



**15th McDOUGALL
MEMORIAL
LECTURE**

Jean Mayer

President, Tufts University, USA

**Rome
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**Food and Agriculture Organization
of the United Nations**

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Mr Chairman,
Mr Director-General,
Honorable Ministers and Distinguished
Delegates,

It is a great honor to have been asked to present the McDougall Lecture. It is also, for me, a special pleasure, Frank McDougall was a friend and colleague of my father, André Mayer, in the years between the two world wars. Stanley Bruce was the High Commissioner for Australia in London, and McDougall was his economic advisor. McDougall knew of the nutrition surveys, linking minimum salary, employment, nutrition, and health, that had been led by my father in France, Lord Boyd-Orr in Scotland, and Hazel Stiebeling in the United States.

It was his account of these surveys that spurred Bruce's opposition to the restriction of food production at the height of the Great Depression. It was his acquaintance with my father and the other members of that small group of international economists, physiologists, and nutritionists that spurred Frank McDougall's lifelong commitment to feeding the world. In 1943, I was at the front in North Africa, then in Italy. But I knew later, from my father, of McDougall's memorandum proposing the formation of an international organization to implement President Roosevelt's pledge of Freedom from Want; of their approach to Eleanor Roosevelt, and through her, to the President; and of the Hot Springs Conference that was in a way the birth of the Food and Agriculture Organization.

It was with great pride that I joined FAO in its first years, and had a hand in the

promulgation of the first set of international calorie and protein requirements.

I have been proud to have the opportunity to meet, several times, with Frank McDougall. It seems appropriate to begin this lecture with his often-quoted statement, made in 1935 and still true: "it would argue a bankruptcy of statesmanship if it should prove impossible to bring together a great unsatisfied need for highly nutritious food and the immense potential production of modern agriculture."

To move on to the more recent past, specifically, thirteen years ago, I was traveling frequently to Rome as a member of the planning group for the 1974 World Food Conference. Many of you remember the Conference itself. Everyone here vividly remembers the cause. During the 1950s and 60s, world food production had been

outpacing world population growth. In 1972, the world suddenly reached a point of discontinuity in the history of the equation of food to population. For the first time in a long time, there were very poor harvests in four major growing areas: the Soviet Union, China, the Indian subcontinent, and the Sahel. Massive replacement grain sales in the United States (which, by the way, went unnoticed by American authorities until they were over) left the United States with no stock of emergency reserves. At the same time, the rise in oil prices in 1972 and again in 1973 left large areas of the developing world without agricultural fuel or fertilizers. All at once, the world grain reserve was reduced by 60 million tons. When the Conference convened in 1974, the world family was down to 20 days of food. There was essentially no food in many areas of the Indian subcontinent. There was food in the Sahel, but lack of organization and extreme difficulties in transportation prevented it getting to where it was needed.

Today, we are thirteen years from a new century. The total food situation has once again been reversed. In 1988, world stocks will equal about 23 percent of consumption. A recent article on economics in a Boston paper was headed, "The Food Glut is Worsening." In the American mid-west, silos are full. Grain is being stored in some schools. The Green Revolution (which first benefitted North America and Europe) has taken hold in Asia and in some parts of Latin America. We are at the point where India, China, Pakistan, and Mexico, among others, are giving technical assistance and sharing results of agricultural research with less agriculturally advanced nations.

There is enough food grown in the world today to feed adequately every person on earth, if the food were equitably distributed. (This, however, would condemn peasants in poor countries to eternal poverty). We could feed billions more if rich nations and the rich people in poor nations decreased their meat consumption. Probably

there would also be a decrease in deaths from cardiovascular disease. Yet we are no nearer the resolve of the World Food Conference, that by the mid-1980s no child should go to bed hungry. The percentage of hungry people is less than in 1974, but because the world population is growing, the absolute number is greater.

