

THE WHITE HOUSE

WASHINGTON

January 19, 1965

TO: Mr. William Connell

Bill:

There is a terrific pressure building up on this population control subject. We have kept an oar in the stream, and I thought the attached might be good for your files. Should the Vice President be called upon to move in this direction, I think we can muster a dozen experts in a matter of hours.


Leon A. Schertler

[Birth Control]

File

November 24, 1964

Birth Control

MEMORANDUM FOR:

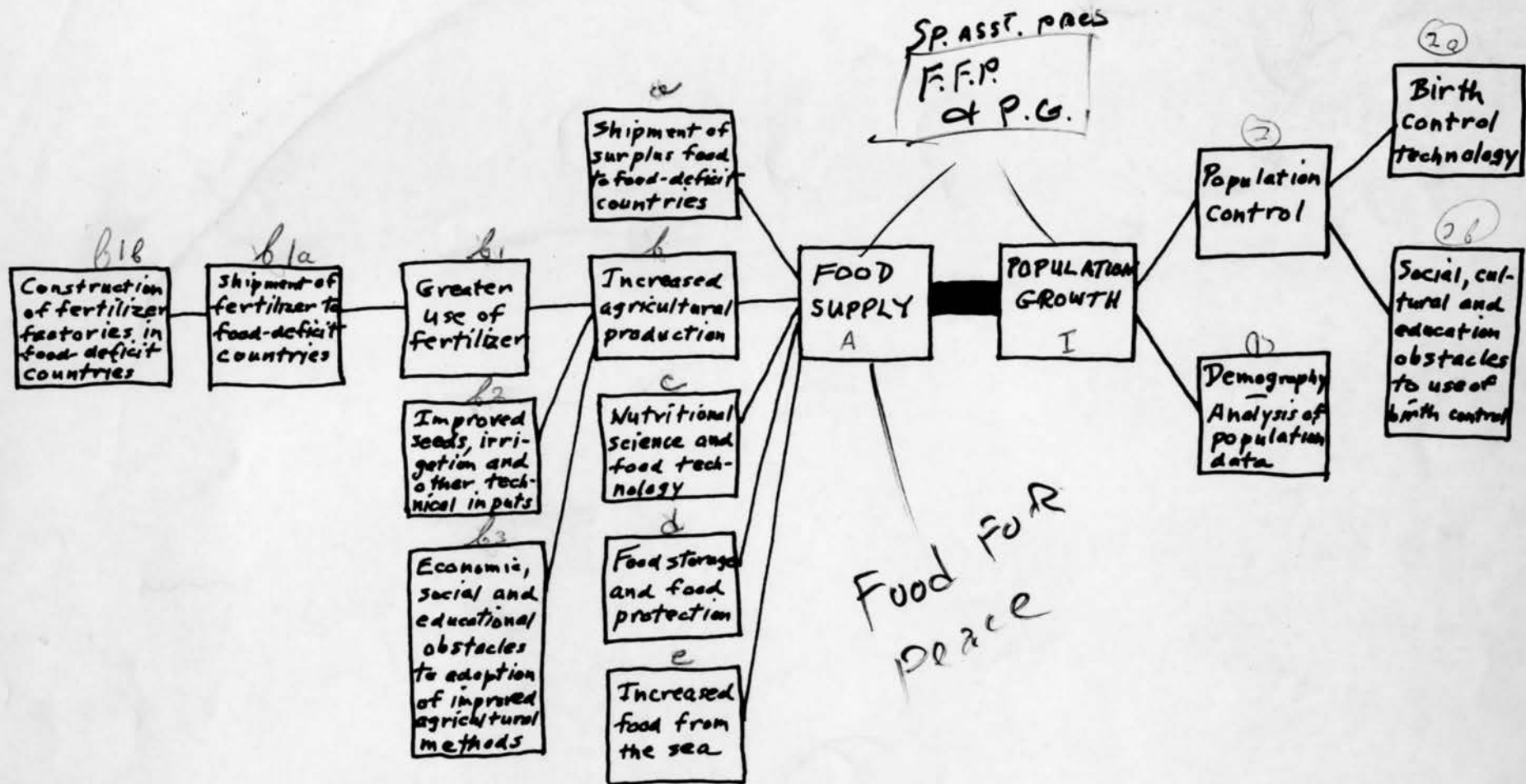
Mr. Bill D. Moyers

Since working in India last spring, I have been both haunted by the problems of the human race and stimulated by the challenge of doing something about them. As Dick has told you, we are moving ahead on nutrition and food development. Orville Freeman is moving fast into the world picture on food needs. On the other hand, the population control problem lacks recognition and coordination. I understand, John Rockefeller III was in town a short while ago and saw Messrs. Rusk and Bundy trying to get a statement on population control in the President's Inauguration message. I also understand Mr. Rockefeller is pushing for a Special Assistant to the President on population control to coordinate the effort, as Dick does in the FFP program. Apparently Mr. Rockefeller believes that if the Government is concerned to such an extent, he can spend enough money to help form public opinion on the subject. Because of certain recognizable problems in going too fast and too far too soon on population control, the President may wish to consider acknowledging the wishes of the scientists, demographers, Rockefellers, etc., by establishing a population control coordinator on his staff through giving this responsibility to the Director, Food For Peace. Human development on a world-wide basis closely relates the food and demographic problems. We are in that job now. Lines of authority and channels of operation already exist in this office. The funds and technicians are available in the various departments and agencies as well as the private sector. The Assistant Director, Food For Peace, a Roman Catholic with six children, would certainly be a "safe" individual to coordinate this effort; keep the President informed, and map the proposed areas of action.

Leon A. Schertler

P.S. With Ray Lamontagne as John D's Executive Assistant, we could easily work with that group and their funds.

Areas for Policy-Making and Action for Combatting the World Food/Population Problem *



* Also, more research needed in all areas

Birth Rates and Death Rates in Selected Countries

<u>ASIA</u>	<u>Year</u>	<u>Birth rate[@]</u>	<u>Death rate[@]</u>	<u>Growth rate % per year 1958 - 62[*]</u>	<u>Life expectancy (male)</u>
Burma	1955	50	35(?)	-	41 (1954)
China	1957	34	11	2.3	-
India	1951-61	41	22	2.3	45 (1957-58)
Indonesia	1962	43	21	2.2	-
Israel	1962	22	6	3.5	71 (1962)
Japan	1963	17	7	0.9	66 (1962)
Pakistan	1962	43-46	16-17	2.1**	-
Philippines	1950-55	50	-	3.2	49 (1946-49)
Taiwan	1962	37	6	3.6	61 (1959-60)
Thailand	1956	42	20	3.0	49 (1947-48)
Turkey	1955	43	11	2.6**	46 (1950-51)
Average for Asia	1958-62	43	20	2.3	-
<u>AFRICA</u>					
Congo (Leopoldville)	1955-57	43	20	2.4	38 (1950-52)
Ghana	1950-55	51	-	-	38 (1948)
Guinea	1955	62	40(?)	3.0	31 (1954-55)
Mali	1960	62	29	3.9	-
Morocco	1962	46	19	3.0	50 (1960)
Nigeria	1952-53	53-57	-	1.9**	-
Rhodesia	1954	45	15	3.3	48 (1953-55)
Tunisia	1962	44	11	1.4**	-
United Arab Rep.	1950-55	45	-	2.6	-
Average for Africa	1958-62	46	23	2.3	-
<u>LATIN AMERICA</u>					
Argentina	1963	22	8	1.6	57 (1947)
Brazil	1953-57	42-45	16-19	3.4	39 (1940-50)
Chile	1962	34	12	2.4	50 (1952)
Colombia	1953-57	44-45	15-17	2.2**	44 (1950-52)
Costa Rica	1963	50	9	4.3	55 (1949-51)
El Salvador	1963	49	11	-	57 (1960-61)
Guatemala	1962	48	17	3.2	44 (1949-51)
Mexico	1963	45	10	3.1	55 (1956)
Paraguay	1953-57	45-50	12-18	2.4**	-
Peru	1953-57	42-48	15-22	-	-
Venezuela	1953-57	44-47	12-15	3.4	-
Average for Latin America	1958-62	41	13	2.8	-

