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Can the World Feed Itself?

by

Clarence Enzler

and the

Subcommittee on Agriculture

A REPORT OF THE SUBCOMMITTEE ON AGRICULTURE

THE CATHOLIC ASSOCIATION FOR INTERNATIONAL PEACE
1312 Massachusetts Avenue, N. W.
Washington 5, D. C.

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CAN THE WORLD FEED ITSELF?

INTRODUCTION

"A hungry people listens not to reason, nor cares for justice, nor is bent by any prayers." (Seneca)

THE English lexicographer, Samuel Johnson, once offered the opinion that "a man seldom thinks with more earnestness of anything than he does of his dinner." Today, scientists, statesmen, and social observers are contemplating as never before the problem of dinner in the future—the problem of food and people.

Can the world produce and distribute ample food for its increasing population? There are a number of people who support the theory that it cannot and propose artificial limitation of the population as a solution to the problem. The purpose of this report is to review that theory and to propound in opposition to it a thesis which, based on the conviction that one part of the natural law is not contradictory with another part and upon scientific and technical facts, indicates a constructive solution.

In 1798, a young English clergyman, Thomas Malthus, published an "Essay on the Principle of Population as it Affects the Future Improvement of Society." Briefly, Malthus thought he had discovered the following:

> Population increases in a geometrical proportion, such as: 2, 4, 8, 16, 32, 64. The production of food on the other hand, increases arithmetically: 2, 4, 6, 8, 10, 12.

Malthus' thesis is that, given favorable circumstances, population tends to double every 25 years, but while the productivity of land can be increased, it cannot be increased indefinitely, and certainly not at a rate equivalent to the growth capacity of population. From these premises, Malthus argues that the time must soon come when there would be too many people for the food-producing ability of the world, unless population were checked by famine, disease, war, vice, late marriages, or some other cause.

At first Malthus' theory shattered the confidence of many who had hitherto accepted the proverb that God never sendeth mouth but He sendeth meat. But as time passed and the dire predictions

failed, the Malthusian theory was scorned. People looked about them. Population was growing, yes, but not nearly so fast as Malthus had feared. Meantime, the development of the New World and an agricultural revolution of a sort in the Old provided the people of Europe and America with more food per person than they had ever had before.

This upward trend in food continued. It was assisted by better transportation and communication, enabling food supplies to be brought from surplus areas to deficit areas. Until quite recently, therefore, it seemed that the question raised by Malthus as to the ability of the world to go on feeding itself had been adequately answered by historical events.

From time to time, however, a weak voice was here and there raised in warning. In 1898, just a century after Malthus published his theory, another Englishman, Sir William Crookes, pointed out that nearly all the easily cultivable virgin lands in the world were in use. He predicted that, unless yields could be increased, the swelling population of the earth could expect difficult food problems about the 1930's. A "colossal dilemma," he called it, and suggested that the path between the horns could be negotiated by enormously increased use of nitrogenous fertilizers.

Meantime, two other aspects of the food-and-people question were receiving increasing attention: the erosion of land and the importance of good nutrition for good health. The outstanding pioneer in the United States and one of the outstanding world figures in combatting soil erosion is Dr. Hugh M. Bennett, chief of the Soil Conservation Service of the U. S. Department of Agriculture. From the 1920's on, Dr. Bennett pointed to vast areas of eroded land in the United States, stressed the necessity of keeping our top soil from blowing and washing away, and suggested conservation measures to hold the land firm.

The story of erosion seemed so dramatic that it lent itself naturally to the "scare approach." Thus, the Nation has been told that already one-third of its "virtually irreplaceable" top soil has been lost; that erosion caused the downfall of several great civilizations of the past; and that the United States is gravely imperiled by this threat to the land. For more than 20 years this same approach has grown in popularity; in the past two or three years it appears to have reached some kind of peak.

Toward the end of the 'thirties, Jacks and Whyte published *The Rape of the Earth* in England. It was reprinted as *Vanishing Lands* in the U. S. in 1939. In 1945 appeared *Food or Famine: the Challenge of Erosion,* by Ward Shepard. That same year saw publica-

tion of *The World's Hunger* by Pearson and Harper. Popular as these books became, they have since been completely overshadowed by William Vogt's *Road to Survival,* (Sloane) which appeared in 1948, speedily becoming a best seller and a selection by Book of the Month Club. Of Vogt's book, more later.

The matter of nutrition was also receiving emphasis throughout this period. In 1937 the League of Nations Mixed Committee published a report on the Relation of Nutrition to Health, Agriculture and Economic Policy, pointing out that "in spite of the gradual improvement in nutrition . . . malnutrition remains today a serious threat to health and well being."

Lord John Boyd Orr, former Director-General of the Food and Agriculture Organization, and David Lubbock in their book, *Feeding the People in Wartime,* cited the effect of insufficient diets on the British people. Orr and Lubbock found it significant that the minimum height of recruits for the British army had had to be reduced to 5 feet at the time of the Boer War (1899-1902), whereas it had previously been 5 feet 3 inches, and before that 5 feet 6 inches.

With the Hot Springs Conference (Virginia) in 1943, in which representatives of 45 nations participated, the importance of nutrition received new international recognition. Two years later, representatives of 42 nations met in Quebec and signed the constitution which brought the Food and Agriculture Organization of the United Nations into existence.

