentrated superphosphate	30 or 32	23 - 39
Triple superphosphate	46	45 - 48
Basic slag	14	8 - 18
Ground rock phosphate (direct application)	30	23 - 35
Fused magnesium phosphate	20	19 - 20
Straight Potassic Fertilizers	% $K_2 0$	% $K_2 0$
Potassium chloride (muriate of potash)	60	59 - 61
Potassium chloride with magnesium	40	39 - 41
Potassium sulphate	50	48 - 52
Potassium magnesium sulphate	22 or 30	21 - 30
Ammonium Phosphates	**Examples of grades**	
Diammonium phosphate	18–46-0	
Monoammonium phosphate	11-52-0	11-(50-55) -0
Ammonium polyphosprate (1)	10-34-0	
Potassium nitrate	13-0-47	
NP, PK, NK and NPK compounds	Numerous grades, for example: 20-20-0, 16-20-0, 13-13-21, 15-15-15, 17-17-17, 12-24-12, 20-10-10, 23-23-0, 25-5-5.	

(1) Liquid

4. Forms of fertilizers.

Mineral fertilizers are available to the farmer in solid, liquid or gaseous form (directly applied anhydrous ammonia). The solid compound fertilizers of the ISO definition may be further divided into mixed fertilizers, produced by a physical process, and complex fertilizers. Mixed fertilizers may, in turn be divided into powder mixtures, granulated mixtures and blends. Granulation may be by steam or by compaction.

Blends normally comprise materials of matching granule size which may be delivered to the farm either in bulk or in bags.

Complex fertilizers are produced by a process of chemical reaction, all the nutrients being present in the same granule.

Fluid fertilizers may be divided into clear solutions and suspensions. The latter are normally multinutrient fertilizers, the suspension being used to increase the nutrient content of the product.

5. Nutrient content and fertilizer grade

The concentration of nutrients is expressed as a percentage of the total weight. For example, ammonium sulphate contains 21% N. This means that 100 kg of ammonium sulphate product contain 21 kg N. Single superphosphate with 18% P_20_5 has 18 kg P_20_5 per 100 kg of product. Potassium chloride contains 60% K_20, i.e. 60 kg K_20 per 100 kg of product.

The grade (or analysis) of a fertilizer refers to the guaranteed minimum percentage(s) of the nutrient(s) it contains and it is expressed as a set of three numbers (more if quantities of secondary or micronutrients are present and declared), separated by hyphens. For example, diammonium phosphate containing 18% N and 46% P_20_5 is expressed as 18-46-0. A compound fertilizer 12-6-6 contains 12 kg N, 6 of P_20_5 and 6 of K_20.

The "nutrient ratio" refers to the ratios of the three nutrient analyses e.g. the 12-6-6 fertilizer referred to above has a 2:1:1 ratio.

It is often necessary to report fertilizer materials on the basis of their nutrient content since:
a) the nutrient content of fertilizers, even for the same type of product, varies and
b) it permits the comparison and addition of the nutrients contained in different types of fertilizers.

It is appropriate to measure fertilizers in terms of product or material for the purposes of storage, transport, handling, etc; but their agricultural effectiveness can only be measured in terms of nutrient. For example, the agricultural effectiveness as a nitrogen fertilizer of urea and calcium ammonium nitrate, the first containing 46% N and the second about 26% N, can only be compared in terms of their nutrient content. Urea contains almost twice as much nitrogen as CAN. The same applies to compound fertilizers. A numerical example of conversion for different products into the three plant nutrients is given in table (3).

Conventionally, fertilizers whose total nutrient content is less than 25% are regarded as "low analysis" fertilizers, whereas fertilizers containing more than 25% total nutrient are regarded as ″high analysis" fertilizers.

6. Time periods

There is no standard time period for reporting fertilizer statistics. Some countries compile their data on a calendar year basis, others on a split year basis. The July/June split year is the most common but other periods are used. The use of a standard, calendar year (January to December), has been advocated but the statistics for certain large consuming countries are available only on a split year basis.

Most, but not all, of the countries of West Europe, North America, Oceania and South Asia report their statistics on a split year basis whereas most of the countries in Latin America, Africa, the Near and Far East, East Europe and the USSR report theirs on a calendar year basis. When grouping the figures of countries using different time periods, it is customary to group the calendar year figures with the first half of the split year figures e.g. 1988 with 1988/89. It is important that the time period to which the figures refer should be specified. However, even if this is done, if the user is not accustomed to this complication, the mixture of time periods causes confusion.

Annual statistics on raw materials and intermediates from which fertilizers are produced, are usually reported on a calendar year basis. The annual FAO crop, livestock, forestry and fishery statistics have been on a calendar year basis since 1966. It would, therefore, be advantageous from the point of view of consistency if fertilizer statistics too were all on a calendar year basis. However, whereas a crop is harvested during a limited period of time, which normally falls within a calendar year, in many countries fertilizer applied in the second half of the calendar year influences the harvest of the following year. It is mainly for this reason that there is difficulty in obtaining unanimous agreement on what should be the standard year for fertilizers.

It is evidently not valid to take the average of the statistics of two calendar (split) years in order to arrive at an estimate of a split (calendar) year figure, in view of the seasonal use of fertilizers.

Many countries currently reporting their statistics on a split year basis could, in fact, report most of their annual figures on a calendar year basis without difficulty. Their production and trade figures are compiled on a monthly basis and can be grouped as desired. For most countries the "consumption" statistics are in fact "deliveries" from the producer/importer and these too can be grouped in any way. There remains the problem of the very few (but important) countries which use more sophisticated methods in order to arrive at figures which are nearer to consumption in agriculture and the fact that the split year is usually more logical from a crop production point of view.

7. Fertilizer statistics

Statistics on the production, imports, exports and consumption of nitrogen, phosphate and potash fertilizers, by country and by type, are given in the FAO Fertilizer Yearbook. This publication also includes statistics on certain raw materials, intermediates and prices.

References:
FAO, Fertilizer Yearbook. Rome.
FAO, 1984, Fertilizer and Plant Nutrition Guide. Fertilizer and Plant Nutrition Bulletin N° 9. Rome.

TABLE 3

AN EXAMPLE OF THE NUTRIENT CONTENT CALCULATION FOR FERTILIZERS

FERTILIZER	NUTRIENT CONTENT	MATERIAL (Tonnes)	NUTRIENT		
			N	$P_2 0_5$	$K_2 0$
Straight nitrogenous fertilizers					
Ammonium sulphate	21 % N	2153	452		
Calcium ammonium nitrate	26 % N	587	153		
Urea	46 % N	3286	1512		
		Sub Total 6026	2117		
Straight phosphatic fertilizers					
Single superphosphate	18 % $P_2 0_5$	1511		272	
Triple superphosphate	46 % $P_2 0_5$	3856		1774	
		Sub Total 5367		2046	
Straight potassic fertilizers					
Muriate of potash	60 % $K_2 0$	8200			4920
Sulphate of potash	50 % $K_2 0$	2562			1281
		Sub Total 10762			6201
Complex fertilizers					
Ammonium phosphate sulphate	(16-20-0)	5618	899	1124	
Diammonium phosphate	(18-46-0)	4816	867	2213	
NPK compound	(20-10-10)	6400	1280	640	640
		Sub Total 16834	3046	3977	640
		Grand Total 38989	5163	9556	6841

III. FERTILIZER PRODUCTION

1. Ammonia and phosphoric acid

The intermediates ammonia (NH_3) and phosphoric acid (H_3PO_4) are used to manufacture certain types of chemical fertilizers. In turn, feedstocks and raw materials are required from domestic and/or import sources to manufacture ammonia and phosphoric acid.

Products not requiring ammonia or phosphoric acid as intermediates include by product ammonium sulphate obtained from steel and caprolactam plants, basic slag, single superphosphate (which is made from phosphate rock and sulphuric acid) and phosphate rock used for direct application.

