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The Human Food Chain

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THE WORLD FOOD SITUATION - GLUT AND STARVATION

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My task this morning is to paint a broad picture of the world food situation in all its complexity. There is no need to convince this, or indeed any audience of the importance of food. Striving for food sufficiency is the primary urge of all humans and of all the species of creation. Certainly "man does not live by bread alone", but it is the energy generated by foodwhich makes possible all his other activities. With insufficient "bread" the individual is unable to live a life of human dignity or develop his or her higher qualities, yet the deprivations of under- or mal-nourishment strike millions of people in the world of today, bringing misery, illness and lethargy and denying fulness of life.

The world food situation has changed greatly during the last decade. In 1977 many were questioning whether the world could increase food production in time to nourish the six billion or more people who are expected to inhabit the planet at the beginning of the next century. Today we are faced with the great cereal surpluses of the North American continent and the butter mountains and lakes of milk and wine of Europe.

Hunger and malnutrition in the South contrast starkly with the overfilled bellies of the North. It is amply clear that production of sufficient food in the world is not, by itself the answer to the problem.

The world public is more aware of these anomalies than ever before. The famines in Ethiopia and the Sahel, given global visibility by the media evoked a generous response in the provision of emergency food. Droughts in these regions are periodic and inevitable, but we must conclude that famines are to a large extent man made. Early warning signs of serious drought in the Sahel went largely unheeded and it was not until the tragedy of famine was dramatized on the television screens that the world conscience was aroused and response was generated. Many factors operate in the transition from drought to famine amongst which lack of infrastructure and inadequate local organization are obvious, but still more important are social conditions, neglect of rural needs and inequity of income distribution and in many of the recent cases wars
and civil strife have greatly aggravated the situation.

The key issue today is how to resolve the dilemma of the coexistence of the overproduction of food with the persistence of hunger. The simplicist view is that continuing and augmenting food aid and the provision of cheap cereals would lessen both hunger and the surplus. This approach, as we shall see later could greatly worsen the situation, although emergency food aid will certainly be frequently necessary. The abolition of hunger is essentially a question of politics, economics and logistics to which technological factors are only marginally relevant Technological advances can greatly increase the quantity, quality and variety of food, but they cannot ensure that it reaches the hungry. For decades at least there has been sufficient food in the world to feed everyone, but with millions lacking the minimum nutritional requirements for a reasonable existence and this disparity shows no signs of shrinking as world food production grows. The estimates of the Food and Agricultural Organization indic-

ate that by the year 2000 the proportion of undernourished people should decrease but that, because of population growth in some of the most severely affected countries, the actual number of malnourished will increse.

Even in India which has moved dramatically from shortage to surplus, there is little evidence of major improvement in meeting the basic needs of the masses. The hungry are the poor who have little means of buying the food which exists. The real problem then, is the abolition of world poverty and the distrbution of wealth. This is a fundamental issue in which food policy is but an element.

THE COMPLEX OF PROBLEMS

All the contemporary problems of the world are interacting in what the Club of Rome terms the World Problematique, that untidy tangle of issues, the relatioons between which are but dimly understood. The food situation is particularly influenced by energy considrations. One has only to consider the impact of the sudden rise of petroleum prices in the 1970s, on oil imports and fertilizer cost in the Third World. A critical aspect of the food/energy relationship is the fuelwood crisis, especially in Africa where 90% of the wood is used for the cooking of food and other energy purposes and where the number of hours spent by women going far afield to collect wood has increased greatly, while in the cities its cost is often greater than the price of the food to be cooked. The solution clearly lies in afforestation, but in many countries the wood replenishment rate is only about 10% that of depletion. Amongst other not strictly agricultural factors which influence food production are, high priority given by many countries to industrialization, inefficient infrastructure and lack of transportation and communication, archaic land tenure systems, the vicissitudes of climate, toorapid population growth with the threat of numbers shooting ahead of agricultural improvement, lack of credit

facilities for small farmers, insufficient understanding of nutritional requirements and their influence on health. Added to these are the distortions due to farm subsidies, price support and agricultural policies in the United States and Europe.