But it was primarily World War II and its aftermath which focused attention upon the problem of food versus the people. War devastation brought hunger to millions who formerly were comparatively well supplied. War-created shortages were intensified in the immediate postwar period by crop failures in many parts of the world. Faced with the imminent prospect of widespread starvation, and the threat thus presented to world order, the United States and other countries exported food, particularly wheat and other grains, to Europe and Asia on a scale hitherto unprecedented in history.

But by 1948-49 a substantial recovery had been effected in Europe's food production. This, combined with a continuation of large crops in North America and Australia, went far to relieve the abnormal shortages. Many European countries have eased or eliminated food rationing. Nevertheless, principally because of an increase in European population of about six per cent, caloric consumption per head is still somewhat below prewar. Food production is expanding more slowly in the Far East than in Europe. In-

flation, as well as political and military conflicts, complicate the food situation in many urban areas. In consequence, the Far East, which was before the war a net exporter of food, is still a large deficit area.

On the world scale, production of major foods is climbing from the postwar low and exceeds the prewar average for many commodities. Despite the disturbances in the Far East, world rice production in 1948-1949 was 20 per cent above the 1935-1939 average, primarily because of the vast U. S. crop. World bread grains production (wheat and rye) in 1949 exceeded the prewar level for the second year in a row. Supplies of fats and oils for the first time were slightly above prewar, though the increase was not uniform for all types. Supplies of most fruits are far above the prewar average. Meat production continued to rise and exceeded prewar for the first time, while milk production was 4 per cent above the prewar level.

The world food situation, then, continued to improve during the 1949-1950 season, with production of major food products two per cent above prewar. But the distribution is substantially altered. Total farm output in the United States in 1949 was nearly forty per cent above the 1935-39 average, while Europe and Asia were still far behind their prewar levels. The present supplies of food and fiber, even if equitably distributed, would not suffice adequately to feed and clothe the world's population. Millions of persons in many countries are seriously undernourished, just as a large proportion of the world's population seems always to have been undernourished even in times when the total population was a fraction of what it now is. But is undernourishment getting worse? Is the population increase getting further ahead of the production of food? Before the middle of the seventeenth century, say population experts, the world never had 500,000,000 people. By 1800 it had twice that number, and since 1800 it has more than doubled again, to a figured two and a half billions living today. This increase may continue at a rate that in just 25 years would add to the present figures as many people as the world's total population three centuries ago.

This trend creates a genuine problem. The world has never produced enough food for its inhabitants. But it has managed to increase production as the population increased. Actually, it has in recent centuries, precisely in the period when the population increase has been greatest, increased food production more rapidly than population. And, as will be seen as this booklet develops, if we combine a genuine ethical and Christian world outlook with

a full utilization of the scientific knowledge and tools at our disposal, it is possible to ensure the production of enough food for current world needs and for the needs of any foreseeable future population.

But world conditions impose an urgency. Hunger is now generally recognized as a powerful enemy of peace. An adequate world food supply equitably distributed, can help build peace. Lack of food endangers it. Some observers believe that the question of world food is the very heart of the problem of peace, and that the way this problem is attacked may be the most decisive factor in the future history of mankind.

After the decline of Malthusianism until the past few years, many of those who feared for the future food supply of the world argued mostly that the situation could still be saved by improved production practices, improved conservation and equitable and effective distribution. Now, however, the emphasis has changed. The solution that many neo-Malthusians now offer is that man's salvation lies principally in the restriction of population and the world-wide adoption of population planning by use of means which are contrary to the moral and natural law.

The most voluble exponent of this viewpoint at the present time is undoubtedly William Vogt, former Chief of the Conservation Section of the Pan-American Union. His contentions may be summarized as follows:

1. Over the past three centuries man has acted as though the resources of the earth were unlimited. By excessive breeding and abuse of the land, man has now involved himself in an "ecological trap." The earth is not made of rubber and it cannot be stretched. Each increase in the number of human beings, therefore, lessens the amount of productive land available per capita.

2. Some nutritionists estimate that it takes an average of 2½ acres to provide a person with an adequate diet. The world's arable land now available, however, is reckoned by Vogt at little more than an acre (other estimates put it at 1.6 acres) per person. And every day 50,000 persons are added to the world population.

3. To make matters worse, we are, Mr. Vogt contends, rapidly destroying the fertility of the earth's already insufficient supply of productive land. The United States in the past century and a half has lost a third of its top soil, over half of its high-

grade timber, a large portion of its wildlife, and much of its reserve supply of water. He points to soil in Ohio which, he declares, once yielded 100 bushels of corn per acre and now averages only 42 bushels. The United States, Mr. Vogt feels, is in a bad way.

4. But the way of the rest of the world is even harder. Already all but three or four of the Latin American countries, according to Vogt, are over-populated. He holds that the same is true of Europe and Asia. As we offer aid to Europe, Vogt contends, we should insist that a substantial proportion of our tax dollars be used in a program of population limitation.

China, with a population of almost half a billion, has already lost all productive capacity from one acre out of every four of her land. She has practically no new acres for expansion and she is unable to feed more people on the less than one-half acre arable land per person which she possesses.

