ASIAN FOOD REQUIREMENTS: A REVIEW

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In order to establish the adequacy—or inadequacy—of food supplies currently available to Asian countries, it is first necessary to establish basic minimum human requirements. In this respect, the standards most frequently referred to over the past decade are those laid down by the F.A.O.'s Committee on Calorie Requirements in 1949.[1] Since frequent reference will be made to these standards, the nature of the specifications involved should be clearly understood.

Since energy, in the form of calories, is expended at markedly different rates according to age, sex, body weight, type of activity and environmental temperature, this Committee recognised the need to specify the nature and habits of the individual for whom basic minimum requirements were to be specified. "Reference Man", as this individual has come to be known, was defined as a 25 year old male weighing 65 kg., living in an area with mean annual temperature of 10°C. His daily pattern of activity was assumed to involve eight hours in a non-sedentary occupation with only occasional periods of hard physical labour, plus 1½ hours work on household chores (or their equivalent), and an additional 1½ hours walking or similar light recreational activity. The balance of each day was assumed to be given over to eating, sleeping, sitting and talking. Reference Man, as defined, was stated to require an annual average of 3200 calories daily in order to ensure maintenance of health and neither loss nor gain in body weight.[2] Subsequent clinical work has shown that maintenance of this pattern of activity on a per capita daily intake of 2200 calories, even for only a few months, leads to a marked loss in body weight.

In its Second World Food Survey,[3] the F.A.O. carried its Reference Standards a step further. After taking into consideration variations in age and sex composition, body weights and environmental temperature, minimum calorie requirements were specified for a number of individual countries, in Asia ranging from 2230 calories per capita in the Philippines to 2330 calories in Japan. Weighting these requirements by population in each Asian country,[4] the minimum per capita requirement for Asia as a whole was assessed at 2300 calories per day.

Next to calories, protein in the diet is the most essential nutritional requirement. Although protein deficiency is not likely to be marked where minimum calorie requirements are met, the source—as well as total protein consumed—is also an important element in nutrition. Although some protein of animal origin is essential, protein from pulses

[1] F.A.O. *Report of the Committee on Calorie Requirements,* June, 1950.

[2] Even in a permanent state of rest, Reference Man would probably require about 1200 calories per day to avoid loss of weight. On the other hand, anyone subjected to a long period of under-nutrition would require somewhat less for body maintenance—possibly up to 30 per cent less, depending on the surface area of the body involved.

[3] F.A.O. *Second World Food Survey,* Rome, November 1952.

[4] "Asia" is throughout this paper regarded as the area bounded by West Pakistan, Mainland China, Japan and Indonesia.

or legumes is also an effective supplement to that in grains, and is particularly important where protein of animal origin is limited. The F.A.O. Committee on Nutrition therefore specified, for all countries, a minimum of 60 grams of protein per capita per day, including at least 7 grams of animal origin and 17 grams from pulse and animal sources.

When measured against these specified minimum requirements, the calorie and protein deficiency in Asian countries in 1949/50 was indeed serious.

TABLE 1

Per Capita Food Supplies: Selected Asian Countries[5]

Country	Year	Calories (per capita per day). Consumption	Calories (per capita per day). Apparent Deficit	Protein (grams per capita per day) Animal Origin	Protein (grams per capita per day) Pulse Origin	Protein (grams per capita per day) Total	Protein (grams per capita per day) Apparent Deficit
Japan	1949/50	2100	230	8	1	53	7
	1960/61	2240	90	18	N.A.	68	—
Taiwan	1948/50	1980	320	14	N.A.	56	4
	1959/60	2310	—	8	N.A.	43	17
Philippines ..	1949/50	1960	270	10	2	44	16
	1960/61	1950	280	15	N.A.	49	11
India	1949/50	1700	550	6	10	44	16
	1957/58} 1958/59}	1860	390	6	N.A.	50	10
Pakistan	1949/50	2020	280	11	7	52	8
	1959/60	2080	220	7	N.A.	48	12
Ceylon	1949/50	1970	300	6	9	39	21
	1960/61	2150	120	9	N.A.	47	13