Sadly, "starvation" is very easy to identify. "Hunger" is a somewhat vaguer concept, and "malnutrition" an even less well-defined one. Looking at hunger, both the World Bank and FAO assume that sufficient energy implies sufficient protein (and perhaps enough of other nutrients). The World Bank uses 90 percent and 80 percent of country-specific FAO/WHO energy requirements. FAO uses the Basal Metabolic Rate - that is, the rate of a person's energy expenditure in the fasting and resting state - to estimate maintenance requirements. Estimating the number of people chronically deprived of the food necessary to lead and enjoy an active, healthy life, the World Bank arrives at

730 million. The FAO estimates 512 million. Using a stricter definition of hunger, FAO puts the number of people close to the survival line in 1985 at 348 million, up from 320 million in 1980 and from 316 million in 1970. Whatever estimate is used, the total is horrendous.

Between 1970 and 1980, 1.5 million people were added each year to the list of the hungry. Then, as the world economy faltered and inflation and debt increased in the developing countries, the figure rose to eight million a year. We must resort to statistics for analysis, planning, and remedial action. But we must also remember that the figure represents 40 million individuals, and that a disproportionate number are children. Furthermore, even when a food balance sheet looks adequate, acute malnutrition can occur in countries or in households, if the foods are divided inappropriately.

Malnutrition is the lack of sufficient amounts of one or more nutrients in the diet. It can occur even when calories and protein are adequate. Infants, young children, pregnant and nursing women are most at risk, because their needs are increased for a number of vitamins and minerals. For example, some 250 000 children go blind each year from xerophthalmia caused by vitamin A deficiency. This condition is easily reversed in the early stages by feeding vegetable foods high in beta-carotene, the precursor of vitamin A, or by giving vitamin A supplements twice a year at the cost of pennies per child.

Goiter and cretinism persist in a number of high-altitude areas far from the sea. Iodine deficiency has been identified as the major cause of both - in the case of cretinism, the deficiency predates pregnancy - and several hundred million people world-wide lack iodine to some degree. Again, at a negligible cost, iodine can be added to food (iodized salt, for example). Added to oil,

it can be injected or taken orally. It is cheaper to give orally, but even the injections, given every three to five years, cost just seven cents per person per year.

Iron deficiency afflicts women in the child-bearing years the world over. UNICEF estimates that about half of the women in developing countries have iron-deficiency anemia. It saps the energy of working women - and no one in developing countries works harder. It deprives a growing fetus of iron for the formation of red blood cells. In households where men and older boys are habitually given the best foods, particularly meats, which are rich in iron, the women and small children may suffer chronic anemia.

In areas where low-protein cereals are the staple foods, small children who cannot consume enough bulk may suffer from protein deficiency, even when calories are adequate. In areas where cassava or potatoes are the staple, protein will be grossly insufficient.

This is less likely to happen in areas where millet, rice, and particularly wheat are eaten, since these cereals are high in good-quality protein. Small children may have a problem eating enough rice. Older children will have no trouble. Nutrition should not be simply a set of corrective measures which are practiced in an episodic fashion after deficiencies are recognized. Nutrition should be the basis for planning agricultural production and food consumption and thus crucial to the laying down of long-term plans.

Some features of the food situation today are reminiscent of the 1930s. The world-wide economic collapse of the late 1920s had brought on the farm collapse of the early 1930s. Soup kitchens and a food surplus existed side-by-side in the United States. We can echo today Stanley Bruce's words at the 1933 World Monetary and Economic Conference: "If the best that can be done for a poverty-stricken world is to restrict

the production of food and other necessities of life, the.... political and economic system is leading to disaster."

There are, of course, major differences between the situation before the Second World War and the situation now. Today there is a surplus in almost every major growing area. In 1932, it may have made some sense to repeat, "the poor we have always with us." In 1987, by contrast, we have learned to multiply loaves and fishes so that all can eat and be filled. Barring massive changes in the climate, the food producing nations could keep the rest of the world on permanent food welfare. That is not the right solution. The world community has or is developing the knowledge in agriculture, food and nutrition, health, communications, transportation, and technology to permit all people everywhere, to feed themselves, provided that, in the near future, world population can be stabilized.