In India, life expectancy at birth is only about 32 years. India's population, now more than 400 million, is increasing at a rate of 14,000 per day,—although the country is able to provide not even 300 million persons with a low minimum of 1,400 calories per day.

But the poorest of all the continents, from the standpoint of natural resources, is Africa which, nonetheless, is still increasing populationwise.

Bluntly, Vogt says: "It is obvious that 50 years hence the world cannot support 3 billion people at any but coolie standards —for most of them . . . unless population can be stopped, we might as well give up the struggle."

5. And again: "If the United States had spent two billion dollars developing . . . a cheaper, dependable contraceptive, instead of the atom bomb, it would have contributed far more to our national security while, at the same time, it promoted a rising standard of living, for the whole world." Thus writes the former Chief of the Conservation Section of the Pan-American Union.

Though Vogt is the most voluble, he is by no means alone in his contentions:

Aldous Huxley writes: "The world's underlying population crisis can only be relieved through the adoption by all nations, of a world policy, aiming at the stabilization of population at a figure at which

the relationship between numbers and resources, numbers and the amenities of life, shall be most favorable."

Guy Irving Burch, director of the Population Reference Bureau, declares: "India is growing at such a rate that if it could lower its death rate to the level of that of the United States or England, with its present breeding rate, India would fill five earths as large as ours and as full as ours is today in one single century."

C. Lester Walker, writing in a Foreign Policy Association pamphlet, "Man and Food," says: "A hundred years hence, if the rate of increase is unchecked, the world total, most population experts believe, will run to 4.5 billion." This would be an increase of 80 percent over the present estimated world population of 2.5 billion.

Frank Pearson and Floyd Harper say bluntly in *The World's Hunger*: "There are no large areas of new land to be brought into cultivation."

Ward Shepard in his *Food or Famine: the Challenge of Erosion*, writes, "Despite the brilliant advances in agricultural science, the productivity of the world's soils in output per unit is slowly diminishing. Mankind is fighting a slow retreat before the gathering forces of famine."

Novelist Pearl Buck ties dictatorship to an inadequate solution to the food versus people problem. "One of the chief causes for the increase in despotic theories of government is overpopulation . . . in all those countries where population is too abundant the cause of the individual is lost."

P. K. Whelpton, of the Scripps Foundation for Population Research, apparently believes that the United States is already overpopulated, for he declares: "If this nation could choose between having a stationary population of 131 million or 150 million or 100 million, it can be shown quite conclusively that the smaller number would be best from an economic standpoint."

And Warren Thompson, also of the Scripps Foundation, states: "The time must come before long when the population of the earth must practically cease to increase, and it now appears that birth control is the method by which this will be brought about."

Such are the arguments and claims of the proponents of artificial birth control as the solution of the world's food shortages. They sound very imposing when formulated on this general level. But they rest on a number of premises which are either demonstrably false or gratuitously assumed. We shall examine them in detail, starting off with a discussion of a question that touches ourselves most closely, the food resources of the United States.

The United States — Can It Feed Itself?

Dr. Hugh Bennett is reported to have said: "There is not enough good land left in the United States. Actually we need more good land for crops now." William Vogt urges his readers to enjoy their steaks now "since there will be many less of them within the lifetime of most Americans."

What is the situation of the United States presently and insofar as the future can be anticipated? It is believed that this country may reach its peak population in approximately 25 years—with a population of perhaps 190 million persons. After that, it is believed our numbers will be stationary or they may decline.

Can our agriculture feed that many?

American farmers in recent years have been producing about 40 percent more food and fibre than the 1935-39 average. In 1948 and 1949, they harvested the largest total crops ever produced on American farms. The significant fact is that these crops have been produced without a great expansion in acreage. Actually, total acreage of harvested crops in 1948 exceeded by only 8 percent the 1935-39 average of 331 million acres.

What then, is responsible for the huge increase in output? Why do we now produce so much more per acre? True, the weather has been good, but not spectacularly so. In 1947, for example, unfavorable weather resulted in a partial failure of the corn crop.

The most important factor in this dramatic production story is a remarkable growth in the efficiency of American agriculture—a growth that makes it possible at the present time for only one person out of every 13 or 14 in the total population to be actually engaged in producing agricultural products. A century and a quarter ago, more than one out of every five persons of our total population was engaged in agriculture. A farm worker today, in other words, supplies food for three times as many persons as the farm worker of the early 19th century.

For about 70 years prior to 1937 the yields per acre of our major crops grew very little. Production per person engaged in farming increased mainly because advances in machinery allowed one man to do the work of several. But since 1937 the increase in acreage yields has been spectacular.

It was at this point that the environment became favorable to the adoption of the more efficient farming practices which had been developed over the past 70 years, but not widely applied. Higher prices for farm products, the outbreak of war with a consequent

increase in demand, the availability of agricultural credit, better distribution of information and demonstration of techniques, and Government financial assistance in the application of conservation practices were important factors that, in combination, led to more efficient farming.

In the past decade, the many years of research that preceded have really "paid off." Hybrid corn now enables our farmers to increase their corn production under normal growing conditions by at least 750 million bushels per year. In the past quarter century, through the development of improved varieties, wheat yields have been increased by 15 to 20 percent. Losses from wheat diseases have been greatly reduced. These advances have made possible wheat crops in excess of a billion bushels.

