

IFA Technical Conference

Venice, Italy
2-4 October 1990

FERTILIZER SUPPLY AND DEMAND TRENDS IN THE 1990's

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1. INTRODUCTION

The demand for fertilizers is dominated by its use in the cereal crops which consume approximately two-thirds of the fertilizers. The first part of this paper is devoted to a review of the world cereal situation. After an assessment of the present situation and outlook for cereals, the pattern of fertilizer consumption is examined. First of all, we trace what has happened during the past 20 years and then forecast consumption during the next five years. In this connection, the United Nations grouping of countries into "developed", "developing" and "centrally planned" is used for its convenience, even though the economic systems are being changed in some of the latter. We then look at supply/demand balances for fertilizers and their main raw materials during the next five years. Lastly, in a more general way, we consider likely developments in the longer term.

2. THE WORLD SUPPLY AND DEMAND FOR CEREALS

Table 1 - WORLD PRODUCTION OF CEREALS
(million tonnes)

| Harvest of | 1987 | 1988 | % Variation | 1989 Estimate | % Variation | 1990 forecast | % Variation |
|---------------|------|------|-------------|---------------|-------------|---------------|-------------|
| Wheat | 511 | 508 | - 1 % | 540 | + 6 % | 569 | + 5 % |
| Rice | 466 | 491 | + 5 % | 508 | + 3 % | 513 | + 1 % |
| Coarse grains | 816 | 746 | - 9 % | 820 | + 10 % | 847 | + 3 % |
| All cereals | 1793 | 1745 | - 3 % | 1868 | + 7 % | 1929 | + 3 % |

SOURCE : FAO (June 1990)

2.1. Cereal Production - 1989 Harvest

According to the latest FAO estimates, total cereal production increased by 7 % in 1989. Wheat production increased by 6 % and coarse grains production by 10 %. This increase follows two years of falling production. Three quarters of the increase occurred in the USA. Significantly higher production was also recorded in Canada, India, China, the USSR and South Africa. Production declined in Argentina and Turkey. In each case, the variation was due either to favourable or to unfavourable growing conditions.

2.2. Cereal Production - 1990 Harvest Forecast

Growing conditions are generally good and, assuming continued favourable weather, the FAO forecasts that the production of wheat and coarse grains could be approximately 3 % higher than in 1989, but adverse weather in some major producing regions could eliminate this increase. Even if it materializes, the increase would just about cover the higher consumption and the grain situation is likely to remain critical for at least one more year.

2.3. Cereal Stocks

Cereal production rose in 1989, but it is anticipated that world cereal consumption during the 1989/90 period will increase even more. In consequence, there is likely to be a further fall in world cereal stocks, although the fall will be less than in the previous year, namely an estimated 5 % by the end of the 1989/90 period, compared with a fall of 23 % in 1988/89. The 1989/90 decline in stocks would be due entirely to coarse grains. However, the stocks of wheat are expected to remain critically low. In this connection, the low volume of stocks held by the major exporters is of particular concern.

Table 2 - WORLD CEREAL STOCKS (1)
(million tonnes)

| | 1986/87 | 1987/88 | 1988/89 Estimate | 1989/90 forecast |
|------------------------|------------|------------|---------------------|---------------------|
| Rice | 54 | 44 | 45 | 51 |
| Wheat | 167 | 142 | 116 | 117 |
| Coarse grains | 234 | 213 | 144 | 123 |
| TOTAL | 455 | 399 | 305 | 291 |
| Stock as % of world | 27 % | 24 % | 18 % | 17 % |

(1) Estimated stocks at the end of the period shown.
SOURCE : FAO (June 1990).

The USDA's current estimate of the 1990 wheat harvest is higher than that of the FAO - 6 % more than 1989, compared with 3 %. Their forecasts are higher for North America and the USSR. If this level of production materializes it will ease but not remove the problem of low wheat stocks.

2.4. Cereal Consumption

In 1989/90, world utilization of cereals is forecast to increase by about 2 %. In the previous year, 1988/89, world cereal consumption declined by about 1 %, largely due to a fall in the use of cereals for animal feed, following an increase in coarse grain prices. The increase in 1989/90 is due to a recovery in animal feed use and the growth of direct cereal consumption in developing countries. There is a recovery in the world beef and veal market, which is expected to continue into 1991.

Animal feed is estimated to represent 38 % of total cereal use, the EEC, USSR and the USA accounting for almost 60 % of total utilization. The use of cereals for animal feed is also important in some of the wealthier developing countries and in China. Cereal consumption for this purpose was increasing rapidly in these countries until the 1980's, but has now tended to stagnate, due largely to economic constraints.

● *Cereal Consumption Per Person*

In developed countries, cereal consumption per head varies little from year to year. In some countries, e.g. in Canada, Denmark, Italy, the UK and the USA, consumption has tended to increase recently due to a combination of changing consumer habits and growing health consciousness with regard to nutrition.

In developing countries, a small increase in total cereal use is expected in 1989/90 due to improved production but, because of the increase in their populations, consumption per person is expected to fall slightly.

Levels of meat consumption in the USSR and East Europe are much lower than in the OECD countries. As personal incomes rise, meat tends to replace part of the directly-consumed cereals in the diet. There is, therefore, a potential for an increase in total cereal consumption per person. However, the statistics indicate that consumption per head is already higher than in the OECD countries. This may be due partly to the high losses of food in the distribution system in the USSR or to statistical aberrations. In any case, in the short term little improvement can be expected in the level of income in these countries.

