Asia's Battle For Food

Asia, with half the world's population, remains today, 20 years after the proclamation of the United Nations' first "Development Decade," an underdeveloped area, with its agriculture still dependent on the year-to-year fluctuations of the weather, which ultimately determine whether the population eats or not. Agriculture still absorbs 60-80 percent of the labor force in most countries and accounts for 30-60 percent of the Gross Domestic Product. With the rise and fall of agriculture, rises and falls the yearly economic fortunes of most countries in the region. A close look at the battle for food in Asia is warranted to assess the progress in recent years and to identify the obstacles to improving the prospects for the continent to escape its fatal agrarian dependence.

Most literature available today either argues for the World Bank's plans of labor-intensive rural-based projects, or merely deals exclusively with short-range monitoring of year-to-year fluctuations. The latter approach would content itself with the figures presented in Table 1. Asia's foodgrains production from 1975 to 1976, excluding China and the other socialist countries for which reliable data is unavailable, dropped an alarming 5.5 percent. Eliminating India, which fell 10 percent from an all-time high of over 120 million tons (mt) to an estimated 108 mt, reveals that the rest of Asia rose by 1.4 percent — still not impressive, and well below the rates of population growth of 2.1-3.3 percent. A more optimistic picture is obtained by examining the movement from 1974 to 1976, because 1975 was generally a bumper year. Output for all of Asia jumped over 7 percent, and over 6 percent without India.

However, such a superficial reading of the figures belies the real situation, as indicated in Graph 1. Graph 1 compares indices of per capita foodgrains production from 1966-76 for the five most populous countries of the region: India, Indonesia, Bangladesh, Pakistan, and the Philippines. The pattern holds for most other countries as well. (The index for each country was derived by dividing foodgrain production — omitting minor crops which showed little year-to-year variation — by population, and indexing for 1969-70 equals 100; 1969-70 were years of high production for all countries.) Per capita levels of production have yet to reach the modest highpoints of 7 to 8 years ago on a sustained basis with the exception of Indonesia. Conventional wisdom says that viable economic development requires an annual average increase of per capita foodgrains of at least 2 to 3 percent. By this measure, all of Asia is hopelessly behind.

The failure over the past decade of Asian agriculture to stay even with population increase raises the question: What happened to the vaunted "Green Revolution?" The figures presented below in the analyses of each national program hold the key. The Green Revolution has been responsible for substantial increases in overall national output and in yields for the regions affected by it. This has been primarily based on the use of high yield varieties of seeds (HYVs) which require irrigation and fertilizer to be fully effective. However, a phenomenon surrounding their use has gone almost entirely unremarked. Where applied, initial large jumps in yields have been followed by a levelling off, or even falloff in yields, even when the full potential of the HYVs is only 30-50 percent realized. This means that when all lands suitable for HYVs (which demand irrigation) in a country are planted, all further increases in output will cease — unless a way is found to augment yields on the lands already planted in HYVs.

The other approach to the problem of Asian agriculture is the World Bank's notion of labor-intensive rural infrastructural projects. As the following report will document, keeping people on the land in this way is a sure-fire method of perpetuating the food production-population crisis. It precludes addressing the solution to how to realize the potentials of the Green Revolution: capital-intensive regional development projects which are capable of rapidly extending irrigation, reorganizing rural social patterns, and providing foci for rapid urbanization and industrialization. Such programs cannot be carried out under any form of "self-reliance" but demand international aid in the tens of billions of dollars for the region, converging on the "International Development Bank" program put forward by the U.S. Labor Party. A continuation of present trends, as shown by Graph I, dooms the region at best to a neck-and-neck race with population; the World Bank would greatly hasten the mass starvation and death inevitable with a non-capital-intensive approach.

Note: All 1976 production and most other crop data used in this report are from the U.S. Department of Agriculture Economic Research Service. Figures for 1966-1975 are from the ERS *Statistical Bulletin No. 555* and the *Foreign Agricultural Economic Report No. 121,* both dated June 1976. 1976 crop data is from unpublished Agricultural Situation Reports for each country, supplemented by data supplied directly to the author. Nearly all fertilizer figures are from the International Fertilizer Development Center in Muscle Shoals, Ala. Population figures used in computing per capita figures are from the U.S. Agency for International Development and Census Bureau data in the *Statistical Bulletin,* with some unpublished adjustments supplied to the author. Certain data were obtained from the World Bank.)