United States agriculture has made great progress in soil management and fertilizing. Farmers have increased the use of liming materials to some 30 million tons annually. "During the decade 1936-46," says Dr. Robert M. Salter, Chief of the Bureau of Plant Industry, Soils and Agricultural Engineering of the U. S. Department of Agriculture, "farmers actually applied three times as many tons of lime as the total applied to American soils up to that time."

Important advances have also been made in the production of livestock and livestock products. Take milk, for example. Annual average milk production per cow in the United States has risen from less than 4,200 pounds a quarter century ago to more than 5,000 pounds today. But the average production for all cows in the Dairy Herd Improvement Association totalled nearly 8,700 pounds in 1948—more than twice the U. S. total 25 years ago and one and three-fourths times the U. S. average in 1948. These facts indicate not only what *is* being done, but what *can* be done.

In 1948, production of all crops per acre exceeded the 1935-39 average by 37 percent, and production per animal unit stood 14 percent above the prewar average. Average crop yields have increased 50 percent during the past 20 years.

Despite these sizeable increases, it is the opinion of scientists in the Department of Agriculture that the end of the trail of progress is nowhere in sight. Dr. Salter declared in a speech before the American Farm Bureau Federation, in December, 1948: "Scientists know that they have only penetrated the fringe of the great natural phenomenon known as hybrid vigor. Field production of hybrid onions has followed the initial success with hybrid corn. Here again is a story of hybrid vigor expressing itself in yields up to 50 percent greater than those from ordinary varieties. Scientists working with

sugar beets and alfalfa have also produced vigorous hybrids. Having captured hybrid vigor with corn, onions, sugar beets, and alfalfa, the plant scientists are now working toward the same goal with several other crops."

Similarly, Dr. Salter points out that the "real significance" of new methods of weed control is yet to be realized. "If the pre-emergence treatment can be perfected it may be possible to 'lay corn by' before it sprouts. We know that the main reason for cultivating corn is to kill weeds, but more research is needed before we can recommend that farmers plant their corn on Monday, spray the ground with 2,4-D on Wednesday, and then forget about it until harvest. Yet, these are real potentialities."

Speaking of the half century ahead, Dr. Salter declares: "It is my considered opinion that science has made no more than a beginning in advancing agriculture in the United States. In fact, the big harvest is still ahead, the stage is set with enormous possibilities." (Address at the Centennial Convention of the National Fertilizer Association, White Sulphur Springs, W. Va., June 14, 1950)

All in all, it appears that the crop and pasture land *now available* in the United States is more than adequate to support our present population with a middle-cost adequate diet. On the basis of crop yields obtained from 1941 to 1945 (assuming 355 million acres in crops plus 140 million acres equivalent of feed from pasture), a population of 203 million persons could be supported with a low-cost adequate diet, 167 million with a middle-cost diet, and 137 million people with a high-cost adequate diet. Any of these diets would provide the food necessary for healthy and efficient living. The moderate and high-cost diets would, however, include a larger proportion of livestock products.

Dr. Charles E. Kellogg, Chief of the Division of Soil Survey, U. S. Department of Agriculture, sums it up as follows: "Many more than our present population could be supported with an adequate diet without employing any more land resources and with no greater production from our land resources." (Paper before Land Economics Institute, Iowa State College, June 21, 1949).

Technical improvements in agriculture, however, are not likely to cease. On the contrary, such progress seems to be on the increase.

As Dr. Kellogg pointed out in the paper referred to: "Between the period just before World War II and 1946, farm production increased about 3 percent per year, with little increase in the land used for crops. It would be conservative to predict a further increase of 10 percent by 1955. A study made by agriculturists in the land-grant colleges and in the Department during the early part of

World War II showed that it would be entirely practicable for farmers to increase production on a sustained basis by at least 20 percent, and by 30 percent on several items . . . a great deal has happened since then to make even those figures look very conservative, indeed."

Even if the conservative figure of a 10 percent increase in production per acre is accepted, 184 million people could be supported with a moderate-cost diet, or 150 million with a high-cost diet on the farm land that is now in use. Inasmuch as the Bureau of Census estimates that the population of the United States is now about 150½ million persons, it can be seen that, using only our present available land, a conservative increase in production would enable American agriculture to produce a high-cost diet for almost the entire population.

Obviously, the future concern of the people of the United States is likely to be more how to dispose of agricultural surpluses than how agriculture is going to keep starvation from our doors.

Let us assume, however, that the population experts are wrong; that our numbers will not reach their peak about 1975, but instead will continue to grow far into the future. What then?

Simply this: If production increases per acre and animal do not meet requirements, *land available for agriculture can be increased whenever the need makes the game worth the candle.* "If we were really pressed for land as people are in many of the crowded countries," Dr. Kellogg says, "we could increase our farm land enormously. In the humid parts of the United States, for example, practically all the soil that does not have steep slopes, that is not thin over bedrock, that is not simply loose, deep sand, or that is not undrainable, could be used to produce crops or pasture. That is, should our need for farm products demand it, we could use a great deal of land which, under foreseeable economic conditions and the foreseeable state of agricultural arts, it would be clearly unwise to use for farming."