<u>NORTHERN AMERICA</u>	<u>Year</u>	<u>Birth rate@</u>	<u>Death rate@</u>	<u>Growth rate % per year 1958 - 62*</u>	<u>Life expectancy (male)</u>
Canada	1963	25	8	2.1	68 (1955-57)
United States	1963	22	10	1.6	67 (1962)
Average for North America	1958-62	24	9	1.7	-
<u>EUROPE</u>					
Czechoslovakia	1963	17	10	0.7	68 (1960-61)
France	1963	18	12	1.2 [#]	67 (1962)
Germany, West	1963	18	11	0.7	67 (1959-60)
Hungary	1963	13	10	0.4	65 (1959-60)
Italy	1963	19	10	0.6 ^{**}	66 (1954-57)
Netherlands	1963	21	8	1.3	71 (1956-60)
Poland	1963	19	8	1.3	65 (1960-61)
Spain	1963	22	9	0.8 ^{**}	67 (1960)
United Kingdom	1963	18	12	0.8	68 (1960-62)
Yugoslavia	1963	21	9	1.1	62 (1958-59)
Average for Europe	1958-62	19	10	0.9	-
<u>SOVIET UNION</u>	1962	22	7	1.7	65 (1960-61)
<u>OCEANIA</u>					
Australia	1963	22	9	2.1	67 (1953-55)
New Zealand	1963	26	9	2.2	68 (1955-57)

@ Per 1000 of total population.

* Population growth rates for 1958-62 include net migration, which is principally important in the cases of United States, Canada, Australia and Israel. These growth rates are in many cases inconsistent with the birth and death rates, but these are the figures given in UN Demographic Yearbook, Table 1.

** These growth rates appear to be particularly low in comparison with birth rates and death rates.

Abnormal growth rate for France in 1958-62 due to repatriation of people from Algeria.

Source: UN Demographic Yearbook, 1963.

Population Data - 1960-1980

<u>Underdeveloped Areas</u>	Assumed annual growth rate 1960-1980	Population, millions				
		1960	1965	1970	1975	1980
Asia (excl. China and Japan)	2.5%	906	1,025	1,160	1,299	1,486
A Africa	2.5%	257	291	329	373	421
Latin America	<u>2.9%</u>	<u>212</u>	<u>245</u>	<u>283</u>	<u>327</u>	<u>376</u>
Total, excl. China and Japan	2.6%	1,375	1,561	1,772	1,999	2,283
China	<u>2.3%</u>	<u>685</u>	<u>767</u>	<u>860</u>	<u>963</u>	<u>1,080</u>
Total, underdeveloped areas	2.5%	2,060	2,328	2,632	2,962	3,363
<u>Developed Areas</u>						
USA/Canada	1.7%	200	218	237	258	281
Europe	0.9%	426	446	466	487	509
U.S.S.R.	1.7%	214	233	253	275	299
Japan	0.9%	93	97	102	107	112
Oceania	<u>2.2%</u>	<u>17</u>	<u>19</u>	<u>21</u>	<u>23</u>	<u>26</u>
Total, developed areas	1.3%	950	1,013	1,079	1,150	1,227
Total world	2.1%	3,010	3,341	3,711	4,112	4,590

Source: 1960 data from United Nations Demographic Yearbook, 1963.

Assumed growth rates estimated from growth rates during period 1920-1962.

Estimated World Population up to year 2000

Time of Christ	1/4 billion	1920	1.8 billion
1600-1650	1/2 billion	1930	2.0 billion
1830-1850	1 billion	1940	2.2 billion
1930	2 billion	1950	2.5 billion
1960	3 billion	1960	3.0 billion
1973	4 billion*	1970	3.7 billion*
1984	5 billion*	1980	4.6 billion*
1993	6 billion*	1990	5.7 billion*
2000	7 billion*	2000	7.0 billion*

* Calculated on assumption of 2.1% per year growth rate, 1960-2000.

Unless the western world acts fast, Asia, Africa, and Latin America face famine in the 1970's

Famine and Fertilizer

Dr. Raymond Ewell,
State University of New York
at Buffalo

The world is on the threshold of the biggest famine in history. Not the world we live in, but the underdeveloped world, the three poor continents of Asia, Africa, and Latin America.

The populations of these continents are growing rapidly, and the production of food in these continents is lagging the population growth. This is the problem in a nutshell. This is the greatest and most nearly insoluble problem in the history of the world. And it is almost here.

If present trends continue, it seems likely that famine will reach serious proportions in India, Pakistan, and Communist China in the early 1970's. Indonesia, Iran, Turkey, Egypt, Brazil, and several other countries will follow within a few years. Most of the other countries of Asia, Africa, and

Rice. In Asia some 70% of the total food supply comes from grain, largely rice. Here, Red Chinese peasants cultivate rice fields in river-flooded land near Chungking

Marc Riboud—Magnum Photos



Latin America will fall in this category by 1980. Such a famine will be of massive proportions affecting hundreds of millions, possibly even billions, of persons. If this happens, as appears probable, it will be the most colossal catastrophe in history. It would be a completely new situation in the world's history—not enough food for the billions of human beings inhabiting the surface of this globe. This would be the Malthusian Doc-

trine finally coming true after 170 years.

The food/population problem will be the overriding problem of the last quarter of this century. The political and economic consequences of widespread famine in Asia, Africa, and Latin America are certain to be massive and far-reaching. It seems unlikely that stable governments can be maintained in countries where a large part of the population is starving.

The food/population problem seems likely to reach such enormous proportions by 1975 that it will dwarf and overshadow most of the problems and anxieties which now occupy our attention, such as the threat of nuclear war, Communism, the space race, racial problems, unemployment, Berlin, Vietnam, the Congo, Cyprus, Cuba, and the like. These current problems will fade into the background as the enormity of the world food problem impresses itself on the western world.

Population Explosion

Now that we have looked at the over-all picture, let's look at some relevant facts. The populations of Asia, Africa, and Latin America are now growing at rates of 2.5%, 2.5%, and 2.9% per year, respectively. These are their highest growth rates in history, and the rates of growth are still increasing. These high population growth rates are frequently referred to as the population explosion—and it really is an explosion. For example, a rate of 2.5% per year will double the population in 28 years.