The Indian Subcontinent

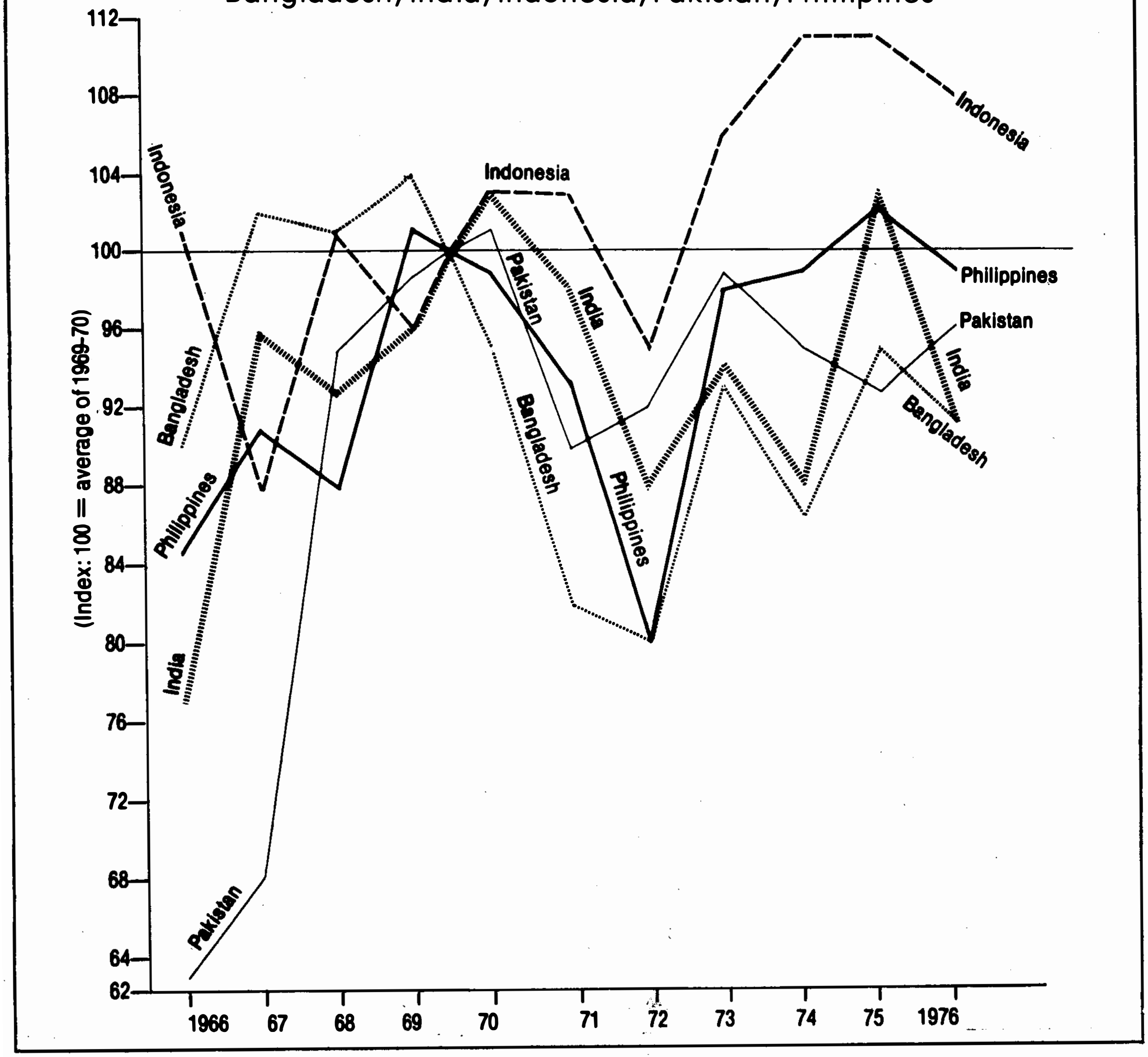
India

India is the Asian showcase for the "Green Revolution." India has the largest irrigation network in the world, outside of China, the best-educated and largest planning elite in the Third World, and has received sustained attention from the World Bank and the Ford Foundation for agricultural development. Today, fully one half of the total lands devoted to wheat and rice are planted in HYVs developed in Mexico and the Philippines. India accounts for over half the population and half the food production in non-Communist developing Asia. What are the effects of these programs after a full decade of development?