During the latter part of the 1950's, this deficit was reduced appreciably, due largely to the expected recovery of agriculture from the disruption caused by World War II and, in several instances, the post-war struggle for independence and in part due to the availability of U.S. farm surpluses. Over the period July 1, 1954 to June 30, 1961, the six countries indicated in Table 1 between them received, under the Public Law 480 programme alone, U.S. farm surpluses valued at $1,978 million. Under Title I of that programme India, for example, received 994 million bushels of wheat and flour, 24 million bushels of feed grains, 31 million cwt. of rice and 54 million pounds of dairy products, fats and oils. Under this same programme the U.S. is currently committed to supplying India with sufficient wheat and rice alone to raise her per capita food supplies by 97 calories per day.

Despite this improvement, there is no real basis for optimism. Since the population of Asia in 1949/50 was approximately 96 millions less than in 1959/60, the absolute annual growth in food supplies necessary to both offset population growth and raise per capita availability was considerably less during the 1950's than will be the case during this or future decades. Furthermore, the data contained in Table I represent *average* availability, and provide no indication of either the proportions of these populations consuming less than average or the degree of hunger and malnutrition suffered by the less fortunate. Even in a re-

[5] 1949/50 data drawn from F.A.O.: *Second World Food Survey,* 1952 and F.A.O.: *The State of Food and Agriculture,* 1961; data for the most recent year in each case were drawn from F.A.O.: *Production Yearbook,* Vol. 15, 1961. "Apparent Deficit" is in each case related to the minimum Reference Standard specified by F.A.O. in its *Second World Food Survey,* 1952.

latively advanced country such as Japan, with a much higher average per capita income than in any other major Asian country and virtually no average deficiency in food supplies, a surprisingly high proportion consumes less, even appreciably less, than average.

TABLE II

Distribution of calorie intake in Japan, 1962[6]

Calories per day as a percentage of the minimum reference standard	Percentage of agricultural households	Percentage of non-agricultural households	Percentage of whole country
36 and less than 40	—	0.2	0.2
40 „ „ „ 60	0.3	1.5	1.0
60 „ „ „ 80	7.2	11.7	10.0
80 „ „ „ 100	26.7	38.7	34.8
100 „ „ „ 120	38.5	30.7	33.8
120 „ „ „ 140	17.4	13.3	14.6
140 „ „ „ 160	8.4	2.0	4.4
160 „ „ „ 180	0.9	0.6	0.9
180 „ „ „ 200	0.3	0.2	0.2
more than 200	—	0.1	0.1

In addition, there are a number of areas in Asia wherein the pressure of population on the means of subsistence has already reduced consumption to near starvation level. Southern Java is probably the best example. Average per capita consumption in Indonesia was recently reported to be 2125 calories daily. But in Southern Java, "the whole population is short of calories and protein, and 'hungeroedema' is endemic . . . akin to the semi-starvation seen in post-war Europe , , , except that a life-long deficiency of protein . . . has predisposed to a much greater incidence of the condition . . .

The average consumption is only 1400 calories and 15 gm. protein per head per day, and for much of the year about 10 gm. daily . . . Poorer people eat only once in two days . . ."[7]

The Current Food Deficit

In view of these apparent contrasts in nutritional adequacy, it seems appropriate that some attempt should be made to examine, in an aggregate sense, the current Asian food deficit in relation to the minimum calorie and protein requirements laid down by F.A.O. After allowing for continued growth in per capita agricultural output at the rates established by Asian countries in the mid 1950's, the U.S. Department of Agriculture has assessed the Asian food deficit in 1962, in relation to the F.A.O. reference standards, as equivalent to 27·73 million metric tons of specified foodstuffs.[8]

[6] Adapted from Margaret McArthur: *Summary of Nutrition Surveys in Asia,* an unpublished paper in which the author quotes the results of a survey conducted for F.A.O. in February, 1962.