But this, it may be contended, does not answer the objection that our continent is sliding to ruin; that it is rapidly losing its ability to produce. Our agricultural surpluses, says Vogt, "are achieved at the cost of wearing out and washing away the land itself—depleting our capital." And again "The future of our country is within our control. But a few more decades of such abuse as we have subjected it to will wrest the control out of our hands. We shall be slipping toward the oblivion of Ur, of Timgad, of Angkor Wat, of the North Chinese, the ancient Mayans, and at a speed too great to check."

With this, many highly reputable soil scientists do not agree.

They reject the idea that land with three feet of top soil will produce "20 or 30 times as much" as land with three inches of top soil. They reject the "balance sheet" theory of soil; the theory that soil is like a bank and you get out of it only what you put in. They reject the assumption that, once soil is eroded, it is forever ruined. They reject the implication that the United States is every year suffering a stupendous net loss in the productivity of its land.

They agree that soils deteriorate and that excessive erosion is a serious problem in some parts of the United States, just as it is in many other countries the world over. But soil erosion, they insist, is only one important aspect of the whole question of soil management. Many other kinds of soil depletion, such as loss of fertility, reduction of organic matter, and losses of soil structure are fully as important as erosion.

They insist that most depleted or eroded soils can be rejuvenated. Thus, an experiment conducted at LaCrosse, Wisconsin, by the Soil Conservation Service in cooperation with the University of Wisconsin showed that the productivity of severely eroded soils in that area can be restored to a satisfactory level for corn and hay. Such rejuvenation requires large amounts of fertilizer, proper rotation of crops, control of further erosion, and building up the organic matter and nitrogen content of the soil. But it can be done. It *has* been done.

In Ohio a similar experiment conducted on land from which the normal top soil had been removed resulted in a corn yield of 86.1 bushels per acre in the fifth year of treatment.

Such soil scientists as Dr. Salter and Dr. Kellogg do not minimize the importance of deeper top soil, nor the harm that is caused by excessive erosion and other soil losses. They hold, however, that while land productivity is declining in some parts of the Nation, it is rising in others. They contend that the soil on hundreds of thousands of farms in the eastern United States are, as the result of good management, far more productive now than they were as virgin soil. They are unwilling to guess what the box score might be as regards the national total of loss or gain, simply because nobody can possibly know that score. They believe that soil science is developing rapidly and that this nation is not confronted by soil suicide.

One thing about which they are certain is that, by applying a combination of improved practices to farming operations, yields of many crops can be increased to almost fantastic proportions. In North Carolina, corn yields under traditional agricultural practices average

about 20 bushels per acre. In 1944, research on the best combination of germ plasm, fertilization, closeness of spacing, methods of cultivation and other practices for mowing were begun in this area. In 1948 over a thousand North Carolina farmers using improved practices had yields in excess of 100 bushels per acre. In 1949, more than 8,000 farmer demonstrators in a seven State region exceeded 100 bushels per acre and a few exceeded 200 bushels.

This kind of "pay-off" formula, as Dr. Salter calls it, has been worked out in the Southeast to produce oats yields of 85 bushels per acre, wheat yields of 30 bushels, soybean yields of 35 bushels; and this is an area in which heretofore yields of these crops have been extremely low. In the West on irrigated land, still higher yields have been achieved: 206 bushels for corn, 114 bushels for oats, 91 bushels for barley and 648 bushels per acre for potatoes.

When we apply these findings to our whole agricultural picture, it becomes evident that research has finally uncovered a virtual Aladdin's lamp of potential productivity. The scientists believe they have the formula that will almost guarantee 150 bushels of corn to the acre on well-drained land with water under control. With such a yield, record corn crops could have been produced on 24 million acres, instead of the 85 million actually used. Sixty million acres could be released for other crops. Put them in wheat and, yielding 30 bushels per acre, it would provide calories and proteins enough for an additional 200 million persons. Or leave them in corn. That would provide calories and proteins for 366 million people. It wouldn't be a balanced diet, but it could be balanced by increased vegetable production on other soils. It wouldn't be so appetizing as steaks and chops. But it would provide food for an additional population nearly two and a half times as large as this nation presently has.

These facts, say the soil scientists, are strong evidence of the absurdity of the contention that the United States must fear overpopulation. And the soil scientists are making new discoveries year by year. The deep-freeze, dehydration processes, and the other means of preserving food provide still other ways to increase food supply by decreasing the decay of food before it can be used. Especially in the South but, for that matter, everywhere in the United States and the rest of the world the enormous waste of good food which is allowed to turn into poisonous garbage in a day or so can be overcome, and in part is being overcome, by using the new means of preservation of food. These new means are themselves being improved continuously.

The World — Can It Feed Itself?

In 1939, it is estimated, half the people of the world existed on less than 2,250 calories a day. Many of these persons had less than 1,000 calories, which is the equivalent of slow starvation.

Today the world has less food per capita than it had in 1939, and it is less evenly distributed. Nevertheless, it is probably true that even after the most destructive war in history, with machinery and buildings destroyed, people uprooted, the land torn by bombs, shells and tanks; herds of livestock dissipated; fertilizer and feed scarce; and actual famine weather in a large portion of the earth; there was proportionately less starvation in the past few years than in the extreme food crises of earlier eras. History records famines in the past that wiped out a tenth, a fourth, or a third of the population of large areas. Nothing similar has occurred in the present crisis.

