

Food Security and Fertiliser - A Global Perspective

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The World, today, is facing many challenges, prominent among these are sustainable development, environmental degradation, and food security for growing population. The United Nations population projections indicate that World population will increase to 8.3 billion in 2025 and 10 billion in 2050 from the present level of 5.8 billion. Such unprecedented growth in population necessitate food production to be almost doubled by 2050. From 1984 to 1994 annual growth in World food grain production was only one per cent . The UN estimates indicate that almost 800 million people in developing countries today face chronic under nutrition and some 200 million children under the age of five suffer from protein and energy deficiencies. At present as many as 88 nations fall into the category of low income food deficit countries : 42 in sub-Saharan Africa, 19 in Asia and the pacific, 9 in Latin America and the Carribbean, 6 in North East/North Africa and 12 in Europe/common wealth of independent states.

The slowing pace of growth in agricultural output is being further complicated by decreasing per capita availability of arable land . Thus, the need to intensify agricultural production from the finite natural resources has assumed greater significance. In meeting this challenge, fertilisers have an important role for two reasons. First, they facilitate the adoption of yield- increasing technologies and thereby promote sustainable growth of food production on limited cultivable land. Second, they help to replenish nutrients removed by crops and therefore prevent soil degradation and preserve the resource base.

World cereal production:

World cereal production increased from 1804 million tonnes in 1984 to 1966 million tonnes in 1992 (Fig. 1). However, after that the food production has dropped and FAO's latest forecast for the year 1995 stands at 1892 million tonnes only.

The situation is not at all that favourable if we take as a yardstick of the cereal stocks available in the world. Indeed, cereal stocks declined from 456 million tonnes in 1986 to 321 million tonnes in 1993 (Fig.2). The later level represents about 18% of world cereal consumption. FAO considers that a range of 17 to 18% is the minimum necessary to safeguard world food security. Food grain prices are gaining new height, causing serious implications for low income food deficit countries. Cereal harvest for the year 1996-97 will be crucial for world food security. A larger increase in cereal production would be needed if stocks are to be replenished.

In the developing countries of South and South East Asia, Latin America and Africa the situation is much more critical. Their population is increasing very rapidly straining their capacity to produce enough food. In Africa, per capita food grain production has actually declined in the past 20 years. Countries that formerly exported food grain now must import them. The national economic growth rate of these countries is too slow to provide the resources to pay for the needed food. They must either be provided with food aid by their more fortunate neighbours or must dramatically increase their own capacity to produce food. The Asian and Pacific region contributes about 44 % of the world's food production against the population of 58%.

Availability of arable land:

The per person availability of land suitable for agriculture and fresh water is declining with the increase in population. In Europe, North Central America and Asia, where population pressures have been strong for years, most of the potentially

arable land is already under cultivation. However, only 17.2 % of the potentially arable land is cultivated in South America, 18 % in Africa and 10.7 % in Oceania. An additional area can be brought under plough in these regions. The per capita availability of arable land, however, will continue to decline fast and it is estimated that by the year 2000 it will be around 0.25 ha per person and will go further down to 0.20 ha per person by 2025 (Table-1).

Crop productivity levels:

Higher yield levels will continue to play important role in meeting the growing demand for food and non food crop production. World cereal productivity per hectare has increased from 2468 kg in 1983 to 2830 kg in 1994 registering an increase of 15 %. During this period yields increased in North & Central America, Asia, S. America and Africa. Whereas Europe, FSU, Oceania suffered serious set back during 1983-94 and it was not until the 1994 that 1983 levels were regained. Productivity of cereals in selected countries and world can be seen from Table-2. The global average yield of cereals per hectare in 1994 was 2830 kg and the yield levels of Netherlands, Belgium, France, U.K., Japan, Egypt, Korea Rep., Germany, USA, and Newzealand were higher than the global average. In the past one decade, a major increase in the yields of cereals have been recorded in Chile, Egypt, and S. Africa.