The basic cause of the population explosion is the rapid drop in the death rate in Asia, Africa, and Latin America since 1945 as a result of the introduction into these areas of penicillin, DDT, and other modern medical and public health practices. Birth rates have remained practically constant, but death rates have dropped sharply since 1945.

Therefore, the population explosion is a new phenomenon—it has been a real explosion only since the end of World War II. Population growth rates were much lower before World War II—for example, 1.2% in both Asia and Africa in 1930–40, and 1.9% in Latin America during the same period. Before 1930 they were even lower. In fact, population growth rates above 1% per year were rare anywhere in the world before the 20th century.

Demographers have projected a growth in population of Asia (excluding China and Japan), Africa, and Latin America rising from 1.4 billion in 1960 to 2.3 billion in 1980. This is a minimum increase, in my opinion, because the population growth rates are still increasing. Should such an increase occur, the population in these three continents

would increase by some 900 million people in only 20 years. This is a stupendous figure—900 million is a lot of people and 20 years is not much time in which to solve the many problems 900 million more people will bring with them. If China is included in this forecast, the population growth from 1960 to 1980 would be 1.3 billion. In the rest of this article China is excluded from the discussion because (1) it is on the other side of the ideological fence, and (2) we have little demographic or economic information on China. Japan is excluded from the discussion, also, because economically Japan is about the same as a European country.

The contrast in birth rates, death rates, and apparent population growth rates in major areas of the world between the developed and underdeveloped areas is striking. Particularly significant is that the underdeveloped areas with birth rates of 41 to 46 per 1000 still have death rates as high as 12 to 23 per 1000. This indicates the probability of further declines in the death rates with consequent increases in population growth rates, particularly in Asia and Africa. The birth rate is an irresistible force which is unlikely to change appreciably for 15 years or more.

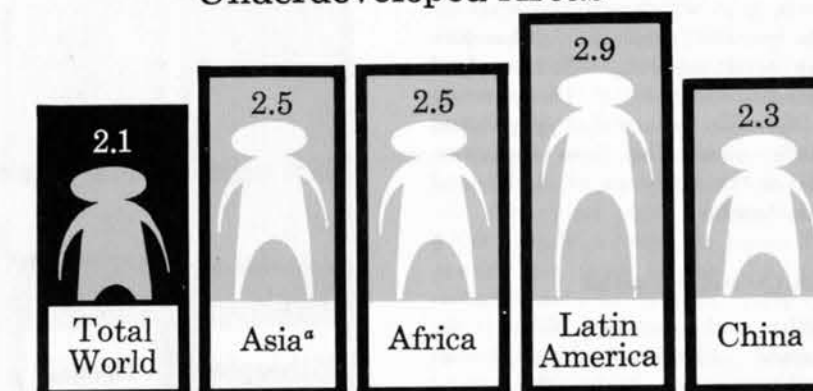
The production of food in Asia, Africa, and Latin America has remained approximately constant for the past three or four years, and there is no social or economic development on the horizon that seems likely to increase food production in these continents enough to feed 900 million more people by 1980. In Asia the annual production of grain has remained constant at about 150 million tons since 1960 so that the per capita production of grain has declined from 16 ounces per day to 15 ounces per day during the past three years. In Latin America the annual production of grain has remained constant at about 42 million tons since 1958 so that the per capita production of grain has declined from 21 ounces per day to 18 ounces per day. Africa has had a small increase in grain production so that per capita production has remained at 15 ounces per day for the past seven years.

Grain is, of course, not the only food, but it is the big staple and supplies a large portion of the food in these three continents—70% in Asia, 45% in Africa, 40% in Latin America. Potatoes, yams, and cassava supply an

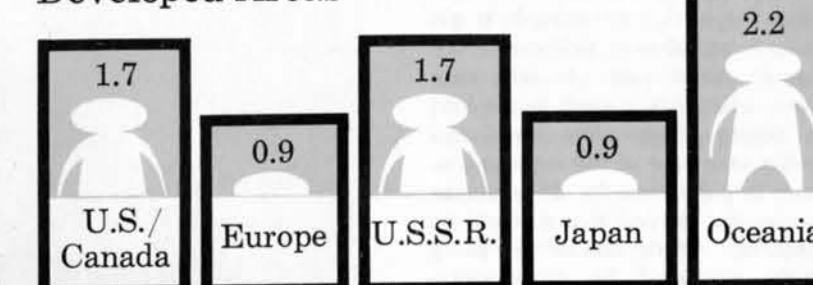
Projected growth rates through 1980 for underdeveloped areas are almost double those for developed areas

Growth rate in per cent

Underdeveloped Areas



Developed Areas



^a Excluding China and Japan

Note. Growth rates are estimated from an analysis of 1920-62 growth rates.

Source: United Nations Demographic Yearbook, 1963

additional large percentage in Africa and Latin America.

Greatest Famine of All Time

If these trends continue for a few more years, famine will inevitably result. And this would be famine on a scale never before experienced in the world's history. There have been many famines in history involving millions of people, but none involving hundreds of millions of people. Moreover, in past famines many people have died of disease as well as of starvation. Now modern medicine keeps people alive even though starving, and they still compete for a share of the inadequate food supply.

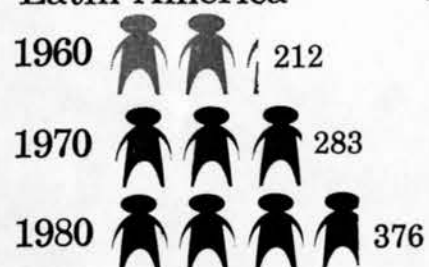
Not only will the forthcoming famine be widespread, affecting hundreds of millions of people, but it will be persistent and will probably get worse

year by year, unless ways and means are soon found to increase agricultural production. It is hard for us sitting in rich, comfortable, overfed America to realize that the greatest disaster in the history of the world is just around the corner. The efforts now being put forward by governments and private agencies to try to avert this disaster are much too small to cope with a problem of this magnitude.

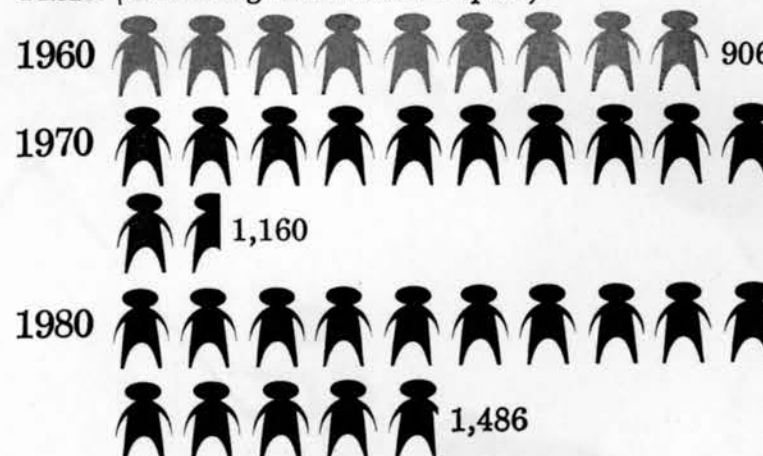
The countries of Asia, Africa, and Latin America vary considerably in their vulnerability to famine. India and Pakistan are undoubtedly the most vulnerable. These two countries will feel the brunt of the world famine first. China may be equally vulnerable, but we have little reliable data on the food situation there. Next in vulnerability come Indonesia, Iran, Turkey, Egypt, Brazil, and a few other countries. These countries have