2. Feedstocks and raw materials

The ammonia feedstocks comprise:
- fossil fuel-based naphtha, associated or natural gas (on-shore and off-shore), refinery gas, fuel oil,
- coal or lignite,
- coke or coke oven gas,
- electricity.

Ammonia procured from external sources - the product of other domestic plants or imported - is independent of feedstock requirements. But nitrogenous fertilizers produced from such ammonia should be included in the total national production of N.

The raw materials used to manufacture phosphoric acid are phosphate rock and sulphur. These two materials are reacted together to produce phosphoric acid. As in the case of nitrogen, fertilizers manufactured from phosphoric acid procured from external sources, domestically produced or imported, should be included in the total national production.

3. Production of fertilizers

3.1. Double counting

Clear definitions of the kind of producer help to avoid problems of the double counting of nutrients.

Primary producers are those who use feedstocks, raw materials and/or intermediates to produce finished fertilizers.

Secondary producers are those who start from finished fertilizer materials and produce other fertilizers.

Only the production of the primary producers should be included in the production data, otherwise the same material will be counted twice (double counted).

Straight fertilizers and ammonium phosphate, domestically produced and imported, are often used to manufacture other fertilizers. It is important that the production statistics should not include these products twice, both as straights and then again as the compounds from which they are produced.

Urea, for example, is sometimes used to produce or enrich grades of compound fertilizers. The urea may be produced by the manufacturer, imported or procured from other domestic urea manufacturers. A manufacturer tends to measure his total production of N including the contribution from urea. The quantity of urea (from either own production or an external supply) so used should not, in fact, be included when reporting the total N produced by the manufacturer. Otherwise it is double counted.

Imported urea (used for further manufacture) has already been recorded as imports into the country and if this quantity is included also in the production statistics, domestic supply is over-estimated. The same applies to imported ammonium phosphate, which is often combined with other materials to make compounds.

Gross production is defined as the production of all fertilizers produced in a country from feedstocks, intermediates, raw materials or from other finished fertilizers, whether these are home produced or imported.

Net production comprises production from feedstocks, raw materials or intermediates, whether produced locally or imported, but excluding products manufactured from other fertilizers. It is the net production figure which should be used for statistical reporting purposes.

It is recommended that the production figures of the straight fertilizers and the ammonium phosphates should relate to their total production, whether they are sold as such or are further processed to make compounds and, of course, that the production statistics for compound fertilizers should not include these quantities. Compound fertilizers produced from imported straight fertilizers or ammonium phosphate, should also not be included in the production figures.

3.2. Collection of production data from the primary manufacturers

Normally production and related statistics are assembled by a governmental coordinating agency, which:
i) collects data from the primary manufacturers on behalf of the Government,
ii) keeps a cumulative record,
iii) issues a consolidated report, recording the situation at a national level.

A specimen reporting form for manufacturers, monthly production, delivery and stock statistics is given in table (4).

In most countries, the deliveries will need to be broken down by region. This information can be given in a separate table.

The information, received from the producers, together with the trade statistics (see chapter IV), may be used to produce a consolidated, national report. This may comprise stock, production, import, export and delivery statistics. A specimen is given in table (5).

Similar tables giving the cumulative figures for the year in question, possibly with comparisons with the corresponding period of the previous year, can be prepared from the monthly reports.

4. Capacities

Information on the production capacities of domestic plants should be assembled at least once a year by the central agency. Proposals for new production capacities and for the expansion of existing capacities should also be recorded.

The number of operating days per annum assumed for the production capacity should be stipulated - it is often 330 days per annum.

The rate of use of the capacity is a measure of the efficiency of production. It is obtained by dividing total production (fertilizer and non fertilizer use) by capacity and expressing the result as a percentage.

In some countries, the central agency may be required to identify plants which are producing at low rates in relation to their capacities, particularly as regards the major intermediates, ammonia and phosphoric acid. The reasons for low rates of production might also need to be identified. This information may be important, for example, in giving early warning of a possible short-fall in supplies which will have to be filled by imported material or by material supplied from elsewhere in the country.

5. Secondary manufacturers

Although the production and deliveries of the secondary producers should not be included in the national statistics, because of double-counting, it may be desirable to assemble separate information on the production and deliveries of the secondary producers if the mixtures or blends they manufacture play an important role in the national fertilizer market.

6. The production of raw materials and intermediates

It will normally be necessary to record also the production of the major raw materials and intermediates, i.e.:
- ammonia,
- phosphate rock (by grade),
- phosphoric acid,
- sulphur.

The forms illustrated in tables (4) and (5) can be adapted for this purpose.

Ammonia and phosphoric acid purchased from outside sources should evidently be excluded from the national production figures of these materials.

In practice, it is difficult to differentiate between quantities of raw materials and intermediates intended for fertilizer use, and quantities intended for non-fertilizer use.

TABLE 4

MANUFACTURERS MONTHLY REPORT
PRODUCTION, STOCKS AND DOMESTIC DELIVERIES

Month .....
To be submitted by .....
Name of the manufacturer .....
Location…….

Metric tonnes

PRODUCT DESCRIPTION	% NUTRIENT	OPENING STOCK	QUANTITY PRODUCED (*)	QUANTITY DELIVERED	CLOSING STOCK
Product (1) **Product (2)** **Product (3)** **Product (4)** **Product (5)**					
Total nutrients **N** **P_20_5** **K_20**					

(*) Excluding quantities manufactured from fertilizers purchased from outside sources.

TABLE 5

CENTRAL AGENCY MONTHLY REPORT
PRODUCTION, STOCKS, IMPORTS, EXPORTS AND DELIVERIES

Month: .....

Metric tonnes

PRODUCT DESCRIPTION	OPENING STOCK	QUANTITY PRODUCED (*)	IMPORT FOR CONSUMPTION	EXPORTS (DOMESTIC PRODUCT)	TOTAL DELIVERIES (DOMESTIC)	CLOSING STOCK
Product (1) Product (2) Product (3) Product (4) Product (5)						
Total nutrients N $P_2 0_5$ $K_2 0$						

(*) Excluding quantities manufactured from fertilizers purchased from outside sources (other domestic manufacturers or imported).

IV. FERTILIZER IMPORT AND EXPORT

Trade statistics comprise data on imports and exports,which represent transfers of materials from one country to another. Surplus countries export to deficit countries.

1. Surplus and deficit of fertilizers

A fertilizer deficit in a country may occur for two reasons:

i) the country does not have domestic production facilities. In such a case, its requirements are met entirely through imports, which grow with increasing demand;
ii) the country is striving for higher production from domestic facilities but requirements for domestic consumption outstrips supplies, resulting in a deficit. The difference between the fertilizer consumption requirement and the probable domestic production of fertilizers has to be met through imports.

A variant of the second situation is where producers import intermediate ammonia (NH_3) or phosphoric acid (H_3PO_4), or both, and process them into finished fertilizers. This further reduces the deficit between consumption and production and hence the need for imports.

A country with an exportable surplus may be:

i) a country which is well endowed with essential feedstocks/raw materials and which can manufacture fertilizers on a large scale at competitive costs;
ii) a country which has developed sizeable capacity for the domestic production of fertilizers, to meet the anticipated growing demand for home consumption. Due to various factors, the latter lags behind domestic production, resulting in a surplus situation.

2. Trade statistics

Trade statistics are generally well documented in both importing and exporting countries. They normally originate from the customs service or from a state trading organization established by the government to export or import different commodities, including fertilizers. Ministries of Industry or of Agriculture are sometimes assigned the task of keeping records of imports and exports. The situation varies from country to country. Specimen formats are given in table (6).

For international trade statistics, international codes are attributed to the products (for example, the "Standard International Trade Codes" or the "Brussels Convention Codes"). These two sets of codes are increasingly being replaced by the “harmonized commodity codes", a list of which is given in the appendix table (7).

3. Fertilizer imports

For deficitary countries it is extremely important that the consumption requirements (and domestic production, if applicable) for the ensuing year should be estimated realistically to avoid unnecessary imports.

However, in most countries agriculture depends on the weather. Therefore, assessment of consumption requirements can never be accurate. Allowance must be made in the estimate of the import requirement to accommodate unforeseen situations.