Man today is able to take a certain degree of effective action against famine; this is precisely what the United States and other countries have done through postwar food shipments abroad and what we are now doing through the European Recovery Program.

It is evident that, as man has come down the corridors of history he has been successful in making his supply of food constantly more and more secure. If this indicates anything, it is that *we must beware of placing an arbitrary limit on the ability of the world to feed itself.* Estimates of world resources made half a century ago, or a century ago, appear to be in most cases far below estimates which would be made now.

Nor is it possible to make an accurate forecast of world numbers over a long period. World population has grown remarkably in the past two centuries. There is at present no apparent reason why it should not continue to grow in the future. Nevertheless, it seems quite rash to assume that just because the tide is rising now it is bound to go on rising indefinitely. Admittedly, there is some reason for projecting present trends into the future; but the farther we project the present, the less likely are we to be accurate in our forecast.

Some scholars take the position that, over the course of history, world population for the overwhelming majority of the time has remained comparatively stable or has increased almost imperceptibly. If this be true, it is not unthinkable that in some future time population growth should again taper off and the number of people in the world should again become comparatively stable — without starvation or atomic war, or population planning.

On the other hand, it is anticipated that the first effects of industrialization in such a country as India would be to bring about a spurt in population before the tapering off and stabilization process would become effective. Interesting as the speculation may be, it is at the same time somewhat rash to place too much dependence upon any estimate or forecast of what the world in the distant future is likely to contain. Food production efforts, however, should be geared to the maximum estimate.

In a class with these speculations may be placed guesses as to the future effect of atomic energy on food production. It may be that atomic energy will provide a means of irrigating great arid regions, but it hardly seems safe at this time to place much reliance upon that possibility. It is suggested likewise that it will be possible in the near future to obtain much of our food from the sea or from the atmosphere. The sea, it is said, contains all the minerals required for life and it compares quite favorably with good garden soil in fertility. It is even asserted that, acre for acre, the sea is far more productive than land. There are other interesting possibilities. One concerns the growing of food in shallow ponds—first growing green algae and then feeding these tiny plants to microscopic organisms of the yeast family. The yeast converts carbohydrates of the algae into protein which would be recovered in the form of white powder or flour to be used in soups or in other ways to fortify foods. Though these speculations and possibilities are regarded in many quarters as interesting "aces in the hole," most soil scientists are of the opinion that for a long time to come man will continue to grow most of his food on productive soil.

Are our soils, our fertilizers, our technological and management ability equal to the task?

Before we reply to that question we must know what the task is. The best available answer is given in the "World Food Survey" made a few years ago by the Food and Agriculture Organization of the United Nations. The FAO looked ahead to 1960 and, on the basis of the estimated world population for that year, it calculated the quantity of food the world would need to provide enough for an adequate diet for everyone. The FAO came to the conclusion that the earth would have to produce more than 60 million additional tons of cereals, 30 million extra tons of meat, 250 million additional tons of fruits and vegetables and another 35 million gallons of milk. In terms of percentages, production of fruits and vegetables on a world basis would have to be increased 163 percent above the 1935-39 average, the output of milk would have to be doubled, peas and beans would have to be increased 80 percent, meat 46 percent, fats

34 percent, tubers and roots 27 percent, cereals 21 percent, and sugar 12 percent.

Is it physically possible for the earth to produce this much additional food?

There are several different avenues by which to approach this problem. One of the most obvious is by using food supplies to better advantage: eliminating waste and improving the nutritional qualities of food. The FAO has estimated that mites, pests and rodents destroy about 60 million tons of the world's grain per year—more than the pre-war wheat and rye supply for the whole of Europe. The U. S. Department of Agriculture has estimated that about ten percent of our annual crop of grains and cereals is ruined by insects, rodents and mold. Four pigs out of ten never get to market, but die on the farm at various ages and for various reasons. Weeds on farms hold down crop yields, and livestock pests cut deep into output of meat and milk.

The value of farm crops can be seriously impaired not only after they leave the farm but even before. An excellent example is hay. Dr. Salter, in his address before the American Farm Bureau Federation, December 13, 1948, said: "Research has shown that as much as 90 percent of the original vitamin A content of standing green forage and as much as 50 percent of the protein may be lost in the period between cutting and feeding under present methods.

"The visible losses and invisible nutritional losses in corn and other grains from lack of proper conditioning and storage also reach staggering totals annually."

The FAO conference at Baguio in 1948 reported that the processing of rice in certain mills resulted in an extensive loss of food. Every housewife or storekeeper also knows the waste that results from inadequate methods of distribution and storage.

Examples could be multiplied. They would all add up to the conclusion that the people of the world can make a significant increase in food supplies and food values—without cultivating a single additional acre—simply by the reduction of waste.

A second and far more important avenue of approach is that of a more intensive and efficient use of land now being farmed. If several countries with soil regions similar to ours make by 1960 the yield increases considered readily attainable by them in the next ten years, production of food would come close to the standards set up by the FAO survey. On the basis of these estimates, world food needs in 1960 would be not only met, but exceeded, for roots and tubers and sugar; and they would be very nearly met for cereals. These estimates, it should be noted, do not require much of an in-

crease in production in Europe, but they do envision substantial progress in China, India and Russia where soil resources were by no means well utilized in the prewar period. On the basis of a conservative advance in the productivity of existing crop lands, there would still be need for some increase in production of fats and oils and very large increases in fruits, vegetables, meat, and milk.