In 20 years the populations of Latin America, Asia, and Africa may increase by 75%

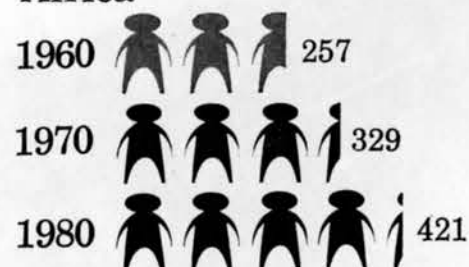
Latin America Population figures in millions



Asia (excluding China and Japan)



Africa



Note. Data are based on an assumed rate of increase of 2.5% per year for Asia and Africa and 2.9% per year for Latin America for 1960-80. Source: United Nations Demographic Yearbook, 1963

high population growth rates of 2.0 to 3.5% per year and population growth is already outrunning food production. Some Asian countries such as the Philippines, Burma, Thailand, Malaya, and Taiwan seem to be relatively secure against famine now, but they all have very high population growth rates which will soon soak up their present surpluses. Therefore these countries, too, will have food shortages within 10 to 15 years unless they can reduce their population growth rates. The same applies to most of the countries of Africa and Latin America.

Birth Control or Famine

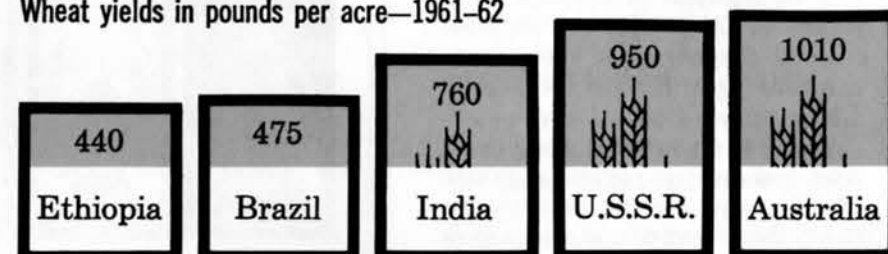
What is the answer? What is the solution? There are three obvious possible answers: Reduce the population growth rate or increase agricultural production, or both. Reducing the population growth rate means reducing the birth rate since it is not socially acceptable to deliberately increase the death rate. In fact, birth control is the only answer in the long run. Improved agriculture could conceivably take care of the expected increases in population for 20 or maybe 30 years, but beyond that it would be impossible. Birth control is being actively promoted by governments and by private groups in most countries in the world today, but it is moving slowly in Asia, Africa, and Latin America and seems unlikely to cause any marked decrease in the birth rate before the 1980's. But ultimately, birth control is the only answer.

Widespread use of birth control is a basic social and cultural change which is certain to occur slowly in these countries. Birth control moved ahead very rapidly in Japan in 1948-55, but Japan has an educated, disciplined populace, whereas most of the underdeveloped countries do not. Oral contraceptive pills are probably not the answer in the underdeveloped countries for reasons of both cost and illiteracy. The most promising contraceptive method for these countries is the plastic intrauterine devices such as the Lippes loop and the Margulies coil. These devices are now being used in more than 25 countries of Asia, Africa, and Latin America, as well as in the U.S., Europe, and Japan. However, mass application in Asia, Africa, and Latin America is likely to be slow.

Increasing agricultural production

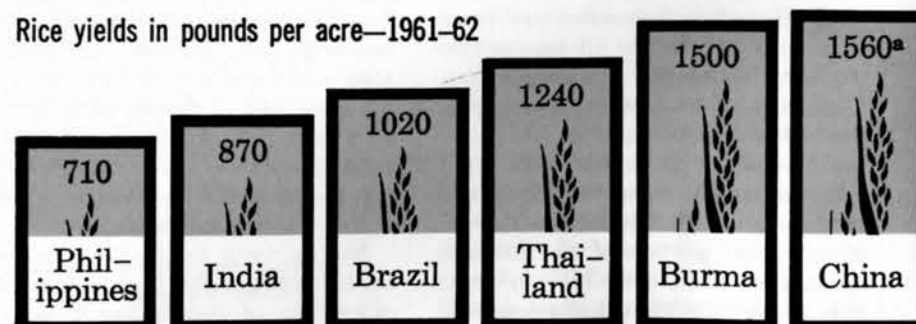
Technological advancements
make possible the doubling or tripling
of grain production . . .