However, we also know we are dealing with something that did not have to concern Bruce, Frank McDougall and André Mayer: an extremely fragile environment that is being stressed in many ways, not the least being world-wide agricultural practices. Indeed, even at the time of the World Food Conference, the scientific community was hardly aware that earth's four great ecosystems, croplands, grasslands, forests and fisheries, had about reached or possibly had already exceeded their carrying capacity.

Again, at the time of the World Food Conference, a petroleum-powered Green Revolution was the only weapon we possessed to combat hunger. It has worked well for Europe, North America, and Asia, and to some extent for Latin America except where there are conditions of civil unrest or enormous social inequalities. But the Green Revolution, as it exists today, is energy, fertilizer and water-intensive (and capital-intensive, for small farmers). It cannot be pursued everywhere and indefinitely without

exhausting resources and further damaging the four ecosystems on which our food supply depends. The farming of the future - and the future is not too far away - must be less profligate.

In tropical areas, and particularly in Africa, agriculture has prospered far less than elsewhere. One essential reason is that research in the subsistence crops of tropical agriculture has only been intensively pursued in the last ten or fifteen years. The diversity of Africa's soils, terrains, and climates is matched by the diversity of its agricultural methods and societal organizations. Another reason, even more important, is that the agricultural revolution into which the rest of the world has moved presupposes a new social, economic, and physical infrastructure. It must be capable of supporting a market-oriented agriculture and a population able to purchase the foods that are produced. In short, the Green Revolution is a social revolution and a managerial revolution as much as a technological revolution.

(Even if, eventually, genetic engineering will progressively decrease the present large requirements of energy, water, and chemicals, the societal requirements will be the same). In addition to a large-scale market, farmers need roads and railroads to bring inputs to the farm and products to market. They will need trucks and small farm machinery - although it is crucial, in countries where the labor force is expanding rapidly, that agriculture not be mechanized too fast. Both the new seeds and nutrient-depleted soils require large amounts of fertilizer. High-yield needs require greater amounts of water, which means additional irrigation. More favorable conditions for growth mean more herbicides, insecticides and pesticides before harvest, and insecticides, fungicides, rodenticides, and storage facilities after. The best way to make more food rapidly available would be to devise storage to protect the 30 to 50 percent of crops that are destroyed before they can be moved to market. All this means a shift from a system of cash or barter to a

moneyed economy and the installation of local credit facilities. Small farmers will find it essential to form cooperatives in order to get better credit and buying conditions, and insure some specialization of labor. Of course, somebody must manage the cooperative.

Finally, food producers must have food consumers. Channels of distribution and means of transportation must be provided. Prices have to be high enough to encourage farmers to increase their output. Prices must be low enough so that the non-farming segment of the population, which will grow as farming becomes more productive, can purchase a nutritious diet. This means parallel development in other sectors of the economy. It makes sense to first create jobs by developing businesses that will help support and increase farm production, for example, manufacturers of small, simple farm machinery, fertilizer plants, small food-processing plants, and the like. Examples of successful development

can be found, compatible with a variety of sociopolitical ideologies, as long as conditions of education, credit availability and local control and local decision-making exist.

This, however, does not happen overnight. In Africa, to help prevent the recurrence of another disaster like the 1972-73 and 84-86 famines, it will be necessary to continue food relief to some countries. In some cases it may be as long as fifteen to twenty years. But this ought to be done very carefully. Food imports should not compete with local products and undermine the struggling farm industry.

Beyond all this is the absolutely crucial long-term support system. Agricultural research and development and a good network of extension services are vital for the evolution of a strong, diversified agriculture. Under "agricultural research and development" I would include veterinary research and services and a strong effort in

aquaculture. Thus far, aquaculture has not lived up to its potential. Africa, in particular, has very little tradition of fish farming, and could benefit greatly from the introduction of a plentiful source of high-quality animal protein. I would also like to see more intensive research on subsistence crops and on ground-cover crops for the Sahelian area. These crops would both fix the soil and serve as pasture for animals. Not enough research is being done on millet, corn, and the varieties of beans and rice that are appropriate for most parts of Africa. As rapidly as possible, we should try, through genetic engineering, to improve the protein content and quality of tuberous crops, especially cassava, and probably of plantain. Research in applied nutrition is urgently needed to develop highly nutritious diets based on native foods. It should be possible to use some dry skim milk. We now have a world surplus, and will probably have considerably more with the development of new hormone treatments of cows, which should double their milk production. Fortified milk

is an excellent source of protein and calcium, vitamins A and D, a number of the B vitamins, and zinc. If lactose intolerance can be circumvented, (and it is not a problem for small children) use of dry skim milk would result in much better diets for children.