Regarding this, however, Dr. Salter writes: "There seems little doubt that a general use of high rates of fertilization on soils that will respond, coupled with modern techniques of insect and disease control, a change in land use patterns, selection of the best varieties, flood and erosion control, and adoption of other lesser techniques, would result in even larger increases."

A third avenue of approach would be to increase food production by bringing new lands into cultivation. The Neo-Malthusians contend that the world has very little new soil to cultivate. Pearson and Harper say bluntly, "The requirements of nature for food production are so rigid that thus far man has been able to use only a small proportion of the earth's land surface and has been defeated in most of his attempts to extend his boundaries."

To this, soil experts like Salter and Kellogg reply: "At present only 7 to 10 percent of the total world land area is cultivated. Except for some desert areas, perpetual snow and ice, tundra, and the most rugged mountains, there is virtually no limit to the acreage that can be brought into cultivation." (Salter, "World Soil and Fertilizer Resources in Relation to Food Needs," *Science*, May 23, 1947.)

Specifically, about eleven percent of the land area of the earth is always under snow and ice; four percent is tundra; sixteen percent is in high mountains; and seventeen percent is desert or semi-desert.

Of the remaining 52 percent, we are now cultivating only about a fifth. In other words, some forty percent of the earth's surface that is physically capable of producing food is not now in use. Admittedly, much of this land is too stony or sandy or hilly or salty or too wet for quick use. There are also such problems as the lack of transportation facilities and the necessary rudiments of technical development. Allowing for all these elements, however, very sizeable areas can successfully be brought into cultivation.

Even in the temperate regions, much of the productive land remains to be used, especially in the United States. North of the temperate zone, where there is a large area of soils known as podzols, only about one percent is now in agricultural use. The podzols are located mostly in Russia and Canada. Assuming on the basis of

agriculture in Scandinavia that perhaps ten percent of the podzols can be brought into cultivation, this would add about 300 million acres of new arable land suitable for dairying and cold weather vegetables.

The red soils of the tropics and subtropics in Africa, South America, Central America, Southeastern Asia and the Pacific Islands offer an even larger opportunity. These resources are almost untouched in South America and Africa. Assuming that no more than 20 percent of the unused red soils in these two continents were cultivated, another 900 million acres would be added to the world's farm lands.

Turning now to the great islands of Sumatra, Borneo, New Guinea and Madagascar, it is conservative to assume that at least another 100 million acres of red soils are available as potential farm land.

The total amounts to one billion, three hundred million acres—an increase of about 40 percent over the three billion acres now cultivated. How much food could these new lands be expected to produce? The soil men arrive at estimates by making comparisons with production on similar land that is now being farmed. For the podzol group, they use Finland as a yardstick; for the red soils, they gauge production by experience in the Philippines. It should be noted that use of the Philippines as a measuring rod is on the conservative side, because the agriculture of the islands is comparatively undeveloped.

If these new lands produced according to the agricultural experience of Finland and the Philippines, the food needs of the world in 1960 could easily be met even without any increase in production on lands now in cultivation. But if to the new lands we add a conservative increase in production from present crop land, the world could produce more than twice as many cereals as the estimated need for 1960, more than two and a half times as many roots and tubers, more than five times as much sugar, three and a half times as much fats and oils, considerably more fruits, vegetables and milk, and slightly more meat than the FAO requirements.

It may be objected: These lands cannot be cultivated without extensive use of fertilizer. True, but world supplies of nitrogen fertilizer are limited only by the capacity of plants to manufacture them. As for phosphate and potash, for which we are dependent on natural deposits, presently known world reserves are adequate for from five hundred to two thousand years even at greatly increased rates of consumption.

Other objections: Will it be possible to teach the farmers of the world new agricultural methods? Will it be possible to bring the new lands to which we refer into cultivation? The answer to these questions is at least partially locked in the future, but who can say that it would be more difficult to help the farmers of under-developed areas acquire new agricultural techniques than it would be to make birth control propaganda so effective as to bring about a virtual revolution in the habits and mores of the entire Asiatic world.

Already there is a good deal of evidence that action to change agricultural techniques as well as to open up new land areas can be effective. Since 1939 the United States has been collaborating in joint agricultural programs with the countries of South and Central America. In cooperation with the scientists of these Latin-American countries, we have helped to develop new crops and more efficient methods of producing the old crops. Our specialists have worked in five countries on fibres, rotenone crops, and essential oil crops. Secretary of Agriculture Charles F. Brannan, referring to this program, has said "We have worked on coffee in four countries, on cinchona and cacao in three. We have worked on tea in Peru and have even cooperated in developing a chicken feed for Guatemala."

President Truman in his famous Point Four has urged that this type of program be made available to the free peoples of the whole world to help them produce more of the goods they need to free themselves from hunger and privation.

The experience of the Food and Agriculture Organization offers hope that international cooperation can effectively better world standards of living. Great progress has been made by the FAO in its few years of pioneering. Its membership now includes more than 60 nations.