The world food situation has thus to be seen in relationship with many other fields, and the solution of itsproblems demands advice and research from many disciplines both of the natural and the social sciences.

SOME GENERAL CONSIDERATIONS

The success of agricultural production since the end of World War II has been phenomenal. In 1950 world grain production was 623 million tons and this increased to about 1.5 billion tons by 1983, an astonishing addition of about 900 million tons per annum, providing a comfortable margin over the population increase of the period. Especially important has been the hybridization of maize and the dwarfing of wheat and rice varieties which have been at the heart of the Green Revolution. In some countries also, there has been an impressive increase in areas under irrigation. Before 1950 increase in food output resulted mainly from the extension of land under cultivation, but after that date new,fertile lands became scarce, while at the same time, cheap chemical fertilizers became generally available. Agriculture has become increasingly energy-intensive. It takes approximately a ton of oil to produce a ton of nitrogenous fertilizer and petroleum is also required for the manufacture of pesticides and weed-killers as well as for tillage and irrigation. During the period 1950-1983, the average consumption of fertilizers per inhabitant of the planet rose from 5Kg to 25Kg while, at the same time the area per capita of harvested cereals dropped from 0.24 to 0.15 hectares. Thus, in a crude sense, the great increase in world food production represents the conversion of oil to edible cereals via a more efficient photosynthesis and also by a partial

replacement of land by oil.

The 1973 jump in oil prices had,not surprisingly, a considerable impact on food production, especially in the developing countries where purchasès of petroleum products bit deeply into their hard currency earnings. On the supply side, rising oil prices considerably raised costs of production, while demand was being reduced by the general economic slowdown. However, high oil cost has only been one of the factors inhibiting the growth of food in many countries. The loss of topsoil through erosion is widespread and threatening to the security of future food supplies. Scarcity of water is also beginning to influence food prospects. The post-war surge in irrigation has slowed down as dam buildingprojects become less favourable and more costly, as reservoirs become silted up, water tables fall, and supplies become saline. In the Third World also indebtedness and economic difficulties, local wars and increased imports of armaments have resulted in a heavy underinvestment in agriculture which is too seldom seen by the politicians as a priority sector.

A particular feature of the situation is the dominance of the world grain trade by North America. The United States and Canada together account for some 70% of exported grain, which gives the region a strong strategic role in the world food economy. This dominance relates not only to cereals for human consumption, but also to feed grains and soya beans. For years, the produce of North America has made up for deficits in the Soviet Union and has been generous in the provision of food½aid to countries facing famine, at times amounting to 25% of the American hatvest. A new feature is the emergence of the European Community as a major and rapidly increasing exporter of cereals, with exports expected to rise to 25 million tons by the nineties.

There has been an extraordinary growth in grain ship-

ments from the developed to the developing countries. The latter have increased their share of the total world imports of cereals from a 1961-63 average of 36% to a 1981-83 average of 43%. This represents an absolute increase of 315%.

The dependence of the Third World and to some extent also, of the Soviet Union on imported food, carries many risks. Firstly, the dominant exporters, USA and Canada belong to a single climatic zone and in a poor year with low reserves, the exportable surplus could prove insufficient, while a quite small fluctuation in the exportable grain surplus could disturb grain prices throughout the world. Serious too could be the use of food dominance as a political weapon. One has only to cite the embargo of exports to the Soviet Union or the denying of food aid to Third World countries whose policies were deemed to be incompatible with United States interests. It is to be noted also, although this may be a distant shadow, that there is a current debate in the United States concerning the need to conserve the resource base of the nation for its own purposes by ceasing to "mine" the topsoil and the cultivation of unsuitable lands to meet the ever growing demands for food from the world outside. Indeed it would appear wise to accept policies favouring long term global interest which would reduce the pressure on American soils in order to ensure sustained fertility and hence export availability in the future. For these and other reasons it would be advisable that the main thrust for the future should be towards the production of as much food as possible as close as possible to where it will be consumed. Paradoxically this does not necessarily run counter to the American interest in food exportation, because the growth of markets in the importing countries is not just a function of their overall growth rate, but also to the extent to which lower income people who spend much of their additional income on food, share in the general growth.