Obviously, a literate population is essential. Most African nations emphasize primary education within the limits of their economic resources. In addition, farmers will need managerial and technical skills, and should understand the relationship of agricultural practices to environmental protection.

In some developing countries, women are responsible for 50 percent or more of the food production. It is absolutely essential to educate and involve them in every step of planning and decisions having to do with the food system. Women are also the custodians of their family's health, and there is an urgent need for nutrition education, most particularly for mothers of young

children. The high mortality rate of children under five could be lowered substantially if the cycle of malnutrition-infection-malnutrition could be broken by a good diet during these years of extremely rapid growth. As women understand nutrition better, they will improve the health of their own families, and thus the health of the nation.

Now let me say a word about the long term - the next twenty years or so. The present Green Revolution is still the only way to increase grain yields. At this point we are totally dependent on massive amounts of petroleum and water. Less water intensive methods of irrigation are being developed. However, the major key to eventual change is research in genetic engineering of food plants and animals (including aquatic animals) for tropical environments.

I do not need to point out to ministers of agriculture that genetic engineering is not the great danger to the environment envisioned by some groups of laymen. That is not

to say, however, that we should not take care with the development of projects in genetic engineering, or test the results thoroughly before disseminating them. But, used properly, genetic engineering is a powerful tool in enhancing food production and doing it in a way that also enhances nutrient quality, uses less of many inputs, and is ecologically beneficial. Tobacco and petunias have been described as the test organisms of agriculture as Escherichi coli, white mice, and fruitflies are the test organisms for medicine. In 1983, scientists succeeded in transforming these plants by transplanting useful genetic materials from one to another. Since then, various laboratories have transformed over a dozen vegetable and commercial crop plants. Plants have already been engineered to resist insect pests like caterpillars and beetles, to resist many viruses, or to live compatibly with a friendly herbicide.

Within the next seven years at the outside, genetic engineers will have tested and have ready for farmers major crops, such as

maize, soybeans, rice, wheat, oil-seed rape, sorghum, cotton and alfalfa that are resistant to fungi, pathogens, pests, and various stresses. Before too long thereafter, tropical crops like millet, cassava, yams and taro will also be ready. Experiments are underway to produce crops that grow hardier and give better yields with less fertilizer and no tilling, which can grow in saline or impoverished soils. The range of important food crops is being increased. Imagine the effects of an added range of 50 miles to the north for wheat in Canada or the Soviet Union. Similarly, imagine what a decrease in water requirements would do for millet in much of the South.

Foods are being designed with higher nutritional value and with better taste, foods that are easier to store, easier to process.

It is also very important that genetic engineering of plants can increase, rather than decrease, their diversity. Such crops

are less vulnerable than mono-cultures to disease and stress. These plants, in effect, are high-technology seeds which do not require high-technology farming.

Plants are not the only subjects of enlightened, humane genetic engineering. At some point in the foreseeable future, genetically-improved animals will be born, so to speak, already vaccinated. They will be resistant to various common infectious, viral, bacterial and parasitic diseases, such as hoof and mouth disease, trypanosomiasis, and intestinal nematode. Cattle and pigs will produce more protein and consume less feed. As plant yields increase, acreage needs decrease. With each acre that is unnecessary to increase production or to feed grazing cattle, the destruction of grasslands and tropical forests is slowed, helping to protect water reserves, prevent erosion, and preserve the germplasm that is the source of all genetic diversity.

Of course we cannot wait for the five to twenty years it will take to see the first of these crops planted on a large scale. This situation is urgent. Together, we must proceed with the Green Revolution, adapting the techniques whenever possible.