[7] K. V. Bailey, "Food Problems in Indonesia", *Australian Outlook,* Vol. 14, No. 3, December 1960.

[8] U.S.D.A.,*The World Food Budget, 1962 and 1966,* U.S. Government Printing Office, October 1961.

The assessed deficit was stated to be nutritionally equivalent to 22·995 million metric tons of wheat, 0·081 million metric tons of beans and peas, 1·429 million metric tons of non-fat dry milk, and 3·228 million metric tons of vegetable oils; that is, in terms of foodstuffs currently in surplus in the United States.

This assessment is based on intercensal estimates of population shown, by recent censuses, to have been markedly conservative. Furthermore, it must be appreciated that this assessment is based on requirements simultaneously minimal in two respects: first, in relation to the minimum physiological requirements specified by F.A.O.; second, in assuming that all available supplies are distributed according to *need* rather than to income or other factors. That is, if 27·73 million metric tons of selected foodstuffs were added to other supplies available in 1962, and all supplies were distributed according only to physiological requirements, this U.S.D.A. assessment would then, and only then, cover the Asian food deficit.

But are these F.A.O. reference standards really appropriate to the current needs of Asian countries? In the initial determination of minimum calorie requirements, the F.A.O. Committee on Nutrition assumed that Reference Man was engaged in eight hours non-sedentary work plus three hours active recreation each day. In estimating minimum requirements for *Asian* populations, adjustments were made for age and sex composition, body weight and environmental temperature, but *no* adjustment was made in respect of energy expenditure. That is, it was assumed that the level of physical activity in Asian countries was comparable with that specified for what was essentially a "western" Reference Man.

In the Far East, particularly in Japan, the level of energy expenditure does appear to be comparable with that in "western" countries. The structure of employment and proportion of economically active population in Japan is now very similar to the pattern in Australia except, of course, that a much larger proportion of total work force is still engaged in agriculture. But even in agriculture—not only in Japan, but throughout the whole Far East—cultivation is traditionally so labour-intensive that average daily energy expenditure would approximate the level specified.

This hypothesis is supported by a recent study of a farm community in a mountainous area of Japan, where arable land is so limited that farm-operators work as lumbermen in off-season periods. In this area, the average daily pattern of activity was not unlike that specified for Reference Man.[9]

TABLE III

Levels of Activity in a Japanese Farming Community

Forms of Activity	Hours of Activity	
	Men	Women
Farmwork	7½	5¼
Housework or household chores	3	6¾
Rest, conversation, cultural recreation	4¼	3¼
Meals	1	1
Sleep	8¼	7¾

Taking into consideration age, body weight and so on, it was estimated that average energy expenditure by men in this community amounted to 2500 calories, while women expended 2080 calories—an average expenditure of 2290 calories daily by the adult population.

[9] Margaret McArthur, *op. cit.*, quoting M. Watanabe: *Shikoku Acta Med.*, 1959.

In contrast, the proportions of economically active in other Asian populations are either appreciably lower than in Japan or are very heavily weighted towards a much less labour-intensive agriculture.

TABLE IV

Economically active persons as a percentage of population[10]

Country	Percentage engaged in Agriculture	Non-agricultural Occupations	All occupations
Japan (1955)	29.10	28.17	57.27
Philippines (1948)	34.04	13.28	47.32
India (1951)	19.79	8.26	28.05
Thailand (1947)	39.50	7.10	46.60
Pakistan (1951)	22.29	6.94	29.23

In Ceylon, for example, the Sinhalese prefer to believe that success or failure of their crops rests more on the goodwill of the Almighty than on any effort which they might make directly.