Rice and wheat are the major cereal crops, and their productivity in selected countries is presented Table-3. World average yield of rice has increased from 2.77 t/ha in 1980 to 3.65 t/ha in 1994. Productivity gains are noticed in almost all countries listed but USA, China made rapid stride where as it declined in FSU/Russia. In Australia, Egypt, Japan, USA, Morocco, Korea Rep., Spain, China and Italy, the rice yield is above the world average yield level. Other countries namely Russian fed., India, Bangladesh, South Africa etc. are below the world average. China and Japan have achieved very high productivity both before and after green revolution. Prior to 1950 rice yield in China was only 1.5 ton per ha which touched 5.9 t/ha in 1994.

World wheat productivity jumped from 1.9 t/ha in 1980 to 2.45 t/ha in 1994. The highest productivity of wheat is 8.0 t/ha in the Netherlands, followed by 7.2 t/ha in U.K, 6.9 t/ha in Belgium, 6.7 t/ha in Germany and France, 4.2 to 5.2 t/ha in Mexico, Egypt and Newzealand. Wheat yield of 8 t/ha obtained in Netherlands is nearly three and half times of the world average. In the past fifteen years both, China and India increased wheat productivity significantly, however, productivity of wheat decreased in Russia/FSU.

FERTILISER CONSUMPTION PATTERN:

Global fertiliser use increased with, however, at a much slower rate in the 1980's and 90's than in the 70's and the 60's . Between 1930 and 1960, World nitrogen, Phosphate and potash consumption increased almost parallel. From 1960 onwards the consumption of nitrogen increased faster than that of phosphate and potash though, the consumption of all three nutrients grew substantially. There was a fall in fertiliser consumption during 1974-75 due to price hike as a result of oil crisis, but the growth of nitrogen consumption quickly resumed. The consumption of phosphate and potash fertilisers also recovered but to a lesser pace. There was a further pause in world fertiliser consumption in 1981 following second oil crisis . In absolute terms total global fertiliser consumption of three main nutrients (NPK) increased from 46.1 million tonnes in 1965 to 145.6 million tonnes in 1988 with 5.13 % compound growth rate (Fig-3). Between 1988 and 1993 World fertiliser consumption in terms of total nutrients fell by almost 20 million tonnes with a compound growth rate of -3.69 %. During 1995, the fertiliser consumption was 127.9 million tonnes. Most of the decrease in fertiliser use was in the E. Europe and FSU. Changes introduced under economic and political reforms led to the collapse of the fertiliser markets in these regions. Fertiliser use also decreased steadily in the North America, W.Europe & Oceania but increased significantly in the Asia, Latin America and Africa. In addition to economic and political reforms, structural adjustment programmes, foreign exchange shortages, depressed crop prices, environmental

concerns and agronomic factors like integrated nutrient management etc. also contributed to recent decrease in fertiliser use to some extent.

Per hectare consumption of fertiliser:

The nutrients used per hectare of cropped land is good index of crop productivity. The fertiliser consumption per unit of land has to increase, particularly in developing countries where the productivity are still low. The average nutrient use per hectare of arable land and permanent crops in selected countries of the world are presented in Table-4. The global average consumption of nutrient use through fertilisers increased from 24.9 kg/ha in 1963 to 99.5 kg/ha in 1989. There after, 1989 it decreased continuously to a level of 83.4 kg /ha in 1993. Netherlands, Japan, Belgium, Egypt, and UK had the consumption between 300-600 kg nutrients/ha while USA, China, France, Germany, Italy and Pakistan are the countries where the per hectare consumption of fertiliser is above the world average and is between 100-300 kg. All other countries namely Russia, Morocco, Australia, Phillipines, South Africa, Mexico, India etc. are below the world average level. There are large variations in fertiliser use in different regions of the world. In many countries particularly the developing ones, fertiliser use in kg per hectare increased in past decade, where as decline has also been observed in countries like Russia, France, Netherland, Germany and Belgium etc. In the case of India per hectare consumption is much lower than the global average consumption, inspite of the country being the third largest producer and consumer of fertilisers in the world. Presently India's fertiliser consumption per hectare is 75 kg, against the world average of 84 kg.