Graph 2 reveals the shortcomings of the programs to date. The most important figure is that for yields, measured in tons per hectare (t-ha). (Only wheat and rice are charted because they are the only crops significantly planted in HYVs. Here and throughout this report, all data on rice refer to *milled* basis.) While yields have risen from .9 t-ha in 1966 to almost 1.3 t-ha in 1975, fertilizer consumption rose during the same period from 1.24 mt (nutrient) (1967) to 2.57 mt, 44 percent and 107 percent increases respectively. Even more dramatically, the percentage of land sown in HYVs rose during the period from a negligible 3 percent to 44 percent. The greatest sustained yield increases came during the first half of the decade, reaching more than 1.2 t-ha in 1971 and then dropping after that even with increasing

Graph 1

Indices of Per Capita Food Grain:
Bangladesh, India, Indonesia, Pakistan, Phillipines



use of HYVs and fertilizer. The immediate cause of the decline was inadequate rainfall. Although HYVs and fertilizer used on irrigated lands were intended to minimize such problems, they did not.

Graphs 3 and 4 show the problem in more detail. The yields on fields planted in traditional varieties (non-HYVs) remain fairly constant, varying with the year's rainfall for both wheat and rice. The HYVs show a pattern, most pronounced for wheat, of falling substantially, and then reaching an average level of two to three times the yield of TVs, (traditional seeds) from which level they also vary widely depending on rainfall patterns. In the case of wheat, the initial excellent yields of well over 2 t-ha have dipped to below 1.7, stabilizing near the level reached in neighboring Pakistan. For rice, initial levels of over 2 t-ha dropped to below 1.7, and have since followed the weather pattern, returning to over 2.1 in the excellent rainfall year of 1975. (It should be noted that overall yields rise even when HYV yields are falling, or do not fall as fast, because the total area sown in HYVs is also rising, a factor not shown on the graph. If percentage of area in HYV were to remain constant, average yields would more closely parallel those of HYVs.)

The pattern of output declines has been explained as the result of bringing poorer and poorer land into HYV cultivation as the program expands. It is likely that better fields may be selected first for HYV use, but the performance of HYV of rice in Graph 4 in 1975 demonstrates that with optimal water, yields can return to the

Table 1— Foodgrain Production in Asia

	(THOUSANDS OF TONS) 1974	1975	1976	(PERCENT CHANGE) 1974-75	1975-76	1974-76
INDIA(1)	100,270	120,000	108,000	+19.7	-10.0	+ 7.7
PAKISTAN(2)	10,114	10,100	10,800	- 0.1	+ 6.9	+ 6.8
BANGLADESH(3)	11,109	12,560	12,700	+13.1	+ 1.1	+14.3
SRI LANKA(3)	1,072	790	690	-26.3	-13.0	-35.6
INDONESIA(4)	18,540	18,950	18,900	+ 2.2	- 0.3	+ 1.9
MALAYSIA	1,355	1,266	1,333	- 6.6	+ 5.3	- 1.6
BURMA(3)	5,715	6,090	6,130	+ 6.6	+ 0.7	+ 7.3
THAILAND(4)	12,107	13,120	12,700	+ 8.4	- 3.2	+ 4.9
PHILIPPINES(4)	5,562	5,920	5,900	+ 6.4	- 0.3	+ 6.1
TAIWAN(3)	2,452	2,494	2,700	+ 1.7	+ 8.2	+10.1
SOUTH KOREA	5,952	6,510	7,065	+ 9.4	+ 8.5	+18.7
TOTAL	174,248	197,800	186,918	+ 5.2	- 5.5	+ 6.7
SUBTOTAL, WITHOUT INDIA	73,978	77,800	78,918	+13.5	+ 1.4	+ 7.3
CHINA(5)	265,000	270,000	265,000	+ 1.9	- 1.8	0.0
TOTAL	440,000	468,000	452,000	+ 6.4	- 3.4	+ 2.7