DIFFERENT REGIONAL SITUATIONS

We turn now to some regional situations. The changed situation in Asia is remarkably encouraging. Both total food production and yield growth have increased considerably, reflecting the success of modern high yield varieties and the systems which made them possible. These systems have now been institutionsalized and further growth is to be expected as existing success encourages territorial expansion, investment in irrigation increases and more double cropping is possible. It must be admitted, however, that there are criticisms regarding the social benefits of the Green Revolution, in that it favours the large farmers in contrast to smallhoders and has thus contributed little directly to solve the poverty problem.

Prospects for the year 2000 estimate a net grain surplus for Asia of 5o million tons. In Latin America increased demand is expected, more or less to keep upwith increased production, leaving a gap of some 20 million tons.

The main deficit areas will be the Middle East and Africa. In the Middle East-North African region a net deficit of about 60 million tons is to be expected at the end of the century.The situation in this region is difficult as a consequence of rapid population increase and the high proportion of arid lands difficult to render more productive. With continuing high oil revenues,the region as a whole should get by with imports, but much depends on the maintainance of political and economic harmony. Particularly difficult will be the position of Egypt with its rapidly growing population, difficulties of extending agricultural production and of increasing its foreign earnings. The real danger area is Africa South of the Sahara, to which we shall devote more detailed attention.

FOOD FOR AFRICA

The recent conditions of drought and famine naturally focussed public attention on the need for emergency relief. It is difficult to maintain concern and a flow of generosity when the emergency has passed, which makes it urgent to drive home that it may be more important to take measures to prevent recurrence than to relieve a single tragic situation. Periodic drought will strike the Sahel region and that of the desert areas of Southern Africa, possibly even on an increasing scale as the struggle for survival on each occasion tends to erode the resource base. Steps must be taken to ensure that future droughts do not develop into famines. Amongst these would be the creation of coherent early warning systems to enable governments and foreign agencies to take action before a crisis situation is reached. More fundamental is the need for improvement in African agriculture in general, with great attention to its distribution and storage.

African conditions for agricultural improvement are inherently more intractable than those of Asia. Firstly, political circumstances are more difficult with black Africa balkanized into so many states with unsatisfactory boundaries, often with little respect for tribal cohesion and with frequent conflicts, wars and coupd d'état.

A further difficulty, derived from the colonial period is a general lack of infrastructure. In so many cases, road and rail communication is from inland capitals and mining centres to the coast, makrng country to country communication very difficult, During the recent famines there was much food in some other African countries, but it could not be transported. Then again most national economic policies, dominated by the articulate towns-people and with little say for the masses of the peasants, have given little priority to food production other than for export crops which provide foreign curency.

Conditions for agricultural improvement are much less propitious than in Asia with its young soils. Africa is characterized by old, laterised soils, for the most part fragile and lacking in nutrients, a matter which has often been overlooked by those seeking to transplant European or American agricultural methods to Africa. A further obstacle is that there is much less irrigation than in Asia and that the prospects for adequate water control are remote.

The challenges faced in increasing Africa's food production are thus, formidable, but there is no caused for despair. Informed opinion is convinced that Africa can approach food self-sufficiency, but only if a number of tough decisions are taken which include granting it a high priority backed by calculated political support.

It appears that the productivity of African agricultural labour is lower than that of Asia and is constrained by an extreme seasonality of labour demand. Much research is required as how best to raise this productivity, both at the human level, by upgrading the quality of labour and also by simple mechanization and technological innovation, by changed crop/labour profiles, by the provision of low interest capital and the introduction of pricing and market reforms to provide incentives.

A particular feature of African agriculture is the extent to which it depends on the work of women. It is estimated that some 65% of the agricultural work of the continent is performed by women and great benefits would accrue from an improvement of their conditions of life, better educational facilities and the opening up of credit systems specially designed to make possible the enterprise of African women.