In Africa, per capita grain production peaked in 1967 just at subsistence level. That is, at 180 kilograms per person per year. During the 1960s, food production had been increasing 2.5 percent a year, barely exceeding population growth. In the 1970s, population growth rose from 2.4 to 2.8 percent a year. The rate of increase of food production declined precipitously, to 1.7 percent. While hunger declined in other areas, the numbers of undernourished in Africa rose steadily, from 92 million in 1969 to 110 million in 1980, to 140 million in 1985. Grain imports increased ninefold between 1972 and 1983. In 1984, food imports consumed about 20 percent of total export earnings. Debt service accounted for another 22 percent. If, as predicted, the population

rises by about 3.3 percent a year for the rest of the century, the growth rate of agricultural production will have to double merely to keep up. In his recent Arturo Tanco lecture, General Olusegun Obasanjo quoted a report of the International Institute of Tropical Agriculture: "In Africa, almost every problem is more acute than elsewhere. Topsoils are more fragile and more subject to erosion and degradation. Irrigation covers a smaller fraction of the cultivated area, leaving agriculture exposed to the vicissitudes of an irregular rainfall pattern. The infrastructure, both physical and institutional, is weaker. The shortage of trained personnel is more serious. The flight from the land is more precipitate..." I might add that in normal times the flight from the land to the cities makes the nutritional state of the poor more precarious. Of course, this may not be so in the case of famines, although during the Nigerian civil war I saw as acute hunger in the countryside as in the cities. Chronic hunger and malnutrition are caused by a lack of access to food rather than by the absence of food.

The Fifth World Food Survey shows that hunger tends to be greater in unemployed urban poor than in rural poor. In rural areas, the exceptions are landless households, particularly those headed by women.

The installation of more productive, sustainable agriculture and of an economy that permits an adequate diet for every person, has been likened to the Marshall Plan. (The Marshall Plan, if you remember, revived the European agriculture and economy after World War II.) In reality, the project is far more complex and costly and will take far longer. It asks for contributions from each member of the world community, for every member has a particular capacity in one area or another.

For example, as we saw only too recently, the world does not yet have a fully effective early warning system for incipient famines. The pieces of such a system are beginning to fall into place. We need

monitoring of harvests and market prices; long- and short-term weather monitoring by satellites and airlines; ground reports of the health and nutritional status of vulnerable populations, most especially of young children. But the pieces are not yet well coordinated. There is no mechanism in place to insure a timely response, either by the world community or by national governments. The trigger, if you want, does not exist. There is no systematic maintenance of reserves, either outside potential famine areas so situated as to allow quick delivery, or inside vulnerable countries to provide stop-gap aid until outside help arrives. Elements of this warning system, when they are in place, can also provide data and analyses for long-term national and regional food and agricultural planning. To work, the system must have inputs from the local to the international level.

Another example of large-scale infrastructure needs is an effective road and transportation network for the

continent. Africa (and to a lesser extent, Latin America) does not yet have the system of transcontinental roads and railroads, North and South, and, particularly, East and West to permit easy movement of food during famines. Even with the difficulties of moving foods inland from the ports, importing food is usually easier than moving it overland from one area of the continent to another. Or, for that matter, sometimes of moving it from one region of a country to a food-short area. Planning for an adequate system of roads and rail has to be done by the region, the nation, perhaps even the localities involved. But the funding and technical assistance must come from individual industrial nations or from the international community. The same is true of planning for water resources.

In general, assistance on large-scale projects to create missing infrastructure will have to come from governments. Private enterprises must realize a fairly quick return on their investment; non-profit

private organizations do not have the financial resources. Companies can be part of the second phase of economic development, and of the research effort - for example, in genetic engineering. Contributions of the international agricultural research network, most especially of the thirteen CGIAR centers, are absolutely indispensable. It has been said that these centers, funded through the Consultative Group on International Agricultural Research, may well be a more significant contribution of the Green Revolution than the expanded harvests. Universities and other research organizations also have a significant role to play, both in research and in its application in the field. Universities are especially qualified to train agricultural research scientists, veterinarians and aquaculturists, teachers, technicians, extension workers, nutrition educators, and managers. In addition, the transfer of intermediate technologies under the Regional and South-South Cooperation effort is particularly useful.