In view of the relatively low level of energy expenditure in rural occupations, F. W. Clements and D. L. Bocobo found no dietary evidence to support the hypothesis that the working capacity of adult males in Ceylon was in any way restricted by under- or mal-nutrition.[11]

The pattern of energy expenditure in parts of Africa applies equally well to a number of communities in South and South-East Asia, and particularly to areas of shifting cultivation. R. H. Fox, for example, in a study of energy availability and expenditure in Gambia stated that cultivators seldom worked or walked for more than three hours daily, even at times of seeding and harvesting.[12] In order to determine energy expenditure, Fox first estimated energy cost in calories per minute for various activities (such as clearing, ridging, hoeing, and weeding), and carefully recorded time spent on these and other activities each day with the march of the seasons. From this information he determined that per capita (adult) energy expenditure ranged from as little as 1470 calories per day in April to a little more than 1900 calories with the commencement of the heaviest work associated with the onset of the agricultural season in June and July. But it is particularly significant that Fox found body weights remained *stationary* at energy intakes of less than 1600 calories during the three months prior to commencement of clearing and other preparation for the new season's crops. Thereafter, body weights fell slightly, continued to fall during the period of pre-harvest hunger, but recovered with the increase in food supplies available from the harvest in December. Even though average annual consumption in these areas was estimated at only 1695 calories per capita per day, Fox concluded that these people were not seriously undernourished.

In India, cultivators appear to expend more energy than the African

[10] Based on data drawn from U.N. *Statistical Yearbook,* 1957 and U.N. *Demographic Yearbook,* 1961. In each case, with the exception of India, "economically active persons" includes unpaid family labour. Comparable data for Taiwan were not available.

[11] F. W. Clements and D. L. Bocobo, *Report on Nutrition in Ceylon,* 1957. F.A.O.

[12] R. H. Fox, "A study of the Energy Expenditure of Africans engaged in various Rural Activities", PhD. Thesis, University of London, 1953.

in the cultivation and care of crops—generally at a level fairly representative of subsistence agriculture in South and South-East Asia as a whole. Over the period 1953-56, Muhammed Shafi made a study of twelve villages in Uttar Pradesh, contrasting in types of soil, availability of water for irrigation and the range of crops cultivated, but in aggregate self-supporting and fairly representative of energy expenditure patterns in Indian agriculture.[13] Shafi measured precisely the area under each crop, allowed deductions for seed used, utilised extraction figures based on village methods of food preparation, and ultimately converted crop yields to consumption and calorie intake. Average daily consumption in these villages was found, during the year, to range from 1828 to 2175 calories, with a simple (non-weighted) average for all twelve villages of 2027 calories per capita per day. The most significant feature of this study lies in the author's assertion that, for these people, per capita consumption of a fairly well-balanced 2,000 calories—still appreciably short of the specified F.A.O. minimum reference standard—is adequate to meet their requirements.

The purpose of this apparent digression has been to lend weight to the suggestion that, on the basis of levels of physical activity *currently* undertaken in South and South-East Asia, the minimum per capita calorie requirements specified by F.A.O. are somewhat higher than immediately necessary. In the Far East, however, the safety margin involved in F.A.O.'s minimum reference standard would no doubt prove to be of a much lower order.[14] But in neither the Far East nor South and South-East Asia is it possible, in view of the almost complete lack of studies of energy expenditure and consumption, supported by additional clinical observation of the subjects involved, to determine the magnitude of the error involved in the minimum requirements specified. It can only be suggested on the basis of the limited information available, that recent estimates of the extent of the Asian food deficit tend to exaggerate the extent of that deficit—subject, of course, to reservations regarding some markedly deficient areas (such as Southern Java) and national distribution of available food supplies. On the other hand, protein malnutrition is already widespread and must therefore be regarded as a problem demanding immediate attention.