On a world basis, the overall result is a tendency for cereal consumption per person to stabilize.

3. FERTILIZER CONSUMPTION : THE PAST 20 + YEARS

3.1. Overall Consumption

Figure 1

The demand for nitrogenous fertilizers continues to outstrip that of phosphate and potash. This is necessarily so since nitrogenous fertilizers are subject to leaching, denitrification and volatilization.

3.2. Developed Countries

Figure 2

The variations in consumption were particularly marked in the developed countries. In fact, their phosphate and potash consumption has tended to decline since 1979. In spite of this, crop yields continued to increase and costly surpluses developed. In general, soils had been well fertilized with these nutrients for many years and some reduction in rates of application could be permitted during a period of economic difficulties for the farmer. However, there is evidence that at present levels of use, crop removal is now greater than the rate of application of these nutrients in certain areas and that, in consequence, some soils are being "mined".

3.3. Developing Countries (excluding China)

Figure 3

In developing countries, the consumption of fertilizers has continued to increase steadily. This is particularly true of nitrogen but in many developing countries fertilizer application has become unbalanced i.e. too much nitrogen in relation to

the other nutrients. The earlier mentioned "mining" of soil nutrients is also severe in many developing countries and falls in yields have been observed as nutrients removed by crops are not replaced. According to the FAO, this problem is a potential "environmental catastrophe".

3.4. Centrally Planned Countries

Figure 4

● *Socialist Asia*

This region is dominated by China. Consumption has increased strongly in China in recent years, although with substantial variations round the trend, and further large gains were recorded in 1987 and 1988.

● *East Europe and the USSR*

In the USSR, the consumption of all three nutrients has been increasing steadily but provisional estimates indicate that there was a fall in consumption in 1989 and that a further fall is likely in 1990, following reforms of the distribution and pricing systems. In the other countries of East Europe, taken as a whole, consumption has remained at approximately the same level since 1980 and no growth is anticipated.

3.5. Regional Shares

Figure 5

The changing pattern of food requirements and production is reflected in the global distribution of fertilizer consumption. In 1970/71, the developed countries accounted for 55 % of fertilizer consumption, today their share is 32 %. The share of the centrally planned countries has increased from 33 % to 44 % and that of the developing countries from 12 % to 24 %.

4. FORECASTS OF FERTILIZER CONSUMPTION

4.1. Developed Countries

Figure 6

Between 1988/1989 and 1994/95, we estimate that total nutrient consumption will increase at a rate of about 0.5 % per annum. A slight decline is expected in West Europe. Improved cereal prospects are likely to be offset by environmental measures restricting fertilizer use.

4.2. Developing Countries (excluding China)

An average rate of growth of 4 % per annum up to 1994/95 is forecast for these countries, with rates of around 5 % per annum in Africa, the Near East and South Asia, somewhat less for Latin America and South-East Asia.

4.3. Centrally Planned Countries

An average consumption increase of 2.4 % per annum is anticipated for Socialist Asia. In China, the population's rising food requirements can be satisfied only by intensifying the agricultural systems. Until recently, there was little development in the other countries of the region but fertilizer use has now begun to increase substantially in Vietnam.

In East Europe, excluding the USSR, consumption could fall temporarily as fertilizer subsidies are removed. It should recover after one or two years as the crop price : fertilizer price ratio becomes more favourable, to return to its former level.

It is difficult to predict developments in the USSR. At present fertilizer consumption seems to be falling due to increased prices, transport problems, the reform of the distribution system etc. However, there is a need to increase agricultural production in order to reduce the massive cereal imports and to improve food supplies. Improvements in the distribution and use of fertilizers and in the distribution of food could permit substantially higher yields from the same quantities of fertilizers. Crop yields are very low in relation to the quantities of fertilizers applied. It is expected that consumption will fall for one or two years before recovering progressively to approach former levels, but it is unlikely that the growth of recent years will be repeated.

4.4. World

Overall, on a world basis, we expect fertilizer nutrient consumption to increase at a rate of about 1.5 % per annum up to 1994/1995.

Table 3 - FERTILIZER CONSUMPTION
(‘000 tonnes nutrient)

| <u>World</u> | 1988/89 actual | 1989/90 forecast | + or - % | 1994/95 | % pa |
|-----------------------|-------------------|---------------------|-------------|---------|-------|
| Nitrogen (N) | 79 760 | 79 993 | 0.3 % | 88 272 | 1.7 % |
| Phosphate (P205) | 37 895 | 37 917 | 0.1 % | 41 708 | 1.6 % |
| Potash (K20) | 27 988 | 27 533 | -1.6 % | 29 354 | 0.8 % |
| N + P205 + K20 | 145 643 | 145 442 | -0.1 % | 159 334 | 1.5 % |

4.5. Regional Shares

Between 1988/89 and 1994/95, the share of the developing countries in world fertilizer consumption is expected to increase from 24 % to 28 %, at the expense of developed and centrally planned countries.

5. FERTILIZER SUPPLY/DEMAND BALANCES

5.1. 1970 to 1989

The supply/demand situation during this period is illustrated by the pattern of fertilizer prices. In figure 7, urea and DAP prices are given as examples. In 1974, following the first oil crisis, there was a sharp increase in prices. Fears were expressed of a world food crisis and of a permanent shortage of fertilizers. There was panic buying of fertilizers in some countries. However, the market responded quickly to the price signals, demand fell and supplies became more than adequate. Prices fell as sharply as they had risen.