Wheat yields in pounds per acre—1961-62

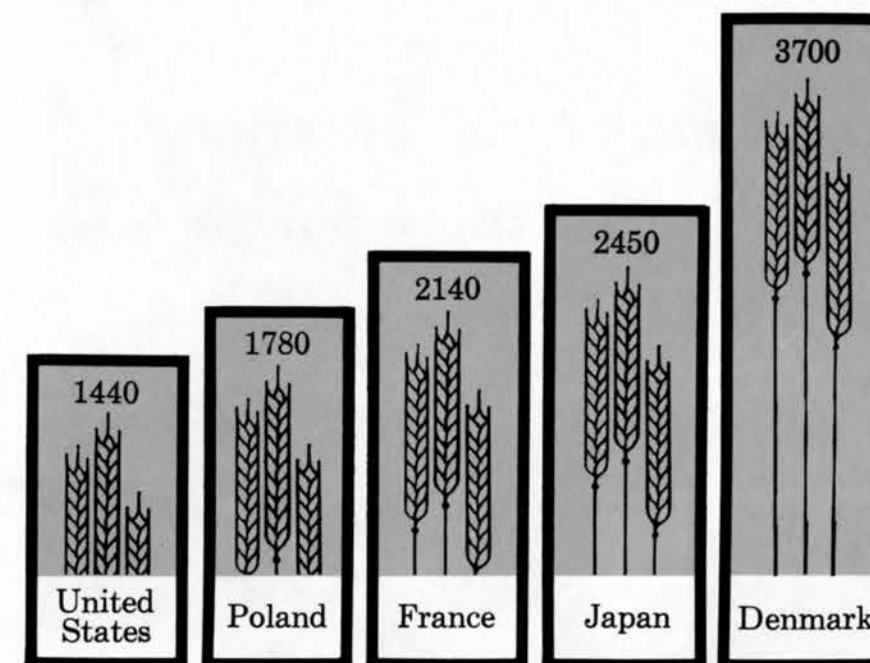


. . . in underdeveloped areas,
where grain is a major item
in the food budget

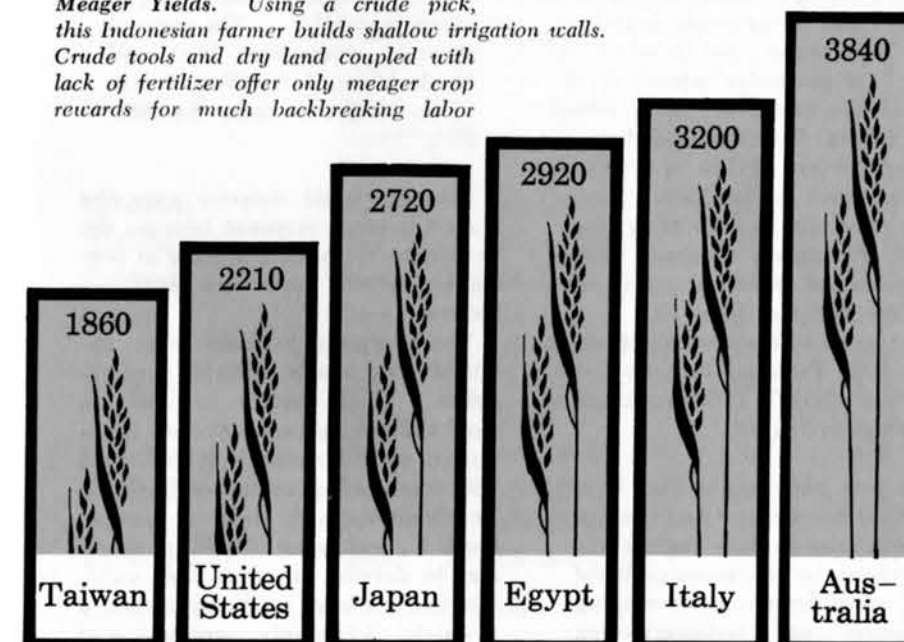
Rice yields in pounds per acre—1961-62



^aFigures are for 1960-61. Note. Rice is milled rice which equals paddy rice times 0.65.



Meager Yields. Using a crude pick, this Indonesian farmer builds shallow irrigation walls. Crude tools and dry land coupled with lack of fertilizer offer only meager crop rewards for much backbreaking labor



Source: United Nations, Food and Agricultural Organization Production Yearbook, 1962

is, therefore, the only real possibility of averting world famine in the 1970's and 1980's. It is technically possible to double or even triple agricultural production in all of Asia, Africa, and Latin America through the use of more fertilizers, more irrigation, better seed varieties, more pesticides, and other improved agricultural practices. For example, the rice yield in Italy is 3200 pounds per acre, in Japan 2720 pounds per acre, in the U.S. 2210 pounds per acre, in China 1600 pounds per acre, but in India only 900 pounds per acre. For another example, the wheat yield in Denmark is 3700 pounds per acre, in Japan 2450 pounds per acre, in the U.S. 1440 pounds per acre, but in India only 760 pounds per acre. Other basic food crops, such as corn, potatoes, beans, peanuts, cassava, bananas, and sugarcane show similar pictures. Many countries such as Pakistan, South Africa, Brazil, Ethiopia, and the Philippines have crop yields as low as or even lower than India. This comparison of crop yields gives an indication of the potential for increasing crop yields in the low productivity countries.

Social Change vs. Farm Technology

There is no doubt that agricultural productivity could be raised greatly in any country in the world—if there were time. But time is the crux of the problem. The use of improved agricultural methods represents a basic social and cultural change, and social change is a slow process. Most of the farmers of Asia, Africa, and Latin America are totally illiterate—they can't read or write or add numbers nor do they understand the elements of plant biology. Under these conditions, the introduction of scientific agriculture into Asia, Africa, and Latin America is likely to be a slow process. In fact, the social, cultural, and educational factors, not the technical factors, are the real bottlenecks in improving agriculture in these countries.

If the population would remain constant for 30 or 40 years, agriculture could change gradually and begin to supply a more adequate diet. Instead the population of these three continents will probably double in the next 25 to 30 years. Where will the food come from to feed 2 billion more people in Asia, Africa, and Latin America by 1990?

Planting. Farmer in Ceylon follows ancient tradition in sowing rice

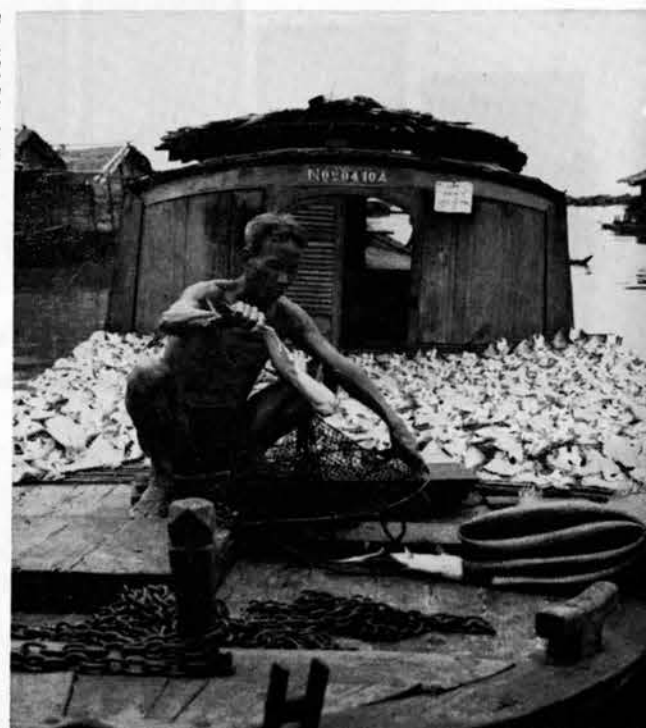
Agricultural output can best be raised by increasing fertilizer use

Fish. Probably no more than 3% of the protein used world-wide comes from fish.

Yet, in some areas split, salted, and sun-dried fish, such as are being readied on this fishing boat in Cambodia, are an important adjunct to the local diet



Trials. Widely dispersed experiment stations, such as this government rice station in Malaya, test and recommend seed varieties and fertilizer programs to local farmers. Here, water buffalo are used to plow the test paddies



Of the various technical factors, increased use of fertilizer offers the best possibility for a quick increase in agricultural production. Field trials in many countries have established that moderate applications of fertilizer will give large increases in yields even if other technical inputs such as seed varieties and water supply are left unchanged. For example, the FAO Freedom from Hunger Campaign has recently completed a series of 9500 fertilizer demonstrations and field trials in 14 countries (Turkey, Syria, Lebanon, Morocco, Nigeria, Ghana, Senegal, Togo, Colombia, Ecuador, Guatemala, Honduras, Costa Rica, and El Salvador). The trials included many crops such as wheat, barley, rice, corn, beans, cotton, potatoes, yams, sugar beets, peanuts, and vegetables. These trials established beyond doubt that substantial increases in yields can be obtained by the use of moderate dosages of fertilizers even if no other technical factors are changed.

Similar trials have been conducted

in India, Pakistan, Taiwan, the Philippines, Mexico, and other countries.

The dosages in these tests ranged from 45 to 135 kilograms of plant nutrient per hectare (40 to 120 pounds per acre) and the increases in yield of grains and beans vary from 30 to 120%. Of particular interest is the fact that the value/cost ratios varied from 2.3 to 7.0, corresponding to economic returns of 130 to 600% on the investment in fertilizer. Similar results were obtained for other crops. In fact, the highest economic returns were obtained from potatoes with value/cost ratios of 10 to 13.