The need for technological innovation in African agriculture is evident, but much more difficult than in the case of Asia with its more amenable soils. Any simple copying of the classical Green Revolution methods is unlikely to succeed and much attention will have to be

given to the selection of these areas where a food production breakthrough is most likely to be achieved. The need for this is well appreciated, but the technical criteria for choice are not well developed and there will be many difficult political problems in the adoption of what will appear as specially favoured areas

The need to intensify research on all aspects of agriculture in Africa. During the colonial period research was almost entirely centred on plantation crops for export to the metropolitan markets, such as palm oil and coffee. while in the early post-colonial years the research community was obsessed by European and North American agricultural practice, with relatively little attention being paid to indigenous African plants which form the staple diet of at least the rural communities. This situation has improved greatly in recent years through the work of the network of specialist institutes within the Consultative Group on International Agricultural Research (CGIAR) but much remains to be done.

The very large increase in food imports has already had a considerable impact on tastes and habits. Urban consumers, recipients of most of the imported food, have acquired a taste for wheat and rice and are increasingly uninterested in the traditional foods. In some regions and especially those which have suffered famine and have received massive food aid are tending in the same direction This, together with the low price of imported grains constitutes a strong disincentive to improved production by the local farmers. The changing food habits of the cities, combined with increased use of kerosene for cooking in face of fuelwood cost and scarcity is making the large cities of Africa extremely vulnerable to disruption of supply or economic collapse. As Lester Brown puts it,
"they are living from ship to mouth". Continuing and generalized reliance on imported food staples, while it might be attractive to the urban and some other populations ~~could lead to collapse ofthe rural economy and dependence~~

could lead to the collapse of the rural economy and a dependence on the food-exporting countries from which it would be very difficult to disengage - in fact a veritable food-based colonialism. Thus the political argument for the encouragmentand diversification of local agriculture is very strong, but such long-term considerations are seldom aired.

The fragility and low nutrient content of African soils, while obviously calling for greater use of fertilizers, demand a much deeper understanding of the various equilibria if sustainability is to be established and higher yields achieved. Research has to be reorientated, not only towards the breeding of higher yielding and more traditional varieties of traditional crops such as sorghum, millet and other dryland crops, as well as roots and tubers, but also towards understanding of the various ecological factors in relation to socio-economic realities.

This stress on he need for introduction of new technologies and for higher labour productivity is in no way a call for large scale farming. The need to secure food security in rural areas and especially those vulnerable t drought is paramount and this is only likely to be achieved by improving the means at the disposal of the small farmer, including better education, the provis- ion of advice, access to low interest credit schemes, improved infrastructure and substantial improvements in the msrket mechan- isms which, in Africa, whittle away so muchof the farmer's profits.

It is too often assumed that peasant farming is inherently inefficient. This is an uninformed judgement. Agreed, small farmers are not marked by their eagerness to adopt new technologies. In the struggle for survival they must necessarily be cautious. A new, high-yielding strain of maize requires sufficient water, fertilizers and pesticides; the farmer knows well that if any of these is lacking, he may well get a lower yield than from the traditional varieties he knows so well. If he is to accept a new innovation he musthave the necessary credit and knowledge to ensure that all the elements for success are there. Peasant farmers in

the Sahel, for instance, have had generations of experience to survive the periodic droughts which have plagued the region for centuries. There is need to build on this experience and there seems to be no reason why it should not assimilate new and appropriate innovation. Indeed it is necessary to do so, as the land has to support many more people than formerly.

A further inhibition of innovation comes from the difficulty of the market to recognize and make price adjustment for improvements of quality. For example this has made it hard to introduce the new high-lysine varieties of maize which, by substantially increasing protein intake, could greatly increase the nutrition of many communities.

Up till now governments have usually left the small farmers to their own devices, concentrating on the more politically influential urban sector or on large scale cash-crop ventures. The immediate need is to make more resources available to small scale farming and to provide extension and other advisory services through which improvements can be introduced.