There was another increase of prices following the second oil crisis in 1979 but this too proved short-lived. During the 1980's, fertilizers have been in over-supply and prices were sometimes below the total production cost.

5.2. 1990 to 1994

Note : except in the case of elemental sulphur (brimstone), the supply and demand estimates given below relate to fertilizer use only. In the tables, the differences between "Capacity" and "Supply" are explained by the effective operating rates, non-fertilizer use, processing and other losses etc.

● *Nitrogen*

Approximately 97 % of the nitrogen fertilizers is derived from ammonia (the remainder being by-product nitrogen, whose level of availability remains approximately constant) and the ammonia supply/demand balance reflects accurately that of nitrogen fertilizers.

World ammonia capacity is expected to increase by about 7 % between 1990 and 1994. Little increase is expected in the developed countries and the additional capacity will be in a number of developing countries (Bangladesh, China, Egypt, India, Indonesia, Iran, Iraq, Nigeria, Pakistan, Saudi Arabia).

Table 4 - AMMONIA, WORLD SUPPLY AND DEMAND BALANCES
'000 tonnes N

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|----------|---------|---------|---------|---------|---------|
| Capacity | 116 399 | 118 473 | 120 376 | 123 393 | 125 055 |
| Supply | 79 401 | 80 894 | 82 658 | 84 911 | 86 422 |
| Demand | 78 061 | 79 801 | 81 655 | 83 526 | 85 373 |
| Balance | 1 340 | 1 093 | 1 003 | 1 385 | 1 050 |

If all the new plants come into operation are planned, the world ammonia surplus should remain at about 1 million tonnes N. However, if some of the new plants are delayed, supply and demand could be close to equilibrium by 1994.

● *Phosphate*

A substantial proportion of the phosphate fertilizers consists of products derived from phosphoric acid, and almost the entire increase is in the form of phosphoric acid-based products. Between 1990 and 1994 no increase in phosphoric acid capacity is expected in the developed countries, nor in Latin America. The largest increases are in Morocco and China.

Table 5 - PHOSPHORIC ACID, WORLD SUPPLY AND DEMAND BALANCES
 '000 tonnes P2O5

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|----------|--------|--------|--------|--------|--------|
| Capacity | 36 019 | 36 661 | 36 912 | 37 777 | 39 075 |
| Supply | 25 593 | 26 001 | 26 373 | 26 894 | 27 416 |
| Demand | 23 530 | 24 170 | 24 926 | 25 475 | 26 008 |
| Balance | 2 063 | 1 831 | 1 447 | 1 419 | 1 408 |

A world capacity surplus of about 2.1 million tonnes P2O5 in 1990 is expected to fall to 1.4 million tonnes in 1994 (4 % of consumption). This is probably sufficient to ensure a more than adequate supply throughout the period. However, if some of the new capacity is delayed, the surplus will be reduced.

A number of DAP plants are being constructed, some of them based on imported phosphoric acid. If the announced projects are implemented there should be sufficient DAP capacity to meet demand at least until the mid-1990's.

The supply of phosphate rock is expected to remain more than adequate to meet demand.

● **Potash**

The world capacity of potash is expected to rise by 2 % between 1988/89 and 1994/95, largely due to increases in Jordan and the USSR. It is expected that potential supply will continue to exceed demand throughout the period but the surplus should decline as consumption grows faster than capacity.

Table 6 - POTASH, WORLD SUPPLY AND DEMAND BALANCES
 '000 tonnes K2O

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|----------|--------|--------|--------|--------|--------|
| Capacity | 34 442 | 37 732 | 37 982 | 37 982 | 38 222 |
| Supply | 30 877 | 31 087 | 31 265 | 31 233 | 31 428 |
| Demand | 27 345 | 27 868 | 28 436 | 28 885 | 29 354 |
| Balance | 3 532 | 3 219 | 2 829 | 2 348 | 2 074 |

● **Sulphur**

A deficit situation will persist until 1991, the extra supplies being drawn from stocks. It should ease afterwards when more Soviet, Canadian, US and Middle East sulphur becomes available. A significant surplus could develop in the mid-1990's.

Table 7 - ELEMENTAL SULPHUR (all uses) SUPPLY AND DEMAND BALANCES
 '000 tonnes S

| | 1990 | 1991 | 1992 | 1993 | 1994 |
|---------|---------|---------|--------|--------|--------|
| Supply | 39 568 | 40 523 | 42 843 | 45 588 | 47 120 |
| Demand | 40 713 | 41 644 | 41 965 | 42 850 | 43 602 |
| Balance | - 1 145 | - 1 121 | 878 | 2 738 | 3 518 |

• For all the nutrients, the situation is most uncertain as regards capacity expansions in the USSR, but variations in production are likely to be reflected in variations in demand, with little overall influence on the world balances.

6. THE SUPPLY/DEMAND BALANCES AFTER 1995

6.1. Demand

No doubt, it is difficult to forecast fertilizer demand. During the past 15 years, events external to the fertilizer industry - and to agriculture- have invalidated the demand forecasts. For example, two oil crises, the 1980 US embargo on grain exports to the USSR, government actions such as the US set-aside programme and the chronic indebtedness and protracted economic problems of many developing countries, have all had a major impact on fertilizer demand. None of them was predictable.