Future Food Requirements

On looking to the future, however, the current safety margin appears to have little relevance. In some areas it might well be assumed that the reason for the current limited physical activity lies in a need to restrict energy expenditure to a level approximating energy availability. If it is assumed that most countries of Asia are currently in the process of economic development and that, with the passage of time, unemployment and under-employment will be steadily reduced, this safety margin must ultimately decline to the point at which the reference standards originally specified by F.A.O. must come to be regarded as a reasonably accurate measure of the food supplies necessary to sustain economic activity.

[13] See L. Dudley Stamp, "The Measurement of Land Resources", *The Geographical Review*, Vol. XLVIII, No. 1, January 1958.

[14] For example, an independent assessment by the Resources Investigation Council of Japan in 1960 placed Japanese minimum requirements at 2200 calories and 71 gm. of protein per capita per day.

But in order to speculate further with regard to possible future growth in Asian food requirements, it first appears necessary to assume that

(1) average per capita food consumption in Asia in 1960 was 2,000 calories per day.
(2) average per capita income in Asian countries in 1960 was equivalent to $U.S. 100 per capita and that, consistent with the hypothesis that the levels of employment and physical activity should be assumed to be moving towards a point at which the specified minimum reference standards *do* apply, real income per capita will grow at the rate of 2 per cent per annum, and
(3) no significant change should be expected in food consumption habits, other than a growth in per capita calorie consumption with growth in real income.

On the basis of these assumptions, real income would rise to $120 per capita by 1969 and, if the relationship between income and calorie consumption evident in Japan and the Philippines in recent years is projected forward for other Asian countries, per capita calorie consumption should rise to approximately 2100 per day.[15]

But in order to estimate the aggregate change to be expected in Asian food requirements, the anticipated growth in population must also be taken into account. The U.N. has estimated that the population of Asia will grow from 1,620 millions in 1960 to 1,980 millions in 1970 and 2,470 millions by 1980.[16] But subsequent census and other data show that population in the base period was under-estimated: by 1960, the population of Asia had grown to 1,674 millions. Allowing for this revision, and applying a form of projection identical to that adopted by the U.N., the population of Asia can be expected to grow to 2,005 millions by 1969. If it is assumed that this population will consume an average of 2,100 calories per capita per day in 1969, it follows that food supplies would need to grow by 28·6 per cent over the level available in 1960.[17]

If real income is assumed to grow indefinitely at 2 per cent per annum, average per capita income in Asian countries would rise to $150 by 1980. Assuming some decline in the income-elasticity of demand for foodstuffs—following a pattern similar to that clearly evident in Japan over the past decade—average per capita consumption would probably rise to about 2,180 calories daily.

But over this period (1969-80), a change in consumption habits should also be anticipated. In "western" countries, growth in real income led initially to increased consumption of cereals, potatoes and other starchy foods followed, with further growth in income, by a steady substitution of more palatable meat, milk, eggs and other animal products for the former (starchy) staples. A similar trend is already evident in some Asian countries, particularly in areas of higher per capita income. In Japan,

[15] If based on the trend in income-elasticity of demand for foodstuffs in India, Pakistan, Ceylon and Taiwan in recent years, per capita consumption would probably rise to approximately 2150 calories per day.

[16] U.N. *The Future Growth of World Population,* Department of Economic and Social Affairs, United Nations, New York, 1958.

[17] Even to maintain *current* per capita consumption, food supplies would need to grow by 19·8 per cent over the same period.

for example, the proportion of calories consumed in the form of cereals and other starchy foods declined over the period 1948/50 to 1960 from 87 to 69 per cent, while calories of animal origin increased from 4 to 11 per cent of total calorie consumption. Even in the Philippines, where food consumption per capita still falls appreciably short of the level prescribed by F.A.O., the proportion of calories derived from cereals and other starchy foods declined over the past decade from 76 to 71 per cent, while the proportion drawn from animal sources rose from 11 to 15 per cent. On the basis of such recent trends, and assuming that the projected growth in income and food supplies is realised, it should be anticipated that consumption of cereals and other starchy foods will continue to decline relative to the consumption of foodstuffs of animal origin, with the latter probably accounting for at least 15 per cent of all calories consumed in Asia by 1980.