TABLE 6

TRADE STATISTICS

a) DESTINATION OF EXPORTS (domestically produced)

Month .....
Product .....
Code .....

Metric tonnes

COUNTRY OF DESTINATION	QUANTITY (*)	NUTRIENT CONTENT % N - $P_2 0_5$ - $K_2 0$	N	$P_2 0_5$	$K_2 0$	VALUE (FOB)
Country (1) Country (2) Country (3) Country (4) Country (5)						

(*) Excluding imported material.

b) ORIGIN OF IMPORTS

Month .....
Product .....
Code .....

Metric tonnes

COUNTRY OF ORIGIN	QUANTITY (*)	NUTRIENT CONTENT % N - $P_2 0_5$ - $K_2 0$	N	$P_2 0_5$	$K_2 0$	VALUE (CFR)
Country (1) Country (2) Country (3) Country (4) Country (5)						

(*) Excluding material intended for re-export.

Procedures for the procurement of fertilizers are described in the FAO document cited at the end of this chapter.

The major procurement methods used for the import of fertilizers are:
i) open tender,
ii) direct negotiations,
iii) long-tem contracts,
iv) barter and counter-trade.

Once the deficit is estimated in terms of products and nutrients N, P_20_5 and K_20, the types and quantities of fertilizers to be imported are determined. Most of the deficit countries, on cost considerations, prefer to import high analysis fertilizers such as urea, DAP and other NP/NPKS. The next step is to plan when the material is required in the ports of the country, i.e. the shipping schedule, with the ports identified. Finally, the countries which are to supply the imports need to be designated. It also has to be decided whether the fertilizer imports are required in bagged form, bulk or a combination of both.

The procedure for determining the source of the imports (i.e. the exporting countries) varies from country to country. It is related to price, the funding pattern, barter deals, tripartite arrangements, link deals, credit availability, etc.

In every case the deficit country should tabulate the import statistics each month, by country of origin, by product, by port, whether in bagged or bulk form and with value of imports, by product. International information on fertilizer trade is available from consultants and specialized publications.

The import value is normally on a cfr basis i.e. cost and freight. This represents the fob (free on board) cost plus the sea freight. Some contracts are established on a fob basis, with the importing countries making their own arrangements for shipping the material from the exporting countries.

The organization responsible for planning the fertilizer imports of a developing country would typically estimate the import requirements by taking the opening stocks at the beginning of the season, adding the quantities of domestically produced fertilizers which can be made available in time to farmers during the season, plus an allowance for "pipeline" stocks. The total is compared with the forecasted requirements and it is the difference which needs to be supplied from imports.

The central agency should be in a position to supply the trading organization with the basic information it requires for these calculations.

Good statistics help to minimize the quantity which needs to be imported. In many countries fertilizer imports are a considerable burden on the country's finances and may have to be paid for in hard currency, unless they are made available through aid programmes. In any event, the quantity imported should be sufficient to satisfy farmer requirements but not such as to result in large stocks which have to be carried, expensively and wastefully, over long periods.

The agency should be able to provide information which enables the situation to be followed, month by month. Supplies and deliveries can be compared with the forecasts to enable corrective action to be taken, if necessary, to avoid a shortage or an undue surplus.

Frequently, the requirements will have been estimated by summing returns from the different regions (the forecasting of demand is dealt with in chapter VIII).

4. Fertilizer exports

In the international trade, it is not enough just to export the production which is in excess of domestic requirements. The exports have to be viewed as regards (i) costs compared with those of other exporting countries and (ii) the long-term supply/demand balance, not only of other exporting countries but also of importing countries, with a view to estimating additional production capacity required within the country. For example, if an exporting country has been supplying a deficit country for the past several years, the situation might change if the latter has been successful in reaching self-sufficiency in fertilizer production. In such situations, the exporter would have to look for new outlets. Most countries where fertilizer demand is increasing and which are endowed with feedstocks or raw materials, strive for self-sufficiency in fertilizer production to satisfy domestic consumption requirements.

An exporter needs to maintain a detailed record of: (i) the supply/demand balances of both exporting and importing countries, (ii) prices (fob and cfr) at which various fertilizers were exported in bulk/bagged form by other surplus countries, (iii) shipping schedules and (iv) terms and conditions of tender/contract negotiated between surplus and deficit countries.

5. Re-exports

Substantial quantities of fertilizers are shipped to countries which are not their final destination. This may be because the port is a convenient (perhaps the only) point of entry, or because the material is imported in bulk and bagged before being re-exported, or for political reasons etc. Sometimes fertilizers are received as part of an exchange agreement and part of the quantity is re-exported. Re-exported material is in transit and, in principle, should not be included in the import nor in the export figures of the transit country. The situation is less serious if the material is recorded in both the import and in the export statistics of the transit country, since the figures cancel out in the net trade balance and the informed user of the statistics will not be misled. But sometimes this is not the case. Wherever possible, the recorded destination of the material should be its final destination; otherwise the trade statistics give a false picture of the movements.

The two most common definitions of trade are referred to as "special trade" and "general trade".

Special trade is a system of recording imports for domestic consumption on the one hand and exports of domestic goods on the other. Special imports include goods for domestic consumption and withdrawals from bonded warehouses or free zones for purposes of domestic consumption. Special exports comprise exports of goods wholly or partly produced or manufactured in the country together with exports of "nationalized" goods, but not of goods held in bonded warehouses or free zones.

General trade is a system that records total imports and total exports, including re-exports.

6. Import and export of fertilizer raw materials

Many countries both import and export fertilizers. On the other hand, trade in fertilizing raw materials and intermediates tends to be one way. Therefore, data collection for these materials is more straightforward. For raw materials, the terms "deficit" (production less than requirement) or "surplus" (production more than requirement) are not strictly valid. A raw material producing country normally will not have adequate fertilizer manufacturing capacity to utilize all the raw materials produced and all complementary raw materials necessary to manufacture fertilizer may not be available in the country.

Data on the import or export of phosphate rock should be compiled by grade, expressed as % BPL (*), and by country and may be monthly, quarterly or annual. Countries which have inadequate indigenous resources and which import the balance to supplement the shortfall are required to maintain both

production (mined) and import data.

Sulphur can be obtained from different sources, native sulphur, Frasch sulphur, recovered sulphur, pyrites, etc., all expressed as sulphur "S". Here too, it is useful to maintain statistics by type and by country for the import and export statistics.

The situation is similar in respect of the collection of data on export and import of intermediates, ammonia (NH_3) and phosphoric acid (H_3PO_4).

(*) BPL = "Bone phosphate of lime". 1 % BPL = 0.458% P_20_5 (approximately)

References:
FAO, 1981, Fertilizer Procurement, by H.S.S. Few, B.C. Hilton and J. Steedman. Fertilizer and Plant Nutrition Bulletin N° 4. Rome.
FADINAP, Fertilizer Trade Information. Monthly Bulletin. Bangkok.

V. FERTILIZER CONSUMPTION AND STOCKS

The best way to assess consumption would be to record off take at the farmer or dealer level. However, this is a daunting task. A more practical alternative is to compile sales by the primary suppliers/manufacturers to wholesalers and/or retailers, through the private trade, cooperatives, marketing federations, agro-industry corporations etc.

1. Collection of consumption data from dealers or farmers

1.1. Consumption at farmer level

Ideally, consumption should relate to the quantities actually used by farmers on crops. This concept is difficult to apply as it requires costly surveys which cannot be conducted regularly. Therefore, it is ruled out as a tool for measuring consumption, on a comprehensive, timely and regular basis.

1.2. Consumption at dealer level

In general, farmers apply the fertilizers during the year of purchase and sales at retail level can be equated to consumption. In practice, the regular collection of sales data from retail dealers, particularly in large countries, is difficult. Their numbers are large and not all retailers keep a proper record of their sales.