Apart from external shocks of this kind, there are some factors which favour, others which restrict the development of fertilizer demand, and many uncertainties.

a) Demand stimulating factors

Up to the year 2000, the world population is expected to increase at a rate of 1.7 % per annum. If food consumption per head remains approximately stable, food production and hence fertilizer consumption should increase at about the same rate on a world-wide basis. However, increased food production is constrained by limits to the area of arable land, the high cost of irrigation projects, soil erosion, land degradation and depletion of water resources. Increased production will, therefore, depend largely on increased yields per unit area, which means higher rates of fertilization.

b) Demand restricting factors

These include :

- . Restrictions on fertilizer use for environmental reasons.
- . Administrative measures designed to reduce agricultural surpluses in developed countries. The impact of such measures is likely to persist in the medium term even if the surpluses disappear.
- . Biotechnological advances leading to increased production per unit of fertilizer nutrient.
- . Improved efficiency of fertilizer use.
- . Increasingly more efficient use of organic manures (where they are available).

c) Some major uncertainties include :

- . The possible improvement of agricultural and fertilizer use efficiency in the USSR.

- . The resolution of the debt and economic problems of many developing countries. Some consider that the situation in the 1980's was an anomaly and, if they are right, increased incomes in developing countries could lead to a sharply increased demand for agricultural produce, and hence for fertilizers.
- . Climatic conditions. Good harvests in the major cereal producing regions could lead to a quick replenishment of currently depleted stocks. Conversely, poor harvests could result in a critical situation with sharp rises in food prices, and hence in fertilizer demand.

6.2. Supply

There are ample supplies in the world of the raw materials for the manufacture of fertilizers ; air, natural gas, phosphate rock, potash and sulphur. The present levels of international prices may not justify investment in new "grass-roots" facilities, but the expansion and modernization of plants on existing sites are feasible. Substantial investment will be required for the construction of new plants and the modernization of existing plants but if fertilizer prices ensure an adequate return on investment, capital is readily available, from either public and/or private sources. The main problem is that, as has happened in the past, and especially in view of the industry's financial problems in recent years, this investment may not be made in a rational and progressive manner.

7. SUMMARY

The world cereal supply situation remains precarious, with global cereal stocks at or below minimum safe levels for global food security. Growing conditions to date this season have been generally favourable but bad weather in some major producing regions could result in shortages on the world market. In the meantime, the world population is increasing at a rate of 1.7 % per annum. At present, cereal consumption per person is not increasing on a global basis but this will not be the case when the debt and economic problems of developing countries are, even partially, alleviated. Then, food production will have to increase at more than the rate of the 1.7 % represented by population growth.

During the next few years, we forecast that fertilizer consumption will increase at a rate of 1.5 % per annum. A priori, this is insufficient but the improved efficiency of fertilizer use, for example in the USSR, could help to bridge the gap.

The pattern of fertilizer consumption observed during the past 20 years, with the developing countries and the centrally planned countries increasing their share of total world fertilizer consumption, at the expense of the developed countries, is likely to change. In future, developing countries and China are likely to increase further their share at the expense of both the developed and of the so-called centrally planned countries.

The supply of fertilizers and their raw materials is expected to be more than sufficient to meet demand throughout the review period, i.e. up to 1995 - and probably beyond - although nitrogen could move closer to equilibrium if some of the ammonia projects are delayed. Despite the need for substantial investment in new or replacement production capacities and prices which do not justify investment in "grass roots" facilities (i.e. without an existing infrastructure), there should be no crisis in fertilizer supplies. It is important, however, that investment in new facilities should be made in a progressive and ordered manner. The regular assessments of the supply and demand situation by IFA and the FAO/UNIDO/World Bank/Industry Working Group on fertilizers indicate when a situation, such as a sudden surge in demand, apparently interesting from an investment point of view, is merely ephemeral. The assessments also point the

direction of the longer-term equilibrium. The long-term health of the industry depends on the ability of decision-takers to read the signals correctly.

It requires only a small surplus of supply to incite producers anxious to earn foreign exchange or to maintain cash-flow to cut prices and render rational investment impossible. This is largely a question of the quality of management and the health of the industry as a whole depends on this factor.

ACKNOWLEDGEMENTS

The contents of this document are to a large extent based on information provided by IFA members in response to questionnaires. The demand assessment was carried out by K.F. Isherwood of the IFA Secretariat. The supply/demand estimates were made by the FAO/UNIDO/World Bank/Industry Working Group on Fertilizers at their meeting in May 1990. The FAO's Global Information and Early Warning System on Food and Agriculture is acknowledged as a source of information for the agricultural situation.