Over the period 1969 to 1980, the population of Asia can be expected to grow from 2,005 to 2,552 millions, and probably further still in the absence of any reduction in fertility. In order to merely maintain current levels of nutrition, it will be necessary to raise Asian food supplies by 52·4 per cent over supplies available in 1960. In order to raise per capita consumption to a level commensurate with the projected growth in income (that is, to 2,180 calories per capita per day), but with no allowance for changes in the composition of foodstuffs, Asian food supplies would need to grow by 66·2 per cent over the 1960 level. If allowance is also to be made for the anticipated growing preference for foodstuffs of animal origin, it is first necessary to take into account the loss of potential calories involved in the process of conversion of plant materials to animal products.[18] In "western" countries, it can be assumed that seven acres given over to animal production would yield a supply of calories equivalent to one acre under grain. But since the efficiency of livestock production in Asian countries is currently much lower than in the West, it can be assumed that Asia as a whole would require at least ten acres under animal production to produce a supply of calories equivalent to one acre under cereals or other starchy foods. On this basis, the anticipated growth in Asian food requirements by 1980 would require an increase in the production of potential calories—or an increase in the area under food production, assuming no change in productivity—of 105·6 per cent over the level of production in 1960.[19]

Future Supply Prospects

If, for the moment, the possibility of an increase in the level of food imports is disregarded, what rate of growth in food production must be achieved by Asian countries in order to meet these requirements? In

[18] For example, one bushel of corn consumed as cornmeal provides sufficient energy to meet the requirements of twenty-three persons for one day. If converted to milk, it would meet the energy requirements of only five persons; converted to eggs, it would support only two persons. For a more rigorous treatment of this aspect, see C. M. Donald, "Grass or Crop in The Land Use of Tomorrow", *The Australian Journal of Science,* Vol. 25, No. 9, March 1963.

[19] It should be noted, however, that no allowance has been made for an increase in the use of fish in response to the growing taste for meat. But there is no doubt that the supply of fish *could* be increased considerably, either from the sea or in conjunction with, and not at the expense of, the current framework of peasant cultivation.

order to merely maintain current per capita consumption, production must increase by 2·0 per cent per annum until 1969, and thereafter at 2·2 per cent annually. To provide for an increase in per capita supplies to 2,100 calories by 1969 and to 2,180 calories by 1980, production must rise annually by 2·8 per cent until 1969 and at 2·6 per cent per annum over the period 1969-80. If an additional allowance is made for substitution of animal products over this latter period, the production of potential calories would need to grow by 3·6 per cent per annum over the entire period 1960-80.

How do these rates of growth compare with past performance? Over the period 1954/55 to 1960/61, food production in Asia (excluding Mainland China) increased at an annual average rate of 2·8 per cent, a rate apparently sufficient, if maintained, to cover anticipated growth in both population and per capita calorie requirements, although not sufficient to permit substitution of animal products for cereals and other starchy foods. But this encouraging recent growth in food production was achieved partly at the expense of cotton and other cash crops and in part reflects the expected (relatively short-term) recovery from disruption caused by World War II and subsequent internal disorder. Furthermore, while growth in farm output in excess of 2 per cent per annum *has* occurred from time to time in both Asian and "western" countries, such a growth rate has rarely been maintained for more than a few consecutive years.