The report of the seventh Meeting of the FAO Fertilizer Industry Advisory Panel, July 7, 1964, summarizes its findings as follows:

"We now have results from over 9500 demonstrations and trials in 14 countries in three regions. . . . There can be no manner of doubt that when farmers in developing countries use fertilizers—even without other improved farming

methods—the results will be good. . . . The average response to the best [most economic] treatments, for all countries, crops, and seasons was 74% [increase in yield]. . . . The regional averages were Near East and North Africa, 54%; West Africa, 72%; Northern Latin America, 95%."

Northern Latin America gave the highest average response because the trials there included a number of vegetables which gave very high responses.

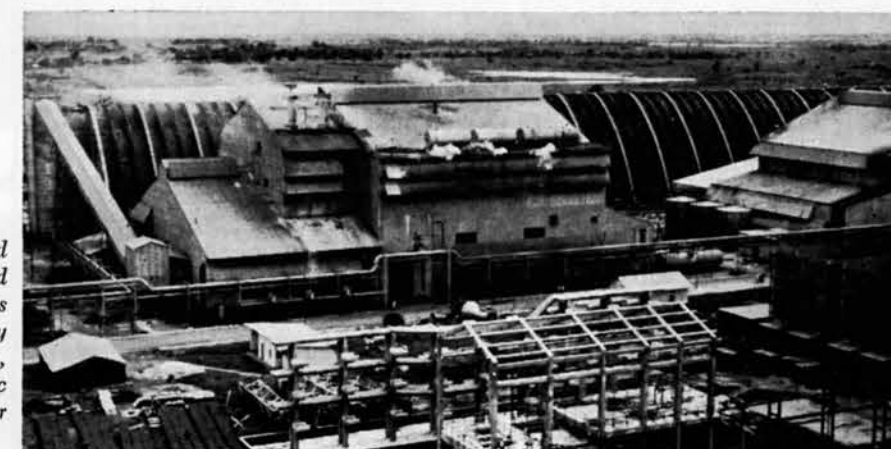
The increases in yield were obtained using locally available seed varieties. Much greater increases in yield could have been obtained if improved seed varieties had been used with increased quantities of fertilizer. To obtain the high yields of Europe, the U.S., and Japan, it will be necessary to develop improved seed varieties, but this takes years of painstaking research. Ultimately, improved seed varieties will have to be used widely



Corn Harvesters. In Latin America grain accounts for about 40% of the total food supply. However, since 1958 grain production has declined from 21 to 18 ounces per day per capita. Here, Peruvian corn harvesters bend under their unwieldy bundles

Sergio Larrain-Magnum Photos

Fertilizer. Efforts to build fertilizer capacity in underdeveloped countries are well under way. This plant at Sindri, India, is probably the largest fertilizer plant in Asia, having a capacity of 140,000 metric tons of ammonia per year



With No Other Changes in Farming Methods, Proper Fertilizer Use Brings Increased Crop Yields

Country	Crop	Dosage kg./hectare (N-P ₂ O ₅ -K ₂ O)	Per Cent Increase in Crop Yield	Value/ Cost Ratio ^a
Turkey	Wheat	40-60-0	73%	2.5
	Corn	40-40-40	85	2.8
Morocco	Wheat	30-60-40	75	3.0
	Barley	30-60-40	91	2.5
	Beans	20-60-40	78	2.3
Lebanon	Wheat	20-25-7.5	101	7.0
Nigeria	Rice	22.4-22.4-0	30	4.0
Senegal	Rice	45-0-0	73	3.3
Ghana	Corn	44.8-0-0	120	3.3
	Rice	22.4-22.4-0	52	3.3
Ecuador	Corn	0-45-45	94	6.3
	Beans	0-45-0	93	2.2
Honduras	Corn	45-45-45	120	4.8
Costa Rica	Rice	45-45-45	80	4.5
	Corn	45-45-45	70	4.0
El Salvador	Beans	45-0-0	50	4.0

^a Value of additional crop obtained/cost of fertilizer

Source: Review of Trial and Demonstration Results, 1961/62, FFHC Fertilizer Program, FAO, United Nations, January 1964



Training. Instructors from the United Nation's Food and Agricultural Organization train local technicians, such as these Congolese students, in the proper techniques for operation and maintenance of farm machinery

in Asia, Africa, and Latin America to meet the food needs, but this will also be a slow process, and it seems unlikely to have a massive effect in the 15 years between now and 1980.

One very promising development has been the establishment of the International Rice Research Institute in the Philippines by the Ford and Rockefeller Foundations in 1962. Also, the work of the Rockefeller Foundation in developing improved varieties of wheat and corn in India and Latin America is of the highest importance.

However, fertilizer seems to offer the best possibility of a substantial increase in agricultural production between now and 1980. The other technical inputs in agriculture probably cannot be brought into action on a sufficiently massive basis fast enough to play a major role. Improved seeds, increased irrigation, pesticides, and all other technical inputs must be utilized to the fullest extent possible, yet it should be recognized that the principal means of raising agricultural productivity in Asia, Africa, and Latin Amer-

Rate of population growth in underdeveloped areas exceeds rate in developed areas . . .

. . . and the difference, at least for the next 20 years, should grow even more striking

* = 5 births per 1000 population (1958-62) + = 5 deaths per 1000 population (1958-62)

Underdeveloped Areas

Asia (excluding China and Japan)	* * * * *	44
	+ + + + +	21
Africa	* * * * *	46
	+ + + + +	23
Latin America	* * * * *	41
	+ + + + +	13

Developed Areas

U.S./Canada	* * * * *	24
	+ + + + +	9
Europe	* * * * *	19
	+ + + + +	10
U.S.S.R.	* * * * *	24
	+ + + + +	7
Japan	* * * * *	17
	+ + + + +	8
Oceania	* * * * *	24
	+ + + + +	8

Population changes due to net migration must be added to (or subtracted from) the apparent natural growth rate. These changes are very small except in the U.S., Canada, and Oceania.

Source: United Nations Demographic Yearbook, 1963

ica in the critical next 15 years will have to be fertilizer.