(1) CROP YEAR, I.E., 1976=1976/77 CROP YEAR

(2) WHEAT AND RICE ONLY

(3) RICE ONLY

(4) CORN AND RICE ONLY

(5) 1974 AND 1975 FROM USDA. 1976 IS AUTHOR'S ESTIMATE. USDA REPORTS "SLIGHT DECLINE."

SOURCE: USDA

same high levels they reached when the program was initiated.

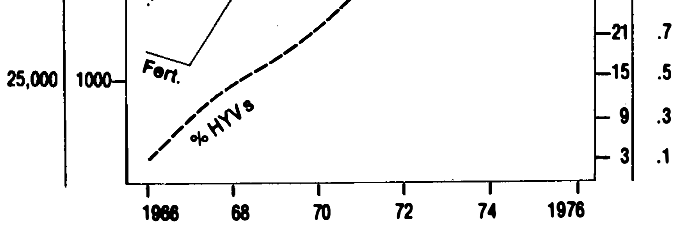
However, the yields of the HYVs on experimental plots when all conditions are controlled, and water and fertilizer are applied correctly, rises to 3, 4, 5 or more t-ha. The data demonstrate that the potential of these seeds is not even being approached. The data here presented on comparative yields from HYVs and TVs indicate that total reliance has been placed on increasing the ratio of HYV to TV, as the sole means to increase total output. The record proves that while total outputs do rise over time, they rise so gradually as to barely, if at all, keep pace with population growth. Only by returning to the existing HYV areas and enabling their yields to begin rising toward the potential of 100 percent increases in output per hectare can this cycle be broken.

The urgency of this is underscored by the fact that the limit of lands suited for introduction of HYVs is fast being approached. At current rates of growth, the entirety of the 56-60 million hectares now devoted to wheat and rice would be sown in HYV in a decade or less. However, HYVs require irrigation, and the limit of irrigated lands — currently about 45 million hectares — will be reached by 1981-82 at current growth rates, or 1983-84 if irrigation is extended to about 50 million hectares as currently planned. But as the quality of irrigation is not uniform and is probably inferior on those irrigated lands yet to receive HYVs, yields can be expected to fall still further.

The optimal conditions for HYVs are finely regulated irrigation such that waterings can occur at specified, regular intervals in precise amounts; and ample fertilizer with appropriate mixes of nitrogen, phosphates, and potassium.

Graph 2

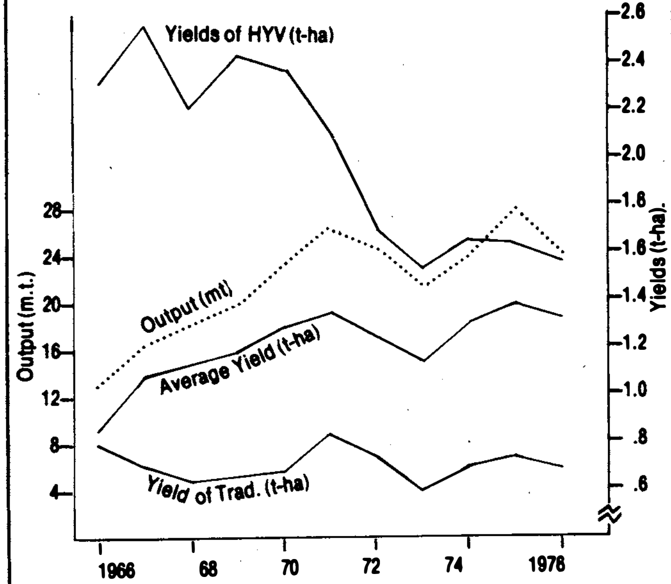
Relative Increases in Fertilizer Use, % of Wheat and Rice Lands in HYVs and Yields and Production of Wheat and Rice (Combined) in India



Sources: Fertilizer data from International Fertilizer Development Center, Muscle Shoals; Ala., remainder of data from USDA

Graph 3

Wheat Production and Yields in India



Source: USDA data

In India, the principal obstacles to achieving the first condition are the reliance for most irrigation water on canal water drawn from the major rivers. The reliance on river water subjects irrigation to the vicissitudes of rainfall. This can lead to large swings in the south, where rain water is the sole source of river water, but also partially affects the snow-melt-fed northern rivers.