The Club of Rome has recently published a report, "The Barefoot Revolution" which describes, from a field study in 19 countres in Asia, latin America and Africa, how groups of villagers and small farmers are forming spontaneously in attempts to improve their life conditions. Some of these "NGOs of the South" as they are proud to call themsel- ves concentrate on agricultural improvement or irrigat- ion, others on education and training or on health and hygeine or on a mixture of all of these. Success is mixed, of course, but it is estimated that this grass-roots movement which is spreading and gaining some coherence is already beginning to touch the lives of some 100 million people. In many instances there is a harmonious cooperation between the new NGOs of the South and many of the NGOs of Europe and North America already well known for their humanitarian and emergency aid operations. Such bodies are in a much better position than are governments to adopt an effective

and participative approach to technical improvement introduction at the grass-rots level. It is strongly to be hoped that governments both in developed and in Third World countries will lend support to this promising new path to development, despite the fact that it is inherently undramatic and has little obvious political appeal.

POPULATION GROWTH

Demographic disparities between countries and too rapid population increasein some of the poorest nations constitute one of the most dangerous and intractable problems of the contemporary world. Although recent years have seen some diminution of fertility rates in a number of developing countries, high rates of demographic increase will continue well into the next century. By the year 2000, the world population will have crossed the 6 billion threshold, as compared with 1.8 billion at the beginning of this century. In terms of sheer numbers, the population willbe growing faster than it is today, with 100 million extra people added each year as compared with 75 million in 1975. The vast majority of the new inhabitants will be born in the already overpopulated and often hungry countries of the Third World. Most of the developed countries will have stabilised their populations by the end of the century or be increasing only slowly. Indeed the total <u>increase</u> in the combined populations of North America, Europe and the Soviet Union will by 2000 be less than the then populations of Nigeria or Bangladesh.

Denographic growth will thus be very different in the various regions of the world. In Europe, the increase between now and the end of the century is estimated to be about 7%, as compared with 17-18% in North America and the Soviet Union (where it will take place mainly in the Asian republics). It is expected to be 24% in East Asia, 55% in South-East Asia, 65% in Latin America and 75% in Africa.

The consequences of rapid popuation growth are numerous, with its influence on food production needs the most obvious.

while it will produce a greatly increased workforce, those countries where demographic growth is greatest, include many already suffering from acute unemployment and under-employment, so that the task of creating enough new jobs will be enormous. Other burdens arising from the increased numbers include the provision of housing and a vast increase in educational expenditure. Political problems will also arise due to population pressures generating extensive waves of migration.

Once again Africa is the crisis centre of the world population explosion. Nigeria, for example is expected to have 169 million inhabitants by the year 2000 with unthinkably high levels thereafter, before the population levels off in the middle of the next century. Of course population extrapolations are notoriously unreliable and external forces such as wars or devastating epedemics of diseases such as AIDS could greatly alter the projections, not necessarily for the better. The immediate concern is that population growth is outstripping food production. In the years preceeding the recent drought, food production in Africa eas increasing by about 1.6% per annum while population was growing at about 3.1% per annum. In those countries where food shortages are now the worst, production percapita has fallen on the average by 2% perannum over the last decade. Malnutrition and the diseases which accompany it,is now the condition of 100 million individuals. There is an obvious need for the consequences of population trends to be taken seriously by governments. This is a matter which has for long been avoided, but it appears at last to be on the agenda. Countries would be well advised also, to undertake studies of the carrying capacity which could be supported at whatever livivng standard they might hope to achieve. That is to consider the relationship between population, their resource potential and environment. Only with such information can development plans be realistic.

SOME LONG TERM CONSIDERATIONS

Despite the persistence of a number of world trends, experience shows that the food situation is subject to unexpected changes. Thus the balance between the demand for cereal imports and the supply of exports has been unpredictable. During the sixties there was widespread doubt as to whether the ever increasing demand for imports could be met, particularly in Asia. There were crises of very low cereal stocks inthe mid sixties and then again in the mid seventies. Today, only a decade later, concern is exactly the opposite with rapidly growing developed country surpluses leading to a drive to find adequate export markets. It is therefore important to raise the question as to whether the present large food production can be sustained as well as to attempt to forsee the consequences of continuingly increasing surpluses.