Figure 1 : **CONSUMPTION - WORLD**
1966/67 to 1989/90

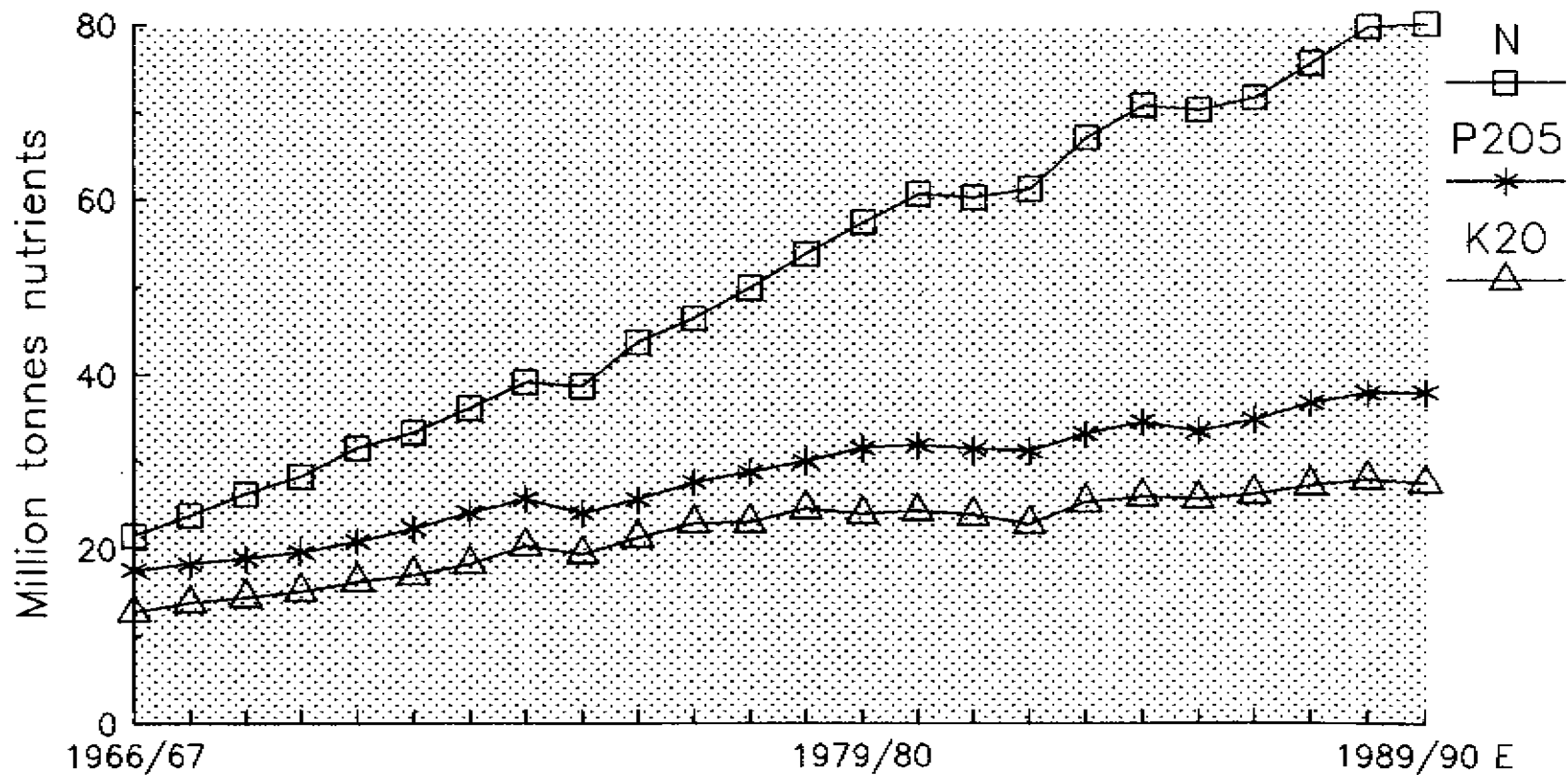


Figure 2

CONSUMPTION - DEVELOPED COUNTRIES

1966/67 to 1989/90

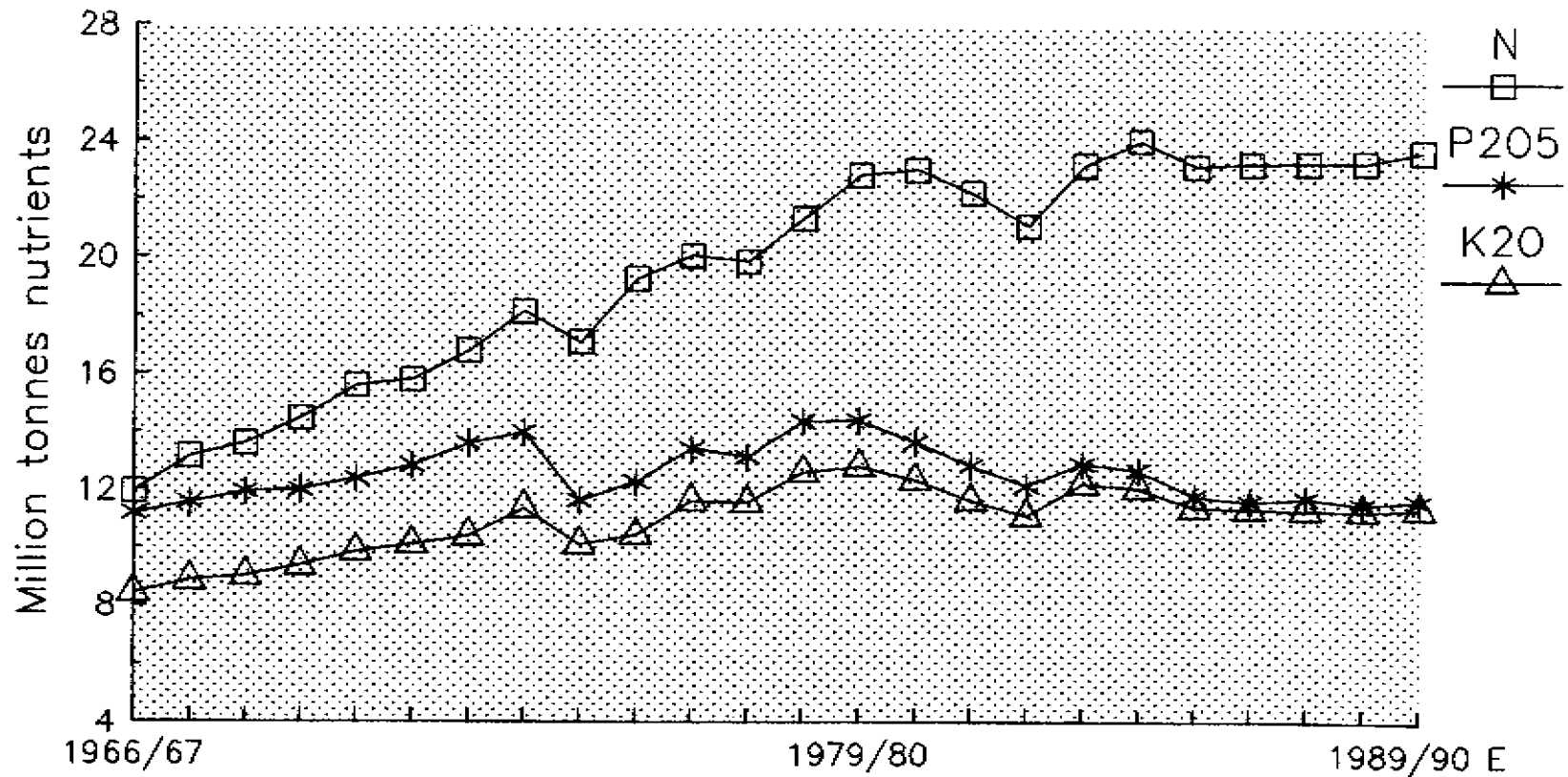


Figure 3

CONSUMPTION - DEVELOPING (exc. CHINA)