Some countries have developed regulations and legislation concerning packaging, distribution, sale, quality, specifications, price, etc. for fertilizers. The maintenance of records of stocks and sales by the retailer is often included in the regulations. In this case, dealer reporting forms could be sent to the central agency at specified intervals. A specimen is given in table (7).

TABLE 7

DEALER SALES REPORT

Name of the dealer .....
Location ……...
Period……
To be submitted by……..

PRODUCT	NUTRIENT CONTENT % N - $P_2 0_5$ - $K_2 0$	QUANTITY (Tonnes)	PRICE PER TONNE (including tax)
Product (1) **Product (2)** **Product (3)** **Product (4)**			

Apart from the difficulty of obtaining the information, the central agency would need to have the facilities to handle the large amount of resulting data.

2. Deliveries by manufacturers and sales organizations

In most countries, the consumption statistics are in fact the actual deliveries to agriculture by the manufacturers. The figures may not reflect accurately current consumption in agriculture due to stock changes, but they are reliable since the recording unit is the factory or the trading enterprise (whose numbers are generally small) and such units keep good records of their operations. In the medium term, the stock changes cancel each other out. The delivery figures are included in the manufacturers, monthly report (table 4).

Importers who deliver fertilizers directly to dealers must also send a monthly report to the central agency, giving details on their deliveries by product and by region.

The sum of the sales from two sources (domestic and imported) represents overall consumption, both passing through a common distribution channel.

(In the case of raw materials and intermediates, the quantities produced may be intended for domestic use and/or export. "Domestic deliveries" include not only deliveries to other users in the country but also "captive" use by the producer, to manufacture down-stream products).

3. Disappearance

In order to estimate the consumption of the different fertilizers, their "disappearance" may be calculated, as follows :

Disappearance = opening stocks + production + imports - exports -closing stocks.

Using this system, sales made directly by the manufacturers to private traders (wholesalers and retailers) and institutional agencies, are assumed to equate to consumption.

4. Apparent consumption

The concept of apparent consumption assumes stability of stock levels at various channels of distribution - private trade, institutional agencies, importing agency (if operating separately). It assumes that supply (availability) equals consumption.

Apparent consumption = production + imports - exports.

When this formula is used to estimate consumption, it implicitly assumes that stocks at the beginning and at the end of the period remain more or less unchanged.

In the longer run, stock-level changes should cancel each other out. However, in the shorter term, closing stocks are not normally exactly equal to opening stocks.

This concept has its merits. Production data are normally fairly accurate and reliable since manufacturers keep their records up-to-date and report to the central cgency every month. Secondly, the number of manufacturers is normally not very large in any given country. The import and export data are also reliable. The only uncertainties are the opening and closing stocks.

It is preferable to apply this method of determining consumption at the end of a cropping season, if none of the previously mentioned methods can be applied. It is normally used at the national level.

5. Stocks

The manufacturer's objective is to keep fertilizer materials moving continuously out of the factory so that the level of stocks in the factory depot remains just sufficient to maintain the pipeline stocks and replenish stocks in regional depots.

An explanation of carry-over stocks is needed here. In general terms, they consist of supplies from producers and/or imports remaining at the end of the season. Working stocks account for a major part of the carry-over stocks and are required to ensure a smooth and uninterrupted flow of supplies from producer or importer, or both, to the final user, the farmer. Working stocks comprise stocks held by farmers, retailers, distributors, sub-distributors, wholesalers, etc., including quantities in transit as well as those held by Government for sale through the public distribution system and for intra-seasonal supply for price stabilization.

A second component of carry-over stocks is the reserve stocks, which include stocks that can be drawn on to meet unexpected deficits in supplies due to shortfalls, emergencies and other contingencies.

Generally, private wholesalers and retailers purchase fertilizers only when there is demand and one can safely assume that at their level, the opening stock at the beginning of a period will be, more or less, the same as the closing stock at the end of the period i.e. sales by the private trade (wholesalers and retailers) to their customers should, more or less, be the same as sales made by manufacturers to the wholesalers and retailers.

Fertilizer consumption is seasonal and related to the cropping system in a country and to the weather. Monthly data indicate consumption trends and identify the peak and the off-season months. This helps fertilizer manufacturers to adapt their production plan from month to month, to avoid overstocking in the factory depot and in regional warehouses. In normal agricultural seasons, levels of opening and closing stocks in a given month should remain more or less unchanged, covering pipeline stocks. Hence, supplies from domestic production and imports should approximately equate to consumption, although off-season dispatches to consuming centers might be higher in order to have the material in place when needed during the peak season.

Statistics on stocks are very important from a marketing point of view as any significant variation in consumption from the anticipated distribution trend would be revealed by a build-up of stocks, due perhaps to inclement weather and/or marketing constraints. On the other hand, a depletion of stocks may be due to favorable weather and a significant shift in the cropping pattern. This gives signals to manufacturers to plan their production and supplies accordingly.

6. Losses

When fertilizers are being manufactured, there is an unavoidable conversion loss of a few percent between the raw material or intermediate and the finished product. Once manufactured, the physical losses are normally well controlled and are small. However, once the fertilizer enters the distribution system, the losses can be very large. Losses can occur for many reasons and at many different points in the distribution chain. It is, in fact, very difficult to measure losses and hence to know their true extent. The "official" figures often underestimate the extent of the losses.

Production is measured after the processing losses have occurred. Physical losses occurring in the plant after manufacture are small.

Losses are rarely apparent in the trade statistics, i.e. the people responsible for the sea transport of fertilizers will ensure there is a close correlation between the records of the quantity supplied and the

quantity delivered. It is immediately after this point, from port handling onwards, that the losses occur, but the measurement has already been taken.

Assuming no changes in the levels of stocks, a good measure of losses would be the difference between the quantities supplied by the manufacturer or imported and the quantities consumed in agriculture or even delivered by the retailer. However, it is very difficult to prepare reliable statistics at farm level and, in almost all countries, the so-called ″consumption″ statistics are in fact statistics of "deliveries" from the manufacturer or importer. The main losses occur after this point of measurement. In the case of many developing countries, fertilizer consumption is measured by taking production, adding imports and subtracting exports (i.e. apparent consumption) The equation is exact and by definition there is no place for losses.

It is therefore necessary to measure the losses as they occur in practice in the distribution system. FADINAP surveys indicate losses as high as 8%. This adds greatly to the cost of the fertilizer supply. In some developing countries not covered by the FADINAP survey, the losses are known to be even higher.

The most important method of reducing losses is to improve management practices. But before management practices can be improved, it is necessary to know the extent of the losses and where and why they are occurring.

VI. FERTILIZER CONSUMPTION IN AGRICULTURE

1. Consumption per hectare of crop

Not many countries compile fertilizer consumption data by crop. Nevertheless, reliable information on fertilizer use at farm level is very important for a proper planning not only of fertilizer supply and distribution but also, for example, for the planning of cropping and of the research activities and advisory services.

Where agricultural input purchases are financed by institutions such as agricultural banks, regional rural banks or special support schemes, these organizations may keep records which can be used to provide data on use of cost of production surveys and farm agricultural inputs. Likewise, management surveys also might provide useful information on many aspects of the use of agricultural inputs. In areas where a large proportion of fertilizer consumption is accounted for by large estates or state-farms, it may be possible to obtain an accurate representation of fertilizer use by obtaining information from each of the large estates. But these situations are exceptional.

The dealer reporting system mentioned in chapter V might be used for estimating the consumption of fertilizers by crops, i.e. the dealer might be asked to assess on which crops the fertilizers he has sold during the period are being used, but this system is unlikely to be practicable where there is a large number of retailers.

Manufacturers and large dealers often survey their farmer customers for their own planning purposes, but the information is rarely published.

Therefore, in most situations it will be necessary to carry out farm surveys in order to obtain the required information. In most countries, there is a large number of farms and it is rarely practicable to carry out a complete census of all of them. A survey of a sample of farmers is used to represent the total.

Sample surveys also are expensive to carry out and may be feasible only once every three or four years, but they provide very useful information.