The issue of population growth is usually seen as a matter for the people of each nation to decide, but the world community should stand ready to give whatever assistance is requested by national governments. It is obvious that even genetic engineering in agriculture cannot forever produce enough food if the world population expands indefinitely. There is no doubt that a rapid drop in the rate of population increase in many countries would help the population: food equation. But it is well to remember that North America and Western Europe, which had their population increase earlier than other parts of the world, also were the first areas to eliminate famine, except in wartime. It may well be that we will run out of housing, schools, health care, and recreation space, even breathable air, before we run out of food. Every person who is born deserves a chance at a good life, and a long one. The world can provide that, as well as an adequate diet, provided we stabilize the population or, better, reduce it through birth control.

All the forms of assistance, ranging from infrastructure to agriculture, to early industrialization, to birth control to health and to education can be given through bilateral agreements between rich or developed countries and poor countries. However there is a risk that such bilateral agreements may create situations of permanent dependence. Whenever possible, it seems more consistent with principles of universal fairness, maintenance of national self-respect, and (when the international organizations work well) with effectiveness, for aid to be provided through multilateral channels. In the opinion of many sympathetic observers, there has been a wide range of impartiality and effectiveness in the activities of multinational organizations. Some, like UNICEF, have justifiably received universal applause - including, for UNICEF, the Nobel Peace Prize. Everyone knows, at the other extreme, the tribulations of Unesco. The very creation of FAO as an international organization, was based on the fact that the problems both of agricultural surpluses and

of agricultural shortages transcend national boundaries. They are thus best dealt with in the framework of international action. From the point of view of practical work in the field, it also is to FAO's advantage that much of the experience gained in poor countries - tropical or arid - is transferable to other areas with similar geological and climatic conditions. Finally, the experience of several crises have shown that to be effective the defense of agricultural prices to producers has to rest on multilateral international agreements. Given a budget of sufficient size, and assured choices of its specialists based on competence and not on politics, FAO should be on its way to fulfilling the hope of its founders, and of an entire generation of us who, back from World War II, believed in world organizations.

There is, however, a condition that has to be underlined. I have spoken of FAO being given sufficient means. This will demand an international commitment to a common goal that has not been seen since World War II, a

commitment of intellectual, human, and economic resources to restoring the life of a continent. The intellectual and human resources are mobilizing. But the world's economic resources are being drained by a commitment to death. The arms race consumes close to 2 billion dollars a day in the United States and the Soviet Union. Our economies suffer, our domestic programs suffer, our people suffer: the United States' infant mortality rate stands eighteenth in the world. The Soviet Union's is forty-sixth. But the two largest powers are not alone in these warped priorities. The developed countries on average spend 5.4 percent of their GNP for military purposes, 0.3 percent for development assistance. The United States' yearly non-military aid for Africa amounts to five hours of the yearly arms budget.

In total, the world spends about one trillion dollars a year on "defense". Between 1975 and 1985, arms imports of the developing countries amounted to 40 percent of the

90 percent of them in developing countries, just to absorb additions to the work force. Without looking at the worsening situation in the industrialized countries, in the developing world alone, one billion people - one in five - are estimated to live below the poverty line, 100 million have no shelter, one billion are inadequately housed. Four times as much is spent each year on armaments as on health care. The Food and Agriculture Organization recently destroyed a plague of locusts in Africa at the cost of less than one half hour of the world's military outlay. Africa, incidentally an essentially disarmed continent in 1960 is accumulating arms and armies at the cost of development.

Just twelve nations have or are thought to have the capacity to produce the nuclear weapons that could destroy all life. But every nation whose military imports consume a significant share of its GNP, or whose military exports make a substantial contribution to its trade balance, is contributing to the slow wasting of its people and the

slow devastation of its environment. We must find a way to break this mad cycle of expenditure. If nuclear arms can be abolished and conventional arms reduced and controlled, the funds and technologies can be redirected to peaceful and humane ends. The first priority should be food for the world.

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