In the trends and estimates already quoted, there is the implicit assumption of a constant environment, physically and politically, with no major event external to the food situation, such as nuclear war, disturbing the projection curves. It is, of course, impossible to allow for the ststistically improbable, but, nevertheless important to look at trends in very different fields which may impact on food supply or demand. Here we shall mention but a few

The first, and most obviously related to agriculture, is degradation and erosion of the soil. Soil erosion is a natural process, but when its rate exceeds that of new soil formation, there is a decline in the productivity of the land. It is estimated that this is the situation in some 35% of the world's cropland. This phenmenonis very marked in the breadbasket of North America where enormous amounts of topsoil with their nutrients are constantly flushed away by the rivers.

We shall not labour further the African tagedy, where the advance of the desert both in the North and the South,

assisted by the cropping of unsuitable land in emergency, is a growing menace. The situation is difficult also in some parts of Asia, notably on the slopes of the Himalayas where population pressure has denuded the trees for fire-wood, causing brutal erosion and the silting of rivers hundreds of miles downstream with flooding consequences. Another aspect of soil deterioration has been the clearing of large areas of tropical forest to make way for agriculture. This has often proved a failure because, paradoxically,the most luxurient forests seem to have arisen on nutrient-poor land.so that sfter a few years of good crops on he cleared land, yery low productivity persists.

A second, long-term uncertainty is the possibility of a fundamental change in the patterns of the world climate. It has been recognized for some decades now that there could be a significant warming up of the earth's surface through the so-called "greenhouse effect", but this has been a matter of great controversy amongst the climatologists. It now appears that a near-consensus has been reached that the dangeris real, as expressed in the 1985 Villach Declaration of the International Council of Scientific Unions. This effect arises from a decrease in the amount of heat escaping from the earth's surface, due to an increase in the concentration of carbon dioxide in the armosphere due to the combustion of fossil fuels enhanced by the accumulation of other gases such as methane. It is suggested that a doubling of the CO_2 concentration in the atmosphere,which may be reached in about forty years time, will increase the average surface temperature by between 1.5 and 4.5°C. with a much greater effect at high latitudes than at the equator. This would fundamentally alter the thermal gradients of the planet and cause very great, but as yet unpredictable changes in climate throughout the world, completely changing the patterns of food production. It would also cause a considerable rise in the level of the sea. The effect would be virtually irreversible. If the burning of oil and coal were to be

stopped when the warming became acute,it is calculated that it would take some 900 years for thepresent carbon dioxide levels to be reestablished.

While there are tremendous uncertainties in this scenario, it must be taken seriouslyy, with constant monitoring of atmospheric CO_2 and other critical gases. It iis quite unrealistic to expect governments with their short time horizons to prohibit the burning of oil and coal with all the economic disruption which this would bring, even were the reality of the phenomenon more certain but much useful preparatory work copuld be started to buffer the effect of temperature rise, through both conventional and genetically engineered plant breeding so as to have a much wider range of potential crops to meet radically changed climates.

Perhaps the greatest long-term uncertainty for food production lies in the question of energy and particularly oil availability and cost after the turn of the century. We have alreadystressed the intimate relationship between food and energy. Food with its calorie content is the most fundamental of all the energy sources available to humanity and is, of course, stored solar energy. The agricultural system is thus a sub-system within the total energy system and an element of the long-term energy problem. At present most national and international considerations of energy are concerned with the present and the near future, such as oil price fluctuations and the dangers inherent in nuclear power generation. Long-term aspects are given insufficient attention.For instance, the recent lowering of oil prices had an immediate effect in diminishing the resources to support research and development of alternative energy sources, yet it would take upwards of 40 years to establish a new world energy system on a significant scale.