In making a sample survey, it is important that the sample of farms selected should be representative of the "population" to be surveyed. Having defined the population, the choice of farms is made randomly (a "random sample"). The size of the sample required is determined statistically.

The population of farms may be divided into groups, say of farmers producing different crops and a sample selected from each group (a "stratified random sample").

In all cases, the survey questions must be clear and must not bias the answer.

The interviewers must be well trained. They should be given an intensive theoretical and practical training in the procedures of data collection, including a full explanation of the concepts and definitions to be used. They should be given practical demonstrations and then asked to carry out data collection under close supervision. The initial training should be followed at intervals by refresher courses.

The basic information to be sought is the:
i) area under various crops grown in the year,
ii) proportion of each crop receiving fertilizers and
iii) quantity of fertilizers (product, N, P_20_5 and K_20) applied to each crop.

The average actual application rate of plant nutrients N, P_20_5 and K_20 by crop can be estimated from this information.

If the quantity of fertilizer used on a crop is divided by the total area of the crop (fertilized as well as non fertilized), the rates relate to fertilizer consumption per hectare of total area of the particular crop, which is evidently lower than the gate per unit of fertilized area.

A specimen form is given in table (8). The need to record the rates of fertilizer use on irrigated crops and rainfed crops separately and to take account of situations where more than one crop per year are grown on the same area of land, should be noted.

2. Consumption per hectare of agricultural land

The intensity of fertilizer consumption in a country depends on a number of factors, notably:
i) the arable area available for cultivation of agricultural crops,
ii) the area under irrigation,
iii) the area under high-yielding varieties, which require higher rates of fertilizers,
iv) the types of crops grown in the country and
v) the extent of promotional and extension efforts, creating awareness among farmers of the benefits from using fertilizers.

Crude inter-country comparisons of total quantities consumed are evidently not valid. For example, a country having 0.5 million hectares under cultivation will have a lower consumption level than a country having 50 million hectares under cultivation, whatever rates the farmer might be using on his crops.

The average rate of fertilizer consumption of a country can be expressed in terms of a common unit - whether this be the gross cropped area, agricultural land. or arable land of the country - to give nutrient consumption expressed as kg nutrient/ha of the area selected.

FAO defines "arable land and land under permanent crops" as "land under temporary crops (double cropped areas are counted once), temporary meadows for mowing or pastures, land under market and kitchen gardens, land temporary fallow or lying idle and also land under permanent crops". "Agricultural land" is defined as "arable land, land under permanent crops and land under permanent meadows and pastures".

By definition,"arable land and land under permanent crops" form a part of "agricultural land", so that fertilizer consumption per hectare based on the latter is evidently lower than the one based on the former, for the same country.

Kg/ha statistics, using either the two units "arable land and land under permanent crops" or "agricultural land" presuppose that the entire area is receiving fertilizers. Experience shows that it is rare for all the cultivated land to receive fertilizers. Fertilizer consumption per hectare of fertilized area would give a more representative index, if available.

Since a few countries have reliable data on fertilizer consumption by crop, inter-country comparisons of consumption on this basis are rarely possible. Under the circumstances, fertilizer consumption per hectare of "agricultural land" or "arable land and land under permanent crops" is usually used for this purpose. Care needs to be taken when interpreting the figures of countries where substantial quantities of fertilizers are applied to permanent grass.

TABLE 8

RATES OF FERTILIZER USE

Season .....

CROP (*)	AREA (Hectares)	AREA FERTILIZED (Hectares)	TOTAL QUANTITY OF NUTRIENTS APPLIED			ESTIMATED RATES OF APPLICATION		
			N kg	$P_2 0_5$ kg	$K_2 0$ kg	N Kg/ha	$P_2 0_5$ Kg/ha	$K_2 0$ Kg/ha
Crop (1) Crop (2) Crop (3) Crop (4)								

(*) The crops which are important as regards fertilizer use.
Countries may find it useful to collect similar information for irrigated and rainfed crops separately.
If more than one crop is grown during the year on the same area of land, both the rates of fertilization applied to each crop and the total applied during the year should be recorded.

VII. PRICES AND SUBSIDIES

1. Introduction

Ultimately, it is the relationship between crop and fertilizer prices that determines to what extent inputs will be purchased by the farmer and whether the crop price will cover his investment costs and expenses incurred in growing the crops. Sale prices of both the input and the output have to be remunerative for the producers, i.e. the manufacturer and the farmer. In the developing countries a subsidy is often required to keep the input prices low, so that the output prices can be kept at an acceptable level. Experience shows that it is preferable to maintain a reasonable input-output price relationship to enable the farmer to use fertilizer profitably and, at the same time, to keep foodgrain prices reasonably low. Inputs generally constitute a costly item in the farmers' budget and it may be necessary to subsidize them to achieve the objective of a satisfactory input-output price relationship.

2. Prices

In many countries fertilizer prices are set by the Government. Government taxes and levies may be added. In some countries sales are on an ex-factory basis, in others on a wholesale, warehouse, nearest railhead, nearest port or retail basis. The farmer incurs other costs in transporting the material to the farm.

2.1. Price definitions

i) Ex-factory price (producer price) signifies that domestically manufactured fertilizer is available at the factory gate at this price.
ii) Ex-port price signifies that imported fertilizer is available at the port of importing country at this price.
iii) Ex-warehouse price signifies that fertilizer is available at the warehouse of the factory or retailer at this price.
iv) Wholesale price signifies that fertilizer is available at this price at the warehouse of the wholesaler, distributor or sub-distributor. Normally large quantities which are purchased at this price.
v) Railhead price signifies that fertilizer is available at this price at the nearest railhead. The railhead price includes railway freight from factory (for domestically produced material) or port (for imported material) to the railhead. This price is also called f.o.r. price (i.e. free on rail, including railway freight).
vi) Retail price signifies that fertilizer is available from the dealer at this price at the retail point.
vii) Price paid by farmer includes the cost of transport to the farm gate, if applicable.

2.2. Prices paid by farmers

Note: this section is extracted from the FAO document "Farm and Input Prices" cited at the end of the chapter.

Prices paid by farmers for their production requisites are needed for the national accounts. These prices and the prices they receive for their agricultural products are often converted into index numbers which indicate the parity between prices received and prices paid by farmers. These indices give warning signals to public agencies of imbalances which might require either raising the output prices for agriculture or lowering the prices of agricultural inputs (or vice versa).

The price paid by the farmer for an agricultural production requisite is, in principle, the price he pays at his farm-gate or village. If the requisite is bought from a factory or government store, the expenses incurred in transporting it to the farm must be added to arrive at the estimate of the price at the farm-gate.

In many developing countries fertilizer prices are government controlled and can be obtained without difficulty from the government departments or public agencies supplying the fertilizer.

If, however, the fertilizer prices are not government controlled, it is more difficult to obtain reliable price statistics. The information may be obtained from the retailers or from a random sample of farmers. If the level of literacy is low, the information is normally obtained from answers to oral questions put by trained interviewers. In a more developed environment, examination of the accounts or mailed questionnaires may be used.

Normally the collection of information on fertilizer prices will be part of a more general survey covering all farm inputs and possibly other items. It may be reported by dealers (chapter V) or combined with the survey of fertilizer usage mentioned in chapter VI. In any event, the standards and methods used must be compatible with existing national, economic and social conditions.

The most important products should be covered and the information requested might include not only the nature of the product, unit weight, price paid and expenses incurred in transporting them to the farm gate, but also the type of pack, the time of the year when the items are bought, etc.

Subsidies, credit at concessional rates of interest and other types of promotional grants are often made available to farmers to enable them to buy the fertilizers. The price reported should be the price they actually pay after deduction of the subsidy. If a tax is added to the price, the tax-inclusive price should be reported.

The interviewers must be properly trained; the remarks on training made in chapter VI are also applicable here.

Table (9) gives a specimen reporting form covering the basic information required.

TABLE 9

FERTILIZER PRICES

Source of information .....
Location .....
Prices as on (date) .....
Nature of prices .....