The FAO works along three principal lines: 1. It provides technical aid to its member governments to help them step up agricultural production. 2. It recommends ways and means for applying knowledge and technical skills to specific problems. 3. It gathers facts on food production and supplies to help its members plan their own food production more intelligently.

It has tackled such problems as controlling rinderpest disease, one of the world's worst plagues of livestock, killing a million cows and waterbuffaloes a year in China alone. FAO technicians found a way to produce rinderpest vaccine cheaply and on a large scale, and last year an extensive rinderpest control project was started in South China.

Many countries in Europe and the Near East are now experimenting with hybrid corn seed, as a partial result of FAO activity.

The Organization, among other things, conducted a school at Bergamo, Italy, to teach hybridizing techniques. Substantial increases in yields have been made, in some instances even greater than the average results in our Corn Belt.

Other FAO projects include nutrition and food management, soil erosion control, reforestation, irrigation engineering, control of rat and insect infestation of stored foods, artificial insemination of livestock, control of tuberculosis in dairy animals, preparation of livestock vaccines, use and repair of farm machinery, and production of fertilizer.

But the problem of food and people, FAO recognizes, is not merely a production problem. Distribution is equally important. Surpluses in one part of the world do not easily find their way to the hungry and ill-clothed in another. The wheat grower in Kansas worries as surpluses depress wheat prices; meanwhile the Indian and the Chinese lie by the roadside dying of slow starvation.

A system of balanced distribution must be substituted for the twin evils of overproduction and underconsumption. This will involve many factors such as improved transportation, the reduction of trade barriers and the distribution of purchasing power.

Some attempts are being made to deal with some of these problems through the FAO, the International Trade Organization and Commodity agreements. Programs of technical assistance to underdeveloped areas may also be expected to help relieve some of these difficulties eventually.

This question of distribution requires more consideration than can be given in this report on production. It will be dealt with in greater detail in a later report.

In the matter of people and food, everything that needs doing can be done by producing, preserving and distributing the latter; but nothing can be gained by reducing or constricting the former. The remedy for poverty and privation is not fewer people, but more production and better distribution. Curtailing population means also curtailing the number of producers. Worse, it means increasing the proportion of older, unproductive people in the population.

The population pessimists err in regarding the problem as almost solely one of land. Food is not produced by land alone, but by land *plus*—plus labor, machinery, fertilizer, research, scientific genius, and other factors. People and people's minds and techniques are themselves wealth and means of further wealth. Thus, the developers of hybrid seed have in effect added millions of acres to the world's productivity; so also the inventors and developers of farm machinery, of insecticides and weed killers, of improved breed-

ing practices for livestock and conservation practices for the land. Curtailing people means curtailing producers of food and the goods that can be traded for food, so that the latter situation is no better but even worse than the former.

It would be the height of folly for humanity to throw up its hands and admit defeat in its battle for food. Even in India and Pakistan, where the food problem is probably more acute than anywhere else on earth, Sir E. John Russell, President of the British Association for the Advancement of Science, writes that there "still remains uncultivated land equal in area to about 70 percent of the cultivated land, some of which can be utilized." And Sir John adds, "More irrigation, more fertilizer, better cultivation and better seed are all being developed." (*Food and People*, Science Service, Inc., Washington, D. C.) Hope for the realization of adequate living standards now is brighter than ever before in history. This is the consensus of the foremost scientists and agricultural leaders.

"I am convinced that we do have the soils we need, we do have the fertilizer resources, we have available the management ability, and we could produce enough food for all." (Robert M. Salter, "World Soil and Fertilizer Resources in Relation to Food Needs," *Science*, May 23, 1947.)

"At the very least, we can do a lot better than we have done so far." (N. E. Dodd, Director-General of FAO, address at National Farm Institute, Des Moines, Iowa, Feb. 13, 1948).

"The possibility of increased food production on lands which are held under cultivation by better utilization of water, through irrigation, by the use of improved varieties, better seed production policies, fertilization, control of insect pests and diseases, and improved cultivation practices is very great." (Dr. L. E. Kirk, Chief, Plant Industry Branch, FAO.)

"The world's forests are capable of supplying the wood requirements of the world's population, even allowing for large increases in consumption." (Marcel Leloup, director, Division of Forestry and Forest Products, FAO.)

"It would be quite a mistake to take a defeatist attitude about the possibilities of the world feeding its people." (F. L. McDougall, counselor, FAO, from a speech before the American Association for the United Nations, New York, March 12, 1949).

"The world problem of feeding an increasing population is not so much a matter of productive soils as it is of developing social institutions to put the soils into production." (Charles E. Kellogg, in speech before American Farm Economic Association, Green Lake, Wisconsin, September 10, 1948.)

"My own conviction, based upon careful estimates of our soil scientists, is that the world *does* have the resources—and most certainly *does* have the know-how—to provide adequate diets for all its population in the foreseeable future." (Secretary of Agriculture Charles F. Brannan, address March 31, 1949, commemorating 100th anniversary of William Jewell College, Washington, D. C.)

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THE CATHOLIC ASSOCIATION FOR INTERNATIONAL PEACE is a membership organization. Its object is to further, in accord with the teachings of the Church, the "Peace of Christ in the Kingdom of Christ," through the preparation and distribution of studies applying Christian teaching to international life.

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