Oil is an unrenewable resource and we shall have burnt up this accumulation of the stored solar energy

of millions of years through two short centuries. In a number of major oil producing areas,including those of the United States, the time isnot far off when the energy requiredfor petroleum exploration and recovery will be as great as the energy content of the new product. On the other hand, Saudi Arabia's reserves may last for nearly a century at the present rate of extraction. The present glut of oil is real and maylast for some years, but by the mid 1990s the world may well be witnessing a race between efforts to develop alternatives and the steady depletion of the world oil reserves. Measures of increased efficiency and conservation in the industrialized countries can make great savings, but, at the same time the demand for oil by Third World countries is expected to rise by 50% between 1980 and 1995. Th use of coal reserves which are still very highis often proposed as the alternative, but the greenhouse effect and acid rain may well dampen this prospect.

The impact of high energy cost and availability in food production is direct and important. Agriculture in the developed countrieswhich are in surplus is highly energy intensive and one must question whether they will be able to maintain their production levels as energy costs rise with scarcity. It is exceedingly important therefore that a beginning be made to consider alternative systems. The upgrading of the productivity of labour-intensive agriculture should be encouraged and followed closely and much research is required to reduce the energy content of Northern agriculture, e.g.by the genetic engineering of plants and animals with higher conversion efficiency and by making possible the fixation of nitrogen by non-leguminous plants.

We come now to the question of the impact ob biotechnology on food production. Ever since the unravelling of the genetic code and the first exeriments on gene manipulation the new biology has seemed to offer great promise for food production and medicine, but progress has been

slow, mainly because of widespread doubts about the ethical desirability of genetic engineering. However much research and development has been accomplished in the meantime, both by small specialized laboratories and by a number of the large pharmaceutical and chemicalmultinationals and it is expected that the first of a new generation of biotechnology products will be introduced to European farms next year. One of these,a growth hormone produced by gene-splicing,claims to increase milk yields by 15-20% without extra feed intake The influence of the new biotechnology is unlikely to be felt before the mid 1990s. It could eventually, greatly help many developing countries to increase their food production,but this could be long delayed. Experience shows that technological innovations generally help those countries which are already advanced and possess research competence and sophisticated infrastructures, thus tending to increase the disparities between the rich and the poor. The probability is therefore that the new biotechnology will initially increase considerably the efficiency of the agriculture and cattle raising
of the countries in surplus, adding to the milk lakes and inciting the food-surplus nations to swamp the Third World with huge quantities of farm exports, with the consequences we have already described. It should be noted also that these developments are tending towards a situation inwhich multinational corporations holding the rights to the new products, will gain a dominant position in the agricultural system of the food-exporting countries,
offering "packets of progress" which will include new high yielding and resistant cereals, the pesticides and fertilizers which they require and technical advice.

CONCLUSION

The success of science and technology in the production of food is enormous and, without doubt, it is technically possible to feed a world population many times greater than that of today. But in food production, as

other fields of major technological change, succes brings a new crop of problems, very different fromthose of the past. The co-existence of food surplus and hunger is no new phenomenon; it has always existed. Technology has magnified it and the media have made it visible to an extent to which it can no longer be ignored.

The success of industrialized farming in the North and of the Green Revolution in the South, provided by 1981,some 17% more calories than are required to provide every inhabitant of the earth with an adequate diet, yet hunger persists.

This situation poses great problems for both the producing and the poor,importing countries.In the latter, as indicated by the statistics of the World Bank, about 700 million people still suffer from malnutrition and this strikes hardest on the children, some 15 million of whom die fron starvation each year - more than 40,000 per day. On the other side, the governments of the Europe and North Anerica, with their enormous surpluses are burdened by huge farm subsidies. In 1986 they spent about $100 billion to compensate their farmers for the low prices caused by overproduction and, even this protection was insuficient to save thousands of farmers from bankrupcy. It is thus clear that the present agricultural system does not work. The market system, even if many of its distortions were removed is unable to solve the problem of world hunger in the face of mass poverty. Further technological advnces which are to be expected, will initially worsen the situation.

There is urgent need for reform. There is a human tendency,collective as well as individual to put off facing up to dificulties until they become too critical to ignore, despite awareness that the longer we delay, the more intractible the problems become. Neglect of long term but fundamental issues is one of the most obvious weaknesses of the political system.The great need is for vision.