PRODUCT	QUANTITY	UNIT WEIGHT	PRICE	TRANSPORT COST TO FARM GATE (if applicable)
Product (1) **Product (2)** **Product (3)** **Product (4)**				

Against the "Source of information" should be indicated the farm, retailer, agency or organization from which the prices have been obtained. Against the "Nature of prices" should be indicated whether the price is farm-gate, retail, cooperative, public agency, etc.

2.3. Import and export prices

Normally import prices refer to prices at which transactions of foreign products are effected and are generally reported as cif (cost insurance and freight). Export prices refer to prices of large quantities destined for outside markets and are recorded as fob (free on board).

Prices of the following kind operate in the import/export trade :

i) fas - free alongside ship.
The exporter has brought the material to the loading point at the port. Loading onto the ship, ocean freight and other charges are on the importer's account.
ii) fob - free on board.
The exporter has loaded the material onto the ship. Ocean freight and other charges are on the mporter's account.
iii) cif - cost, insurance and freight.
= fob price + insurance + ocean freight, i.e. the price of the material landed in the importing country. Unloading operations and other expenses at the port of import are on the importer's account
iv) cfr (formerly c + f) - cost and freight
= fob price + ocean freight (other details are the same as iii, with the difference that insurance of the cargo is paid by the importer).

Further information concerning these terms is given in the INCOTERMS' document cited at the end of this chapter.

Once the material reaches the importing country, port charges, various other administrative charges, inland railway freight distribution margin, etc. are added to arrive at the sale price at which the farmer purchases the material.

3. Subsidies

Fertilizer subsidies might take different forms and given at various levels as described below. Whatever the case may be, information on subsidies needs to be collected.

3.1. Production subsidies

In the case of countries which do not need to import fertilizers to supplement home production, the question of having one single price for the same indigenous product does not assume serious proportions. However, if the country has to import fertilizers, unless it allows a free market forces to determine the price, leaving everything to the paying capacity of the consumer, different prices for the same product manufactured at different plants and for similar imported material may cause marketing problems.

In such cases, countries usually adopt one of the following three courses of action: either to raise the prices of other producers to the level of the highest or to bring them all down to the level of the lowest or to take the average value of such prices. If the first course is adopted, the input and output costs will be high. A number of farmers will not be able to purchase the fertilizer and the sale price of the crops so produced will also be higher. On the other hand, with a low input cost a large number of farmers are in a position to use the input and the agricultural product also costs less, if compared to the previous situation. This is possible only when the sale price is statutorily controlled throughout the country, and the plants whose costs are higher are subsidized to bring them down to one common price (whether the average or the lowest). Of course, in this case, the burden on the budget can be substantial and this has to be weighted against the benefits to the consumers.

3.2. Fertilizer price subsidies

Most developing countries have fertilizer price subsidies to keep the fertilizer prices low and make farmers conscious of the benefits of fertilizer use. Subsidy may be given at various levels - to transporters, importers, wholesalers, cooperatives, etc., all with the common objective of making fertilizer affordable for the farmer. Whatever the level at which subsidy is given, ultimately it must be passed on to the farmer.

3.3. Other form of subsidies/incentives

The forms of subsidy discussed above have the general purpose of bringing down the farmer's price of fertilizer throughout the country. Special subsidies may be used as incentives, extended to a target group of farmers to meet specific requirements, such as, for example, a transport subsidy in hilly and inaccessible areas or subsidies given by some provinces on specific fertilizer materials with the objective of promoting a more balanced use of fertilizers. There may be subsidies on soil amendments to correct soil alkalinity/acidity, exemption for a specific period from the levy of taxes in the case of a new fertilizer unit, supply of power, feedstock and raw materials to the fertilizer industry at concessional rates, etc.

4. Relationship between input and output prices

The ratio between the crop price and the input price indicates the incentive for the farmer to use inputs on a continuing basis. It represents the quantity of a particular agricultural product required to purchase a unit of plant nutrient N, P_20_5 and K_20. The lower the ratio, the more favorable it is for the farmer to use fertilizers and vice versa.

The "Productivity Index" (PI) is the additional yield in kg obtained per kg of plant nutrients applied.

The “Value Cost Ratio” (VCR) is the value of the increase in crop yield divided by the value of the fertilizer used. It is a measure of the profitability of fertilizer use.

5. Comparison of fertilizer prices

Fertilizer prices are influenced by the cost of production and import, exchange rates, "hidden" subsidies and other factors, which vary widely from one country to another. Therefore, inter-country comparisons of farmers’ prices, even for the same product, are rarely valid.

For comparisons within a country fertilizer prices may be expressed in terms of nutrients, say, the price of 1 kg of N in the form of urea, ammonium sulphate, CAN etc. Likewise the price of 1 kg of P_20_5 may be expressed in the form of SSP or TSP and the price of K_20 as muriate of potash.

References:
FAO, 1980, Farm and Input Prices: collection and compilation. Rome.
INCOTERMS, 1990, International Chamber of Commerce. Paris.

VIII. FERTILIZER DEMAND FORECASTS

1. The need for forecasts

Forecasts of fertilizer demand are required for short-term and long-term planning purposes.

1.1. Short-term forecasts (the coming season)

The forecasts are required for the following reasons:

- fertilizer supplies must be available when they are required by the farmer. If they arrive too late in the season, they are useless for the present season and will probably deteriorate before the next;
- the fertilizers must be of the types required by the crops and soils on which they have to be applied;
- they must be available where they are required; the forecasts are necessary for planning transport and storage;
- an adequate supply of fertilizers to agriculture is crucial to the economies of many developing countries;
- but it is also important that costly imports, possibly involving large amounts of foreign exchange, should be minimized;
- fertilizer stocks must be minimized. Excessive inventories are a substantial economic burden not only on the finances but also on the country's infrastructure (credit facilities, transport, port capacity, storage space, etc.);
- forecasts of fertilizer requirements are needed in discussions with donors regarding fertilizer aid or with the Central Bank for the release of foreign exchange;
- they are necessary for the calculation of agricultural credit requirements.

Fertilizer supplies originate from domestic production supplemented by imports. The normal procedure is to take account of the opening stocks at the beginning of the season, add the quantities of domestically produced material which can be made available in time to farmers during the season and compare the result with forecasted requirements, the gap having to be filled by imports. Allowance is also normally made for pipeline stocks.

For this purpose, the estimates referred to in earlier chapters of probable domestic production and fertilizer stock levels are required. An essential additional item is estimates of the farm demand for fertilizers. This demand should be forecast by region, by product and preferably on a monthly basis for short-term forecasts.

1.2. Long-term forecasts (four years)

Long-term projections are also required to assess the national need for additional production units, to estimate future import requirements, and to evaluate whether mixing, bagging, handling, storage and transportation facilities are adequate. Long-term consumption forecasts are also required for the planning of related activities, such as research and advisory services.

Starting from plans for the future agricultural production of a country, it is relatively easy to calculate theoretical fertilizer requirements by multiplying crop areas by recommended rates of fertilizer use. However, it is important to distinguish between the true demand for fertilizers and the theoretical requirements. It is most unlikely that they will coincide.

Overestimation of fertilizer demand during the past 20 years has done a great deal of damage to the world fertilizer industry and to some national economies. The “over supply” situation has resulted in rather low prices for fertilizers but the medium term benefit of uneconomic prices to agriculture is doubtful. In the short term, the buyer is pleased to be able to buy fertilizers at the low prices which result from “over

supply", but the low prices lead to inefficient use, wastage and pollution. Low prices discourage investment in fertilizer production facilities and in the longer term shortages may ensue. And it is always the poorest countries, which most need their agricultural production, which are the hardest hit under such circumstances.

For all these reasons, it is therefore most important that the demand forecasts should be realistic, if waste is to be avoided.

The long-term estimates may be basically in terms of nutrients but an assessment of the products likely to be required is also necessary.

1.3. Consumption (delivery) statistics

It is necessary to have a reliable basis of current and historical statistics of fertilizer demand, referred to in chapters V and VI.