1966/67 to 1989/90

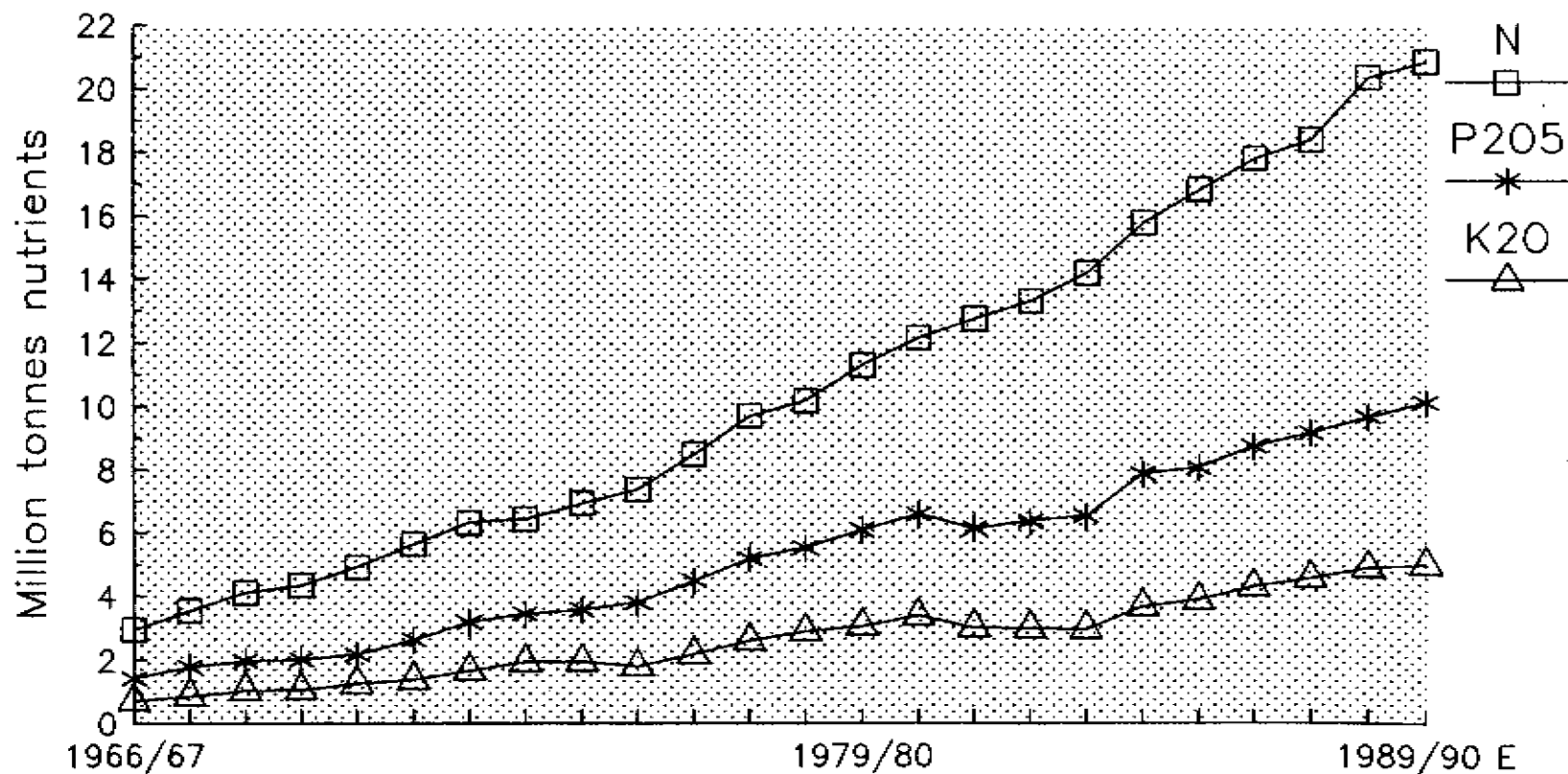


Figure 4

CONSUMPTION – CENT. PLANNED (inc. CHINA)