Minimum Goals

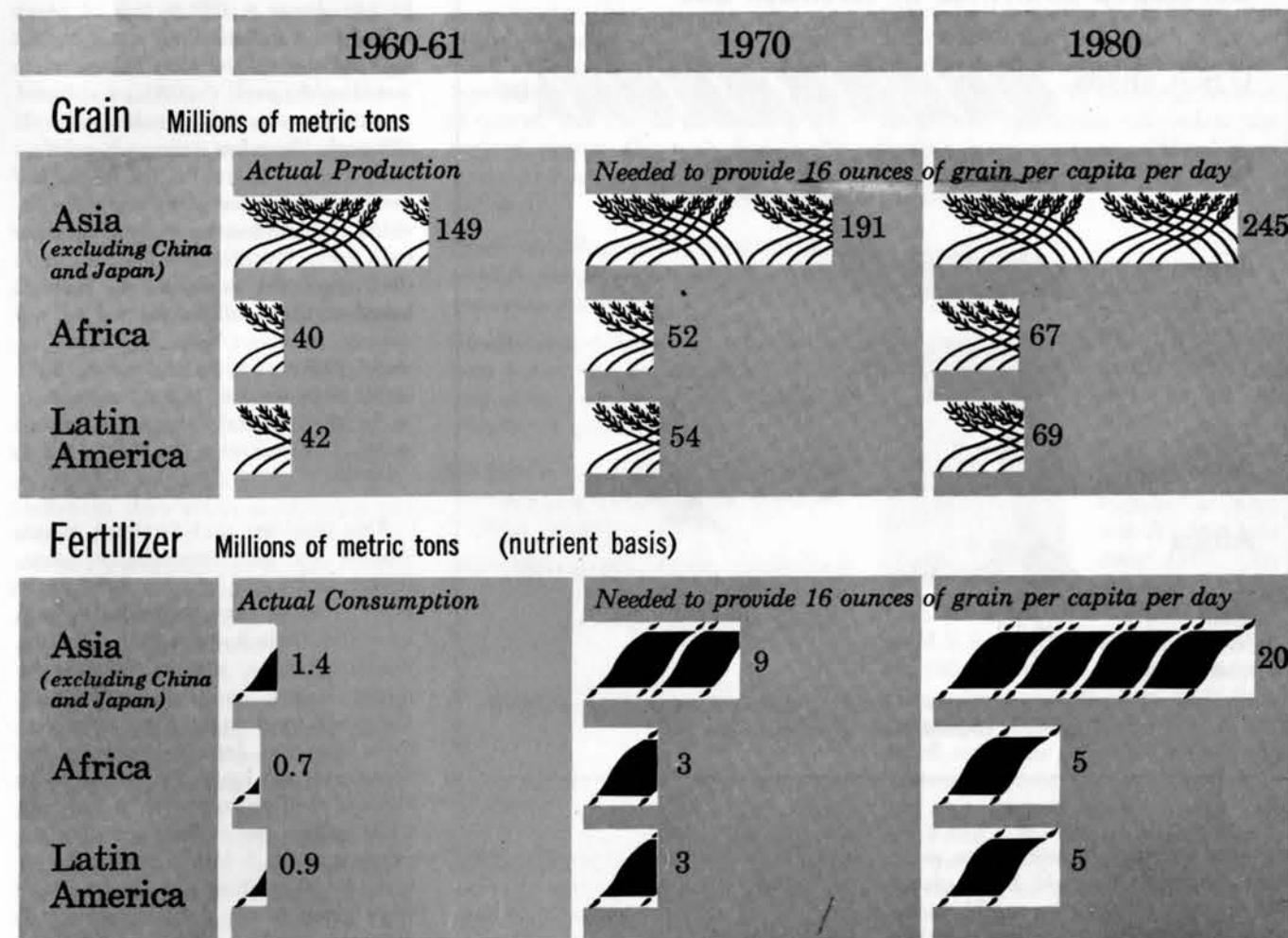
How much fertilizer will it take? What facilities will be needed? How much will it cost? How will the fertilizer be distributed and applied to the soil?

As a minimum goal, let us assume that agricultural production should be increased enough to provide 16 ounces of grain per person per day in Asia, Africa, and Latin America in 1970 and also in 1980. This is the present level of consumption, so the minimum goal suggested is simply maintaining the present nutritional level, inadequate as it is. Everyone with any humanitarian instincts would like to see the diet of the underdeveloped areas improved, but this is virtually impossible until the birth rate is reduced substantially. The underdeveloped countries will be pushed to the limit to maintain the present diet even with maximum help from the developed countries. The people of Asia, Africa, and Latin America ask only for enough rice, wheat, corn, and beans. Foods like meat, fish, eggs, and milk are beyond the reach of most of the people of these lands now and are likely to be even less available in the future as the populations continue to increase.

To provide 16 ounces of grain per day for the 400 million additional population of these continents in 1970 would require 15 million tons of plant nutrients, compared with consumption of 3 million tons in 1960-61. Consumption is probably about 4 million tons in 1963-64. To feed the 900 million additional population in 1980, 30 million tons of plant nutrients would be required. These figures were calculated on the basis that one ton of plant nutrient results in 8 tons of additional grain and that two thirds of the fertilizer would be used on grain, one third on all other crops. The over-all tonnages of 15 million tons in 1970 and 30 million tons in 1980 compare with total world consumption of 30 million tons in 1962-63. Also for comparison, the current big Soviet fertilizer push has a target of 16 to 20 million tons of plant nutrients in 1970 (80 million tons gross weight of fertilizer).

To emphasize this point further, I am willing to put myself on record that if Asia, Africa, and Latin America are

To provide Asians, Africans, and Latin Americans with a minimum diet through 1980, grain production there will have to double, fertilizer use increase about 10 times



not using quantities of fertilizer approaching 30 million tons by 1980, they are almost certain to be engulfed in widespread famine.

The consequences of the population explosion have been discussed and analyzed in theoretical terms for a decade now, but the time for theory is nearing an end and the time for action is here. There has been too much talk and theorizing about how to solve the world food crisis in the year 2000 when the beginnings of the crisis are probably only five or six years away.

Of the requirements we have been discussing, it is important to keep in mind the dominant place of India. India, with a 1961 population of 440 million, is about one third of the underdeveloped world. The rest of Asia—Pakistan, Indonesia, the Philippines, Turkey, Thailand, Burma—with

a 1961 population of about 475 million is another one third. Africa and Latin America each constitute one sixth of the underdeveloped world.

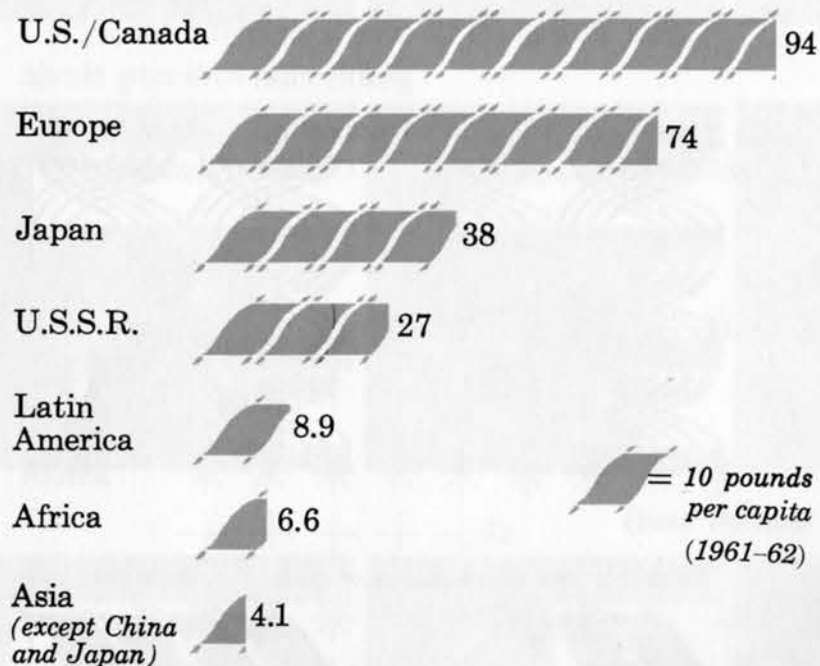
The immediate problem is how can the countries of Asia, Africa, and Latin America obtain a supply of 15 million tons of plant nutrients by 1970 and 30 million tons by 1980. Domestic production of fertilizer in all three continents together is about 1.5 million tons in 1963-64 and a good estimate for 1970 production would be 3 to 4 million tons. Production in 1970 might be increased to 5 to 6 million tons by a new crash program of fertilizer plant construction, but generally speaking it is already too late to increase production greatly by 1970. I believe, therefore, that most of the fertilizer needed by Asia, Africa, and Latin America in 1970 will have to be

imported from the industrialized countries. Some countries would have the foreign exchange to buy the fertilizer they need through commercial channels, but most countries would have to rely on foreign aid.