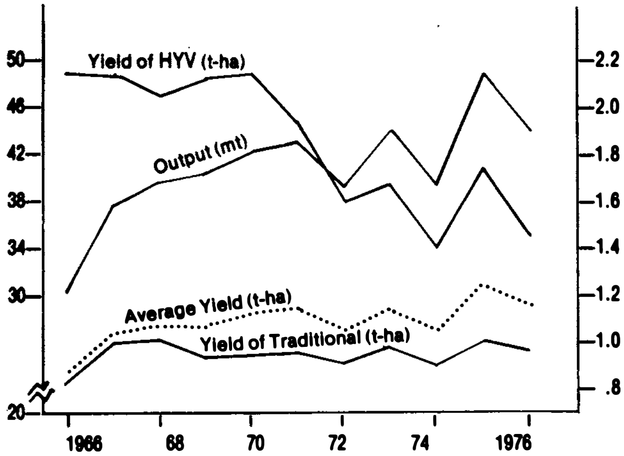
The manner of allocating water is an ancient anachronism based on complicated formulas to guarantee that every villager receives exactly equal amounts of water during the growing season — but on schedules that have absolutely no relation to when the water is needed. These schedules have wreaked havoc on attempts to scientifically utilize HYVs.

The second condition is proper quantities of fertilizer. Fertilizer figures for HYV lands are not available, but it is certain that two to four times as much could profitably be used if other conditions were correct. According to the 1975 projections of the International Fertilizer Development Center, India would be using twice its current consumption of fertilizer by 1980, which would still leave it well below adequate usage. After stagnating from 1972 to 1976, fertilizer use is expected to jump 18 percent to 3.24 mt of nutrient in 1977.

However, the increasing fertilizer use under present conditions confronts economic contradictions as well. According to a USDA expert on India, in 1976 the high price of fertilizer and the low price of wheat narrowed the profit margin so greatly on commercial wheat production that a full 7.5 percent of the wheat lands, 1.5 million hectares, were removed from wheat cultivation in 1976 and given over to cash and garden crops for sale in the cities. Fertilizer, water, and other input, cost the average commercial wheat farmer $60-80 per acre in 1976, as against only $100 expected gross receipts upon sale. Two years ago, $100 profit was possible.

Graph 4

Rice Production and Yields in India



Source: USDA

One alternative under consideration is to substantially raise the procurement price, thereby raising profitability. As posed at present however, this appears to be more a political payoff to a small segment of landlords and wealthier farmers who would benefit. This solution does not provide for getting fertilizer and other modern inputs into the vast majority of fields that are still run largely by families for their subsistence; most lands would either be unaffected by such a measure, or it would induce families to sell food they need for themselves for a little cash to buy other consumer goods.

The problem confronted on a vast scale in India is classic: how to transform a predominantly agrarian-rural society to an industrial-urban one. In the underdeveloped sector, the initial problem is compounded by the sheer magnitude of population on the land, and low levels of productivity and general culture. In India, only multi-billion dollar regional projects for overall water control, regulation, and distribution can hope to solve the irrigation-for-HYV conundrum outlined above, and shake up the existing patterns of peasant cultivation (including busting up the landlord system as it now exists) which requires outside capital.

Already in his first few weeks in office, India's new Prime Minister Morarji Desai has made clear that he intends to go in the opposite direction. His administration has mooted the option of using most of India's 15 mt of foodgrains reserves (needed against likely crop shortfalls in coming years) to pay laborers subsistence wages in "food-for-work" labor-intensive infrastructure projects. His administration has stated its intent to dismantle much of the heavy industry, public sector of the economy and emphasize cottage and small-scale industry.