These delivery statistics can be analyzed to provide guidance on future requirements. In the developed countries the suppliers will use these statistics, which are often published, to define their strategies and often supplementing them with their own private studies. Large imbalances are avoided by market forces.

In the developing countries, the same basic statistics are required but the countries are often not at a stage where market forces alone are sufficient to ensure adequate supplies.

2. Forecasting procedures

In the developing countries, the relevant authorities in the different regions are often asked to estimate their annual requirements and to send them to a central agency, generally a department of the Ministry of Agriculture or a fertilizer marketing organization. The returns are summed up to provide an estimate of the national annual requirements.

This system almost inevitably results in an overestimate of demand, since the regional authorities will "play safe" and ask for ample supplies well in advance of the requirement date. If means can be found for financing the quantities of imports indicated by these over-estimates, they will be procured, with consequent economic wastage.

Furthermore some planning authorities seem to have difficulty in understanding that different crops and different soils require different types of fertilizers. If resources are scarce and farmers have to accept the fertilizers which the State can supply, at least the agronomists should be consulted to suggest which fertilizers are best suited to the crops in the locality.

It is therefore important to supplement the analysis of the demand statistics in the different regions with assessments of the agricultural requirements (see below).

The weather or changes in economic circumstances can invalidate the best of plans but wastage should be minimized by making practical and realistic forecasts.

3. Analysis of the consumption statistics

Graphical and statistical techniques are frequently used to make long-term forecasts. If other factors remain constant, this is a very good method but, unfortunately, this rarely happens. Man-made and natural catastrophes upset the most sophisticated forecasts. Even lesser events can have very significant consequences.

In the developing countries, fertilizers are price and income elastic. If the price goes up, especially in relation to the prices of agricultural products, consumption will fall, and vice-versa. If the farmers cash availability falls, due perhaps to a poor harvest in the previous season or to inadequate credit facilities, he will purchase less fertilizer. These factors should always be kept in mind when using statistical techniques to make forecasts.

Nevertheless, graphical and statistical analyses have their place.

. Graphs: the historical data are plotted and the line extended or extrapolated to give the forecast.
The advantages of graphical analysis are:
- it is more flexible than a mathematical function,
- it saves time,
- it is easy to explain to others.

On the other hand, the analysis is subjective. Different curves can be fitted to the same line.

. Mathematical functions: a mathematical function can be fitted to the historical data. Different curves may be used - linear, exponential, logistic, etc. Visual examination of the trend line can often give an indication of the appropriate function and period to be fitted. Often, fitted over an appropriate period and extrapolating no more than 3 to 5 years ahead, a simple linear function suffices. The R squared coefficient of correlation gives a measure of the "goodness of fit" of the chosen period and trend.

. Percentage growth rates: this is a poor method. Because consumption has increased at a rate of 5 % per annum for the past few years it cannot be assumed that it will continue to increase at 5 % per annum during the coming years. It is preferable to estimate likely increments on absolute changes rather than on percentage changes. The percentage decreases over time, for the same absolute increase, because of the higher base level.

. Econometric models: statistical models showing cause and effect relationships have been constructed and some have given plausible results. They seek to establish a causal relationship, for example the influence on fertilizer demand of crop prices in relation to fertilizer prices, farm incomes in the previous season, credit availability and crop areas. For long-term forecasts, factors such as changes in crop area, irrigation, high-yielding varieties, number of retailers, etc. may be included. The factors included in the model need to be compatible with economic theory.

The problems with econometric models are that:
- they require a considerable amount of accurate statistical data,
- the causal factors themselves have to be forecasted,
- there is often a correlation between the variables so that their separate impact cannot be identified,
- unforeseeable external events can easily upset the results,
- some important causal factors (such as the advisory effort) cannot be quantified.

Modeling requires the services of an expert econometrician and the results need to be assessed critically. Modeling can give useful insights into cause and effect relationships, for example, on the likely effect on fertilizer demand of a change in the fertilizer price.

. Linear programming: this is often used for optimizing transport and storage operations.

4. Agronomic assessments

The demand for fertilizers is a "derived demand", i.e. dependant on agricultural demand. Therefore the first neeed is to have reliable statistics on the areas of the main crops grown in the different regions. It is also useful to have estimates of the current rates of use of fertilizer on the important crops, referred to in chapter VI. These might be compared with the recommended rates of use. The agronomists can advise on the fertilizer recommendations for the different crops, based on crop response curves, derived from fertilizer trials.

As regards the future, the Ministries of Agriculture should be able to give guidance on the likely development of the areas of the main crops and irrigation projects, from which forecasts of fertilizer requirements can be calculated. In many countries the developments will be dictated by the food requirements.

The theoretical requirements of the different types of fertilizers for the various regions can be calculated from the anticipated crop areas and the recommended rates of fertilizer application. This information on theoretical requirements is useful, but it has to be remembered that the quantity is a theoretical maximum, not a demand forecast.

In practice, the quantity of fertilizer used per hectare depends on the degree of agricultural development of a country. National fertilizer consumption normally grows over time, in the form of an S-shaped curve (Lee, 1980). There are three stages: Introduction, Take-Off and Maturity. Initially growth is slow, but during the take-off stage it accelerates. At the maturity stage it levels out, as the national average fertilizer consumption approaches recommended fertilizer rates for major crops, over almost all the cropped area. The progress from stage 1 to stage 3 may take several decades.

Different regions within the country are likely to be on different parts of the curve. Some favored crops or regions may be near the top of the curve while others are still near the bottom.

Different nutrients may be on different parts of the curve. Nitrogen consumption is often higher up the curve than phosphate or potash.

The effective demand for fertilizers depends on a large number of factors, especially the price of the crop produced in relation to the price of fertilizer, the crops areas, the availability of irrigation, an adequate fertilizer supply, the ability of the farmer to market his crop, his credit facilities, his knowledge of fertilizer use.

5. The preparation of forecasts

As mentioned above, the normal procedure for forecasts is that information from the different regions is aggregated by a central authority to the national level.

To summarize some of the key statistics in the forecasting of fertilizer demand are:
- fertilizer deliveries (from domestic production and imports),
- fertilizer stock levels ,
- crop areas,
- irrigated areas,
- rates of fertilizer use on crops,
- crop and fertilizer prices,
- credit availability.

Experts familiar with the agronomic, economic and commercial conditions of the region/country should be involved in the assessments, if possible.

Methods which the fertilizer distributor may use to estimate the amount of fertilizer he can sell, are explained in detail in the FAO Fertilizer and Plant Nutrition Bulletin N° 8. These instructions are usable by anyone making forecasts on a regional basis.

At a country level, the statistical analyses mentioned above can be used to check the plausibility of the aggregated figures. The simple addition of the regional estimates is likely to lead to overestimates for the country as a whole.

6. Checks

During the season actual deliveries can be matched against the forecasts and corrective action, i.e. a curtailment of supplies or the procurement of additional supplies can be taken if necessary.

At the end of the season the forecasts should be compared with the actual offtake which materializes, so that the assessments can be improved for the next season.

Forecasts must be reviewed at regular intervals, in the light of the most recent statistics and agricultural developments. The short-term forecasts might be reviewed quarterly, always one year ahead, while the long-term forecasts should be reviewed at least every year.

References:

FAO, 1985, Manual on Fertilizer Distribution. Fertilizer and Plant Nutrition Bulletin N° 8. Rome.
Lee, C.Y., 1980. Studies of fertilizer use and marketing policy. FAO/FADINAP. Bangkok.

APPENDIX TABLE 1

PRODUCTION AND COMPOSITION OF ANIMAL MANURE (SOLID)

ANIMAL	PRODUCTION KG/DAY/HEAD (Excluding litter)	COMPOSITION (Units per Tonne or M_3)		
		N	P_20_5	K_20
Milk cows	45	5.5	3.5	8.0
Fattening pigs	5.8	4.5	4.0	5.5
Sheep	3.5	6.0	4.0	11.0
Laying hens	0.18	11.5	14.0	

Source: ITCF, France. Quoted in "Guide pratique de la fertilization raisonnée", SNIE, UNCAA, INAC, 1990.