Self-Sufficiency by 1980

For the longer term in 1980, most countries should plan to become largely self-sufficient in fertilizer production—at least the larger countries. In round numbers, fertilizer plants cost about \$1 billion per 6 million tons of annual production of finished fertilizer (on a plant nutrient basis). Therefore, enough fertilizer plants to produce 30 million tons of fertilizer would cost about \$5 billion—10% of the cost of putting a man on the moon. If 30 million tons of fertilizer were

Latin America, Africa, and Asia trail far behind developed countries in fertilizer use



Source: United Nations, Food and Agricultural Organization Yearbook, 1962

produced and used in Asia, Africa, and Latin America, it would be a giant step toward solving the world food problem in 1980. Historians of the future may remark on whether it was more important to have devoted our resources during the 1960's to putting a man on the moon or to have devoted our resources toward averting the world famine of the 1970's.

Total world fertilizer production should be approaching at least 100

million tons of plant nutrients in 1980 compared with 30 million tons at present. The western world (including Japan) is now producing about 25 million tons and will probably increase to 50 to 60 million tons by 1980. The Soviet Union now produces about 4 million tons and is planning for 30 million in 1980. Asia, Africa, and Latin America will need 30 million tons in 1980, which hopefully they may get from their own production or from the

western world. China is producing less than 1 million tons now, but it is reported to be planning a large increase.

The aggregate construction cost of \$1 billion per 6 million tons of plant nutrients was based on a N-P₂O₅-K₂O ratio of 2-1-0.75. This was selected as the ratio that Asia and Latin America appear to be heading toward, although Africa has a somewhat different pattern. Therefore, the 30 million tons postulated for 1980 would be divided 16 million tons N, 8 million tons P₂O₅, 6 million tons K₂O. Also, the aggregate construction cost is based on these estimates:

- Per 100,000 tons N, \$20 to \$25 million.
- Per 100,000 tons P₂O₅, \$8 to \$12 million.
- Per 100,000 tons K₂O, No processing needed.
- Per 100,000 tons mixing capacity, \$1 to \$1.5 million.

The fertilizer and fertilizer plants needed by the countries of Asia, Africa, and Latin America will largely have to come from the industrialized countries, including the U.S., Canada, western Europe, eastern Europe, the Soviet Union, and Japan. In fact, these will have to be given largely to these countries for the simple reason that they don't have any money. The value of the fertilizer would be roughly \$150 million per million ton of plant nutrient in the 2-1-0.75 ratio. Therefore, if 10 million tons of fertilizer were given to the needy countries in 1970 this would be worth \$1.5 billion.

Such a foreign aid program could be carried out through a series of bilateral agreements or it might be carried out more efficiently through a multilateral program. For example, such a program could be carried out through an International Fertilizer Supply Agency set up to handle the

distribution of foreign aid fertilizer for all the industrialized countries.

Likewise the fertilizer plants would have to be given to the needy countries in the form of foreign aid. As already noted, about \$5 billion worth of fertilizer plants are needed by all the countries of Asia, Africa, and Latin America by 1980. The product from \$5 billion worth of plants would have an annual market value of about \$4 billion.

Even after the quantities of fertilizer we have been discussing became available, there would still be a big educational job ahead to get farmers to use the fertilizer. This would require an extensive and intensive propaganda campaign together with adequate economic incentives. The countries of Asia (except Japan, of course), Africa, and Latin America do not have enough agricultural specialists in their own countries to put over such a program. Therefore, the western world and Japan would have to supply thousands of agricultural specialists if an intensified fertilizer program were to be successful.

The oceans offer a possibility of increased food production, but capital costs are high and the realistic potentials are generally overestimated. Total food from the sea, including both fish and vegetable matter, provides less than 1% of the total calories consumed in the world today, although fish may provide as much as 3% of total protein consumed. On the face of it the possibility of food from the sea playing a major role in feeding the hundreds of millions of additional human beings during the next 10 to 15 years does not seem realistic. Moreover, the capital investment required per unit of additional food from the sea is much higher than in conventional land agriculture.

Programs for Action

To recapitulate then, there are several programs which need to be carried out concurrently to avert, or at

least to alleviate, the impending food crisis in Asia, Africa, and Latin America:

Program. Shipment of surplus food from food-surplus countries to food-deficit countries.

Significance. This is now being done, of course, and will be particularly important during the next five to 10 years, and will probably continue indefinitely.

Program. Shipment of fertilizer from fertilizer-surplus countries to fertilizer-deficit countries.

Significance. Important during the next five to 10 years, but should be replaced by indigenous manufacture of fertilizer as soon as possible.

Program. Expansion of fertilizer manufacturing industry in fertilizer-deficit countries.

Significance. Should be accelerated as rapidly as possible and will be particularly important in the 1970's and 1980's.

Program. Reduction in birth rate and population growth rate in food-deficit countries.

Significance. Food-deficit countries should make plans to reduce the birth rate to less than 20 per 1000 and the population growth rate to less than 1% per year, as Europe and Japan have already done. This is the only ultimate solution to the food/population problem.

The developed countries will have to give major assistance to the underdeveloped countries if this great food problem is to be solved. The underdeveloped countries simply cannot do it on their own resources. The alternative will be widespread famine and political instability on a scale unprecedented in the world's history.

We have been considering some far-reaching and very complex problems. I am sure that greater use of more fertilizers is the most promising ap-

proach to solving the world food problem, at least in the relatively short term of 10 to 15 years. Without a great deal more fertilizer, the people of Asia, Africa, and Latin America are going to be much hungrier in the 1970's than they are now. Thomas Malthus has had many deprecators in the past, but it looks as though he may be proved right after all—unless the world's resources are mobilized soon and effectively.



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This article is based on a talk that Dr. Ewell gave at a luncheon meeting of the Division of Fertilizer and Soil Chemistry held during the 148th National Meeting of the American Chemical Society in Chicago, Ill.

Per Capita Use of Fertilizer in Latin America, Africa, and Asia Lags Rest of the World—1962-63

(thousands of metric tons of plant nutrients)

	Oceania	U.S./Canada	Europe	Japan	U.S.S.R.	Latin America	Africa	Asia
Nitrogen (N)	50	3,554	4,920	669	1,070	356	400	1,181
Phosphorus (P ₂ O ₅)	890	2,937	4,830	465	853	323	310	405
Potash (K ₂ O)	90	2,291	4,880	506	826	219	100	194
Total nutrients	1,030	8,782	14,630	1,640	2,749	898	810	1,780
Population, millions (1962)	17.2	206	434	95	221	224	269	952
Nutrient, lb./capita	132	94	74	38	27	8.9	6.6	4.1

Note. Excluding China and Japan.

Source: FAO Production Yearbook, 1963

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