Pakistan

The agricultural situation in Pakistan is immediately more promising than that in India because the present government is embarked on a program for fast industrialization.

Pakistan achieved a record wheat harvest in 1976 of 8.4 mt, 8 percent above the previous high of 7.8 mt in 1973 and 1974. Rice production, at 2.5 mt, remained near the 1973 level. Expectations for the wheat crop in 1977, most of which is now being harvested, are 8.9 mt or higher, according to the USDA agricultural attaché in Pakistan. The two-year rise of 17 percent from the 1975 output of 7.6 mt is due to excellent rainfall, increasing fertilizer use, and the continuing extension of area in HYV.

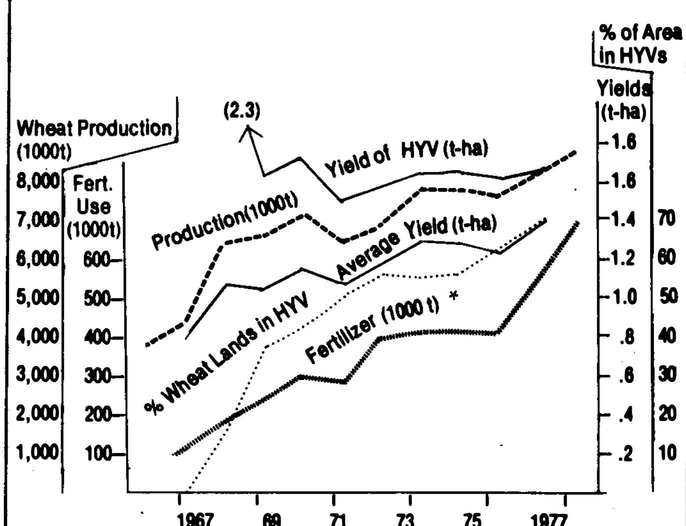
Graph 5 shows the progress of overall wheat production, the average yield, the percentage of wheat lands in HYVs, the amount of fertilizer used, and the yield on the HYV lands. The graph shows that yields and output are much less dependent on rainfall than in India; Pakistan receives little from direct rainfall, but is supplied by the snow-fed Indus and its tributaries. Areas irrigated by canal or tubewell, and provided with fertilizer, should have fairly regular yields.

The graph shows that fertilizer use increased with the increase of HYV lands, and that the steep rise in fertilizer use from 1975-77 is associated with the steep rise in output.

The curve for percentage sown in HYV belies the truism of falling yields as usage increases. Recovering from a low of 1.5 t-ha in 1971, HYV yields rose to 1.65 in 1973, where it has stayed since (and probably risen in 1977). Nonetheless, HYV yields still remain far below their potential. This question is even more immediate for Pakistan than for India, because HYVs already account for 68 percent of Pakistan's wheat lands and 82 percent of its wheat output. The overall increase in yields from .8 t-

Graph 5

Relative Increases in Fertilizer Use, % of Wheat Lands in HYVs, and Yields and Production of Wheat in Pakistan



* 1974 and 1976 interpolated

Sources: USDA for production data, World Bank for yields and percentage of wheat lands in HYVs, International Fertilizer Development Center for fert. data.

ha in 1967, before the arrival of HYV (when Pakistan's *per capita* grain production was at index 63, 37 percent below the 1969-70 level (see Graph 1) to 1.37 t-ha in 1976 was entirely due to the conversion to HYV of previously non-HYV irrigated land. But as of now, only an estimated 450,000 hectares of non-HYV irrigated land remains to be converted. At current growth rates, this will be gone in two years, halting expansion of yields and output. The remainder of Pakistan's wheat land, about 1.5 million hectares, is very low productivity (.4-.55 t-ha) non-irrigable land in Baluchistan and Northwest Frontier Province.