1966/67 to 1989/90

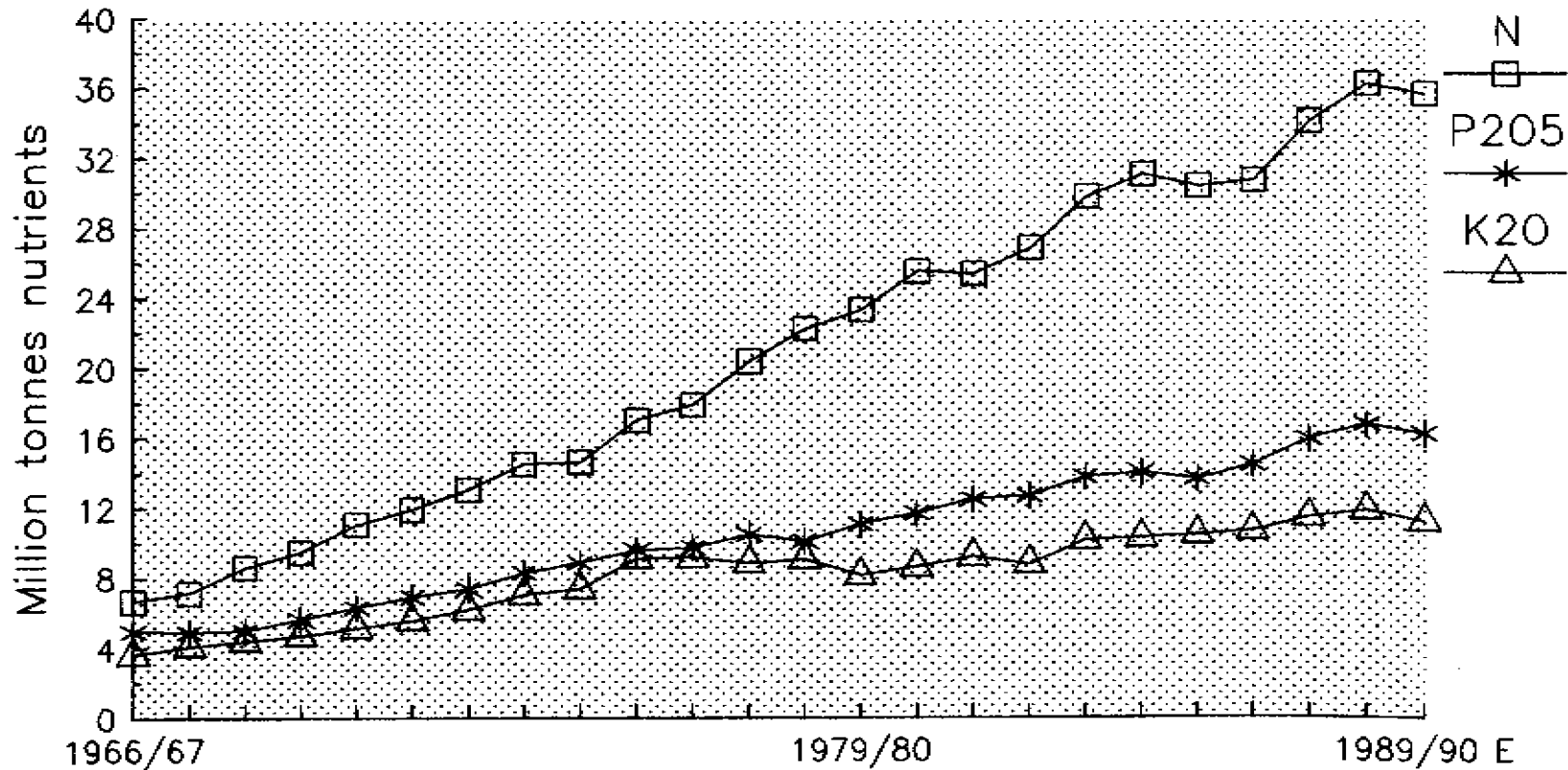


Figure 5

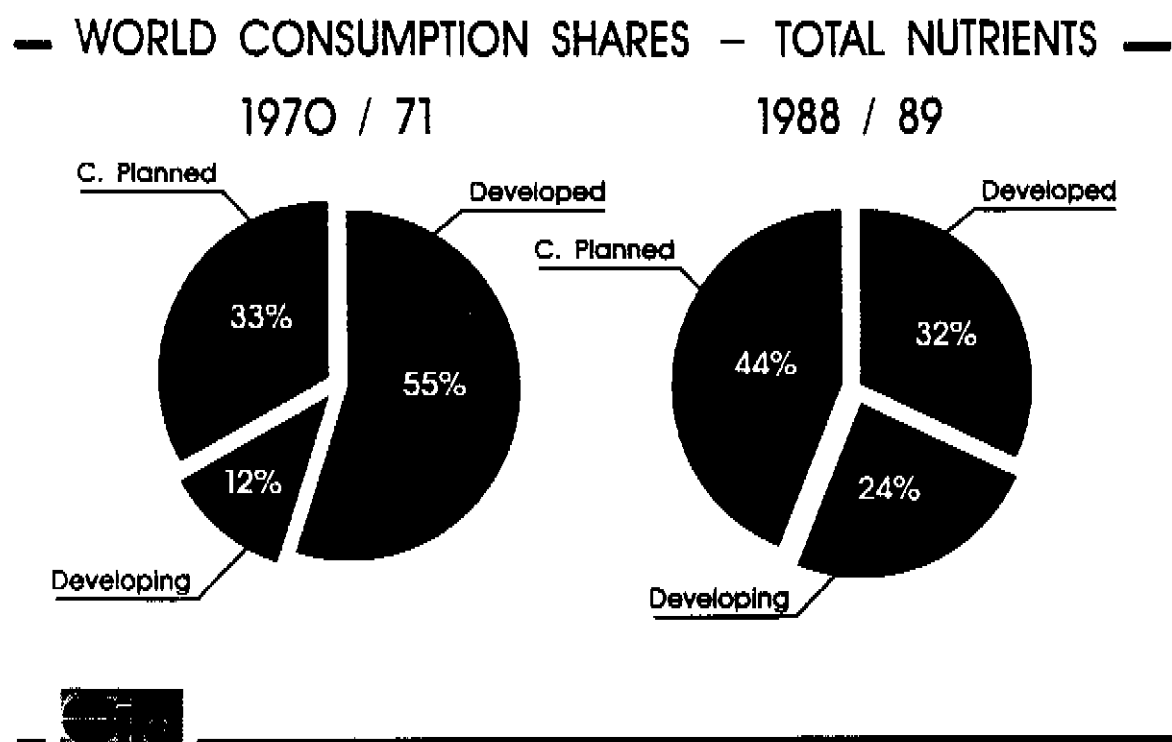