Nevertheless, it is evident that every effort must be made over the next two decades to equal or even exceed this recent rate of growth in Asian food supplies. It is equally clear that the realisation of this objective will rest much more heavily on increased productivity in Asian agriculture than on any foreseeable growth in supplementary sources of supply. For example:

(1) A number of Asian countries do have reserves of land available. But these land reserves are generally marginal, particularly in terms of inherent fertility, ease of cultivation, and suitability with regard to retention of moisture. In view of the widespread (and no doubt continuing) lack of technological skills available in most Asian countries, these less attractive areas will probably add no more than 20 or 30 per cent to the level of Asian food production over the period under review.[20]

(2) Nor can trade be regarded, as it could have been in the nineteenth century, as a suitable mechanism for the transfer of foodstuffs from areas of surplus to areas of want. Trade on a commercial basis implies a flow both ways. With continued protection for domestic industries in "western" countries, the development of substitutes for agricultural raw materials, and increasingly efficient recovery of waste and scrap metals, together with continuing reinforcement of the present regional patterns of trade, most Asian countries now face bleak prospects for both their traditional export staples and growing exportable

[20] This assumes, of course, that migration (within national boundaries) to areas of new land development is feasible. But kinship, religious and other social ties are particularly strong in these countries, so much so that it cannot necessarily be assumed that a given pressure of population on land resources will itself ensure an outflow of population from densely populated to less densely populated areas.

surpluses of simple manufactured goods. Since Asian countries are now seeking to import the large quantities of plant and equipment necessary to the process of industrialisation, the foreign exchange earnings remaining for the import of foodstuffs, even in times of famine, are now insignificant.

(3) Over the past few years, aid in the form of foodstuffs has constituted a valuable (if somewhat marginal) contribution to the food supplies of a number of Asian countries. But had the United States distributed its entire farm surplus, in a continuing sense, over the population of Asia in 1959, this would have been sufficient to add only 76 calories per capita per day to supplies available from other sources.

Furthermore, there are several major obstacles to any increase in or extension of aid in this form:

(a) Some of these Asian countries are regarded by the U.S. as politically incompatible.

(b) Some Asian peoples as yet have no taste for the principal foodstuffs currently in surplus in the United States.[21]

(c) Port and harbour facilities, as well as the means of internal transport, will probably continue in many countries to remain inadequate to handle and distribute any appreciable increase in the level of food imports, and

(d) The current (average annual) farm surplus in the U.S. would be sufficient to add only 46 calories per capita per day to Asian food supplies in 1980. Admittedly the U.S. *could* produce a larger surplus. But should it be suggested that she deliberately embark on such a programme, knowing full well that this could only be achieved by raising domestic taxes still further?

Ultimately, it can only be concluded that Asian countries must aim to meet at least the bulk of these additional food requirements from land already under cultivation. Here it is tempting to point to the marked contrasts in agricultural productivity in Asian countries and to suggest the need only to transplant improved techniques amongst the less efficient cultivators. In Japan, for example, something like 67 million tons of fertiliser is used annually, in conjunction with seed selection, efficient water control and labour-intensive cultivation. Rice yields in Japan currently average about 4,800 kg. per hectare. In India, the fertiliser used would probably amount to less than 10 million tons annually: the average rice yield, reflecting a much lower rate of fertiliser use and less efficient methods of cultivation, is currently little more than 1,300 kg. per hectare. But amongst illiterate, tradition-bound populations—and even though very considerable scope exists, in purely physical terms, for increased productivity—the meagre agricultural extension forces available can at best hope for limited progress.

Nevertheless, and over and above the need to ensure adequate levels of nutrition in the future, there is a very real need also to raise productivity *per worker* in Asian agriculture. For the process of industrialisation to be successful, manufacturing industries in Asian coun-

[21] For example, see U.S. Department of Agriculture, *Report of the Wheat Utilization Mission to: Japan, India, Indonesia.* (Foreign Agricultural Service), January 1961.

tries *must* find markets for their products. The prospects for export of manufactured goods from Asian countries are even less encouraging than for industrial raw materials, while domestic markets are currently limited by low levels of income. If productivity and income can be raised in rural areas, substantial markets will be created, making possible an exchange of manufactured goods for the foodstuffs necessary to sustain a growing urban population.

It can only be concluded, therefore, that growth in population, income, and availability of food supplies per capita can only be sustained via a marked and continuous growth in Asian agricultural productivity.