Even though the anticipated output for 1977 will return the country to the per capita foodgrains output of 1969-70 (index 99, Graph I), Pakistan is expected to become an exporter of wheat in a few years. This calculation is based on the coming on stream of the Tarbella Dam which will irrigate an additional 900,000 hectares in the next few years, and other projects, much of it for wheat. A long-range program to reclaim 5-10 million hectares of currently saline or waterlogged land will also increase the wheat potential. But raising yields from 1.6 t-ha to 2.5-3 and more is, as in India, the only long-term answer.

Data is not currently available on why HYV yields have stayed at 1.6 t-ha. It is clear that irrigation, fertilizer and HYV combined have eliminated the year-to-year fluctuations in Pakistan. Except for occasional flooding, the Indus plus the approximately 150,000 tubewells in operation provide a steady supply of water. The response rate for fertilizer use (increase in output increase in fertilizer use) is not obtainable, but yields of 2.5-3.0 t-ha for wheat, and comparable ones for rice, ought to be possible. A crash program to attain that level by 1985 would provide 18-20 mt, a yearly average increase of 7-8 percent.

The government of Pakistan is strongly encouraging the increased use of fertilizer. Fertilizer consumption rose from 116,000 t. (nutrient) in 1967 to 310,000 t. in 1970, 437,888 t. in 1973 and 693,000 in 1976-77. Production has lagged far behind, but plants to begin operation this year, in 1979, and in 1980 will increase production capacity 150 percent to nearly a million tons. This permits growth in the use of fertilizer to 790,000 t. with no imports (assuming current utilization rate of 84 percent of capacity), and more if importing continues. The fertilizer subsidy has been reduced from 50 percent to 20 percent, but there is still a price incentive to use more. Pakistan has ample feedstocks for its fertilizer plants, so prices in future may fall when its plants come onstream.

Official policy encourages tractor use, and tractor importation. At present, the demand for tractors exceeds the available supply.

In sum, Pakistan's agricultural future is bright if yields can be raised consistently at 5-8 percent a year on HYV areas, which will provide farmers the means to upgrade and mechanize their operations, and create capital for industrialization to absorb labor freed from the countryside.

Bangladesh

Bangladesh remains a country without hope of overcoming its underdevelopment, or escaping the ever-present danger of devastating famine, without massive outside help. Rice production (the only significant food crop) only surpassed the highest pre-Liberation level — 12 mt in 1969 — in 1975, and edged a little higher in 1976 (see Table 2 and Graph 1). Per capita levels remain 11 percent below the 1969 level. Yields for rice have varied from 1.13 to 1.21 t-ha in the last four years, depending on the weather. Fertilizer use is significant, reaching 195,000 nutrient tons in 1973, and 454,000 tons gross weight in 1977.

However, Bangladesh' rice agriculture is totally dependent on the monsoon and the Brahmaputra and Ganges river flow. Every year large portions of cultivable land is flooded with several feet or more of water. Under such conditions, HYVs and fertilizer are useless; only specially adapted strains of rice can tolerate such conditions. Apart from the other problems of Bangladesh's wretched backwardness, little can be done to improve yields until the regional development projects needed in India are undertaken to control the two mighty rivers that divide the country, to permit irrigation. A few years respite may result from labor-intensive projects currently underway to extend irrigation to certain less flood-prone regions. Even this depends on not having a failure of the monsoon, which would bring instant famine as severe as that of the fall of 1974.

Sri Lanka

Sri Lanka's education-literacy level is one of the highest in the Third World, and the inherent difficulties of agriculture compel the country toward industrialization. But with scant means to generate domestic capital investment and equally scant development assistance available from outside, Sri Lanka is stuck in a perpetual downward spiral.

Table 2— Rice Production in Bangladesh

(thousands of tons)

	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976
RICE PRODUCTION	9,575	11,171	11,344	12,005	11,144	9,912	9,930	11,721	11,109	12,561	12,700
PER CAPITA RICE PRODUCTION (KG.)	149	169	167	172	157	136	134	153	142	156	153

SOURCE: USDA

Table 3— Rice Production in Sri Lanka

(THOUSANDS OF TONS)

	1974	1975	1976	1977
RICE PRODUCTION	1,072	790	690	1,200*

*ESTIMATED SOURCE: USDA