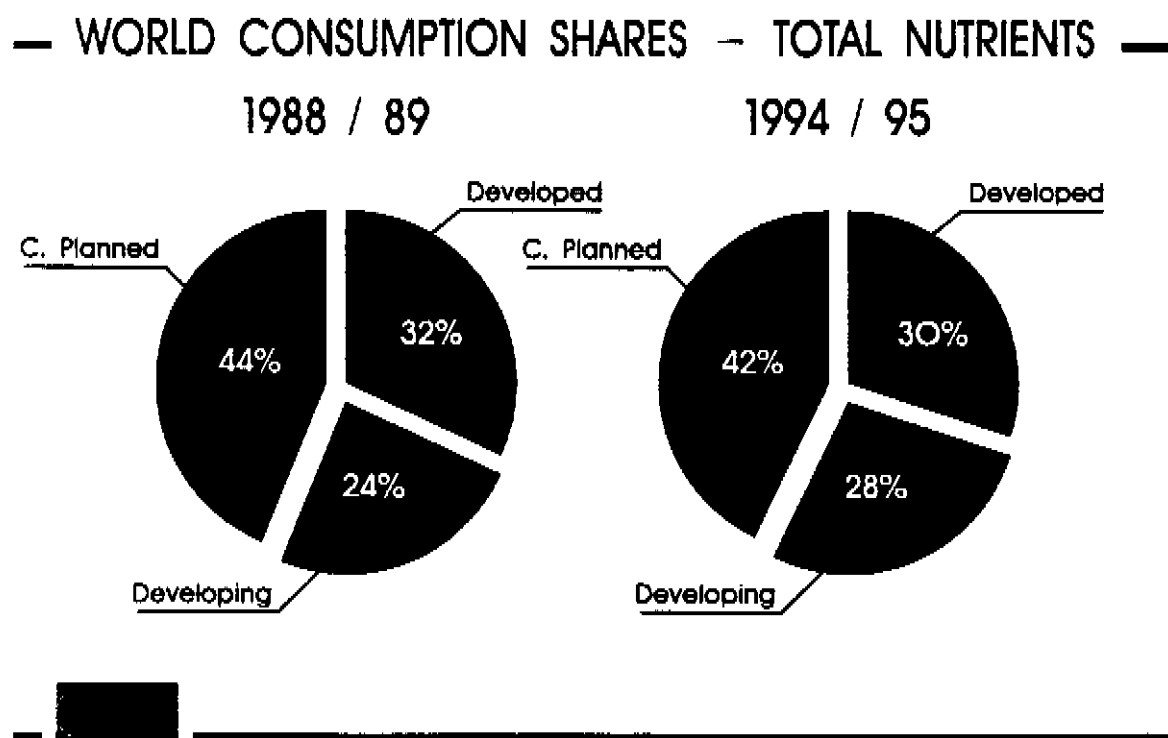


Figure 6



— DAP AND UREA PRICES (CONSTANT 1985 \$) —
1967 TO 1989