APPENDIX TABLE 2

NUTRIENT COMPOSITION OF SEWAGE SLUDGE

COMPONENT	CONCENTRATION (%)		
	MINIMUM	MAXIMUM	MEDIAN
Organic C	6.5	48.0	30.4
Inorganic C	0.3	43.0	1.4
Total N	<0.1	17.6	3.3
NH_4-N	<0.1	6.7	1.0
$N0_3$ -N	<0.1	0.5	<0.1
Total P_20_5	<0.1	14.3	2.3
Inorganic P_20_5	<0.1	2.4	1.6
Tota I S	0.6	1.5	1.1
K_20	0.02	2.6	0.3

Source: FAO. "Fertilizer and Plant Nutrition Guide". Fertilizer and Plant Nutrition Bulletin N° 9, 1984.

APPENDIX TABLE 3

AVERAGE NUTRIENT CONTENTS OF OILCAKES

MATERIAL	NITROGEN N%	PHOSPHATE $P_2 0_5$%	POTASH $K_2 0$%
a. Non-edible oil cakes			
1. Castor cake	5.5 - 5.8	1.8 - 1.9	1.0 - 1.1
2. Cotton seed cake (undecorticated)	3.9 - 4.0	1.8 - 1.9	1.6 - 1.7
3. *Mahua* cake *(Bassia latifolia)*	2.5 - 2.6	0.8 - 0.9	1.8 - 1.9
4. *Karanj* cake	3.9 - 4.0	0.9 - 1.0	1.3 - 1.4
5. Neem cake	5.2 - 5.3	1.0 - 1.1	1.4 - 1.5
6. Safflower cake (undecorticated)	4.8 - 4.9	1.4 - 1.5	1.2 - 1.3
b. Edible oil cakes			
7. Cotton seed cake (decorticated)	6.4 - 6.5	2.8 - 2.9	2.1 - 2.2
8. Groundnut cake	7.0 - 7.2	1.5 - 1.6	1.3 - 1.4
9. Linseed cake	5.5 - 5.6	1.4 - 1.5	1.2 - 1.3
10. Niger cake	4.7 - 4.8	1.8 - 1.9	1.3 - 1.4
11. Rapeseed cake	5.1 - 5.2	1.8 - 1.9	1.1 - 1.3
12. Sesame (Til cake)	6.2 - 6.3	2.0 - 2.1	1.2 - 1.3

APPENDIX TABLE 4

NUTRIENT CONTENTS OF FERTILIZERS OF ANIMAL ORIGIN

MATERIAL	NITROGEN N%	PHOSPHATE $P_2 0_5$%	POTASH $K_2 0$%
1. Dried blood	10.0 - 12.0	1.0 - 1.5	0.6 - 0.8
2. Fish manure	4.0 - 10.0	3.0 - 9.0	0.3 - 1.5
3. Bird guano	7.0 - 8.0	11.0 - 14.0	2.0 - 3.0
4. Hoof and horn meal	14.0	1.0	
5. Bone meal (raw)	2.0 - 4.0	22.0 - 24.0 (8.8 - 9.6 citric acid soluble)	
6. Bone meal (steamed)		22.0 - 30.0 (15.4 - 21.0 citric acid soluble)	

Source: FAO, "Fertilizer and Plant Nutrition Guide". Fertilizer and Plant Nutrition Bulletin N° 9, 1984.

APPENDIX TABLE 5

SECONDARY NUTRIENTS IN SOME COMMONLY USED FERTILIZERS AND SOIL CONDITIONERS

ITEM	SECONDARY NUTRIENT		
	% SULPHUR as S	% CALCIUM as CaO	%MAGNESIUM as MgO
I. Fertilizers and amendments			
Ammonium sulphate	24	-	-
Calcium ammonium nitrate	-	10 - 20	0 - 7.5
Single superphosphate	12	25 - 30	0.5
Triple superphosphate	1	17 - 20	0.5
Potassium sulphate	18	-	-
Potassium chloride with magnesium	4	-	6
Potassium magnesium sulphate	18	-	8 - 11
Epsom salt	13	-	16
Diammonium phosphate	up to 3	-	-
Ammonium phosphate sulphate	10 - 14	-	-
Dolomitic limestone	-	29	5 - 20
Kieserite	20 - 22	-	26 - 27
Quick lime/burnt lime/unslaked lime	-	85	-
Gypsum (calcium sulphate)	15 - 18	23	-
II. Micronutrient fertilizers			
Zinc sulphate	18	-	-
Manganese sulphate	15	-	-
Copper sulphate	13	-	-
Iron sulphate	12	-	-

APPENDIX TABLE 6

SOME COMMONLY USED SOLID MICRONUTRIENT FERTILIZERS

ITEM	MICRONUTRIENT		MINIMUM ELEMENT CONTENT (%) (EEC standards)
	ELEMENT	EXPRESSED AS	
Sodium borate	Boron	B	10
Copper salt	Copper	Cu	20
Ferrous salt	Iron	Fe	12
Iron chelate	Iron	Fe	5
Manganese salt	Manganese	Mn	17
Ammonium molybdate	Molybdenum	Mo	50
Zinc salt	Zinc	Zn	15
Zinc chelate	Zinc	Zn	5

NPK compounds can contain secondary and micronutrients according to agricultural requirements.

APPENDIX TABLE 7

THE HARMONIZED COMMODITY CODING SYSTEM

Fertilizers

H.S. Heading N°	H.S. Code	H.S. Description
31.01	3101.00	Animal or vegetable fertilizers, whether or not mixed together or chemically treated; fertilizers produced by the mixing or chemical treatment of animal or vegetable products.
31.02		Mineral or chemical fertilizers, nitrogenous
	3102.10	- Urea, whether or not in aqueous solution
		- Ammonium sulphate; double salts and mixtures of ammonium sulphate and ammonium nitrate:
	3102.21	- Ammonium sulphate
	3102.29	- Other
	3102.30	- Ammonium nitrate, whether or not in aqueous solution
	3102.40	- Mixtures of ammonium nitrate with calcium carbonate or other inorganic non fertilizing substances
	3102.50	- Sodium nitrate
	3102.60	- Double salts and mixtures of calcium nitrate and ammonium nitrate
	3102.70	- Calcium cyanamide
	3102.80	- Mixtures of urea and ammonium nitrate in aqueous or ammoniacal solution
	3102.90	- Other, including mixtures not specified in the foregoing subheadings
31.03		Mineral or chemical fertilizers, phosphatic
	3103.10	- Superphosphates
	3103.20	- Basic slags
	3103.90	- Others
31.04		Mineral or chemical fertilizers, potassic
	3104.10	- Carnallite, sylvite and other crude natural potassium salts
	3104.20	- Potassium chloride
	3104.30	- Potassium sulphate
	3104.90	- Others

H.S. Heading N°	H.S. Code	H.S. Description
31.05		**Mineral or chemical fertilizers containing two or three of the fertilizing elements nitrogen, phosphorus and potassium; other fertilisers; goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg:**
	3105.10	**- Goods of this chapter in tablets or similar forms or in packages of a gross weight not exceeding 10 kg.**
	3105.20	**- Mineral or chemical fertilizers containing the three fertilizing elements nitrogen, phosphorus and potassium**
	3105.30	**- Diammonium hydrogenorthophosphate (diammonium phosphate)**
	3105.40	**- Ammonium dihydrogenorthophosphate (monoammonium phosphate) and mixtures thereof with diammonium hydrogenorthophosphate (diammonium phosphate)**
		- Other mineral or chemical fertilizers containing the two fertilizing elements nitrogen and phosphorus:
	3105.51	**- - Containing nitrates and phosphates**
	3105-59	**- - Others**
	3105.60	**- Mineral or chemical fertilizers containing the two fertilizing elements phosphorus and potassium**
	3105.90	**- Others**

Extracted from "The Harmonized Commodity Description and Coding System", Customs Cooperation Council, Brussels