Ratio N:P:K Consumption:.

Data on consumption ratio of major plant nutrients (N:P:K) for the last 34 years (1961-95) reveal a widening trend in the N:P:K consumption ratio. In 1995, the ratio of N:P:K was 3.8:1.5:1 which is quite wider than the consumption ratio achieved in any of the previous year (Table 5).

Continued imbalanced nutrient applications will have an adverse affect on soil fertility and crop productivity. Each year more and more nutrients are being removed from soils. Cultivation of high yielding varieties of crop and higher cropping intensity accentuate the problem of nutrient depletion , present indications are that even by 2000 global consumption ratio of NPK would remain unchanged which may leave a negative balance of nutrients in soil, particularly for phosphorus and potash.

The ratio of N:P:K consumption vary widely from region to region (Table 6). These depend to a considerable extent on fertiliser use, cropping pattern and the fertility status of the soil. From the point of balanced fertiliser use of NPK, Central Europe is at a comfortable position followed by North America, East Asia., W.Europe and FSU. The imbalance in consumption is particularly acute in Near East, Socialist Asia and South Asia. These are the areas where immediate corrective action needs to be taken to check fall levels of fertility and crop productivity and sustain agriculture.

Future Outlook:

Future fertiliser consumption:

It is expected that world fertiliser consumption by 2000 will be about 145.6 million tonnes, with a growth rate 2.4 per cent per annum (Table-7). The highest growth rate of 6.4 per cent per annum is anticipated for Central Europe, followed by a average rate of growth of 4.7 per cent per annum for Near East, and between 3 to 4 per cent per annum for Latin America, Oceania, Africa, South Asia, Socialist Asia and FSU, how ever, a decline in growth is anticipated in Western Europe.

Supply and Demand estimates:-

World nitrogen supply is expected to increase by about 11.2% by the year 2000. Additional capacity is predicted in North America, Asia and Middle East. If all the new plants come into operation as planned, there will be a surplus of nitrogen to

the extent of 3.98 million ton N by 2000 (Table-8). World nitrogen demand is predicted to increase at an average rate of about 1.6 per cent per annum only over the next five years. It is presumed that W.Europe, Asia, Africa and Oceania regions will be in deficit throughout 1996-2000 and will depend on Central Europe, Middle East and FSU countries to meet their demands. The Calculated nitrogen supply surplus will be 4.3 % of the supply in the year 2000.

A substantial proportion of the phosphatic fertilisers consists of products derived from phosphoric acid. Almost entire increase in phosphate supply is in the form of phosphoric acid based products. The world supply for P₂O₅ by 2000 is expected to increase by 3.7 per cent. The global consumption of phosphate fertilisers is expected to grow at an average rate of 2.3 per cent per annum during the period 1996-2000. The calculated supply surplus will be only 0.5 % of the supply in the year 2000.

The world available supply of potash is expected to rise by 3.4 per cent, largely due to increases in Jordan and Latin America. It is expected that potential supply will continue to exceed demand throughout the period but the surplus will decline as consumption grows faster than capacity. World potash demand is forecasted to increase by about 2 per cent per annum on average through 2000. The IFA estimates show the persistence of a supply surplus which would reach 4.5 million ton K₂O, i.e. 16 per cent of the supply capability in the year 2000.

Conclusion:

World food production in 1990 totalled around 4.6 billion tonnes. If per capita food intake remains constant, the predicted increase in population to 8.3 billion people by 2025 would require an additional 2.6 billion tonnes. However, if the entire population were to be sure of a high quality diet and the pockets of malnutrition eliminated, Global annual food production will have to increase by more than 75% over the next 30 years. The FAO estimates that only 24 % of future food needs can come from bringing new land into cultivation, while the remainder will have to be met by improving the productivity of existing farm lands.

A key factor in achieving this predicted production will be a marked increase in fertiliser consumption from 123.1 million tonnes in 1994 to 145.6 million tonnes by 2000. As regards the fertiliser supply is concerned, it would be sufficient to meet the demand during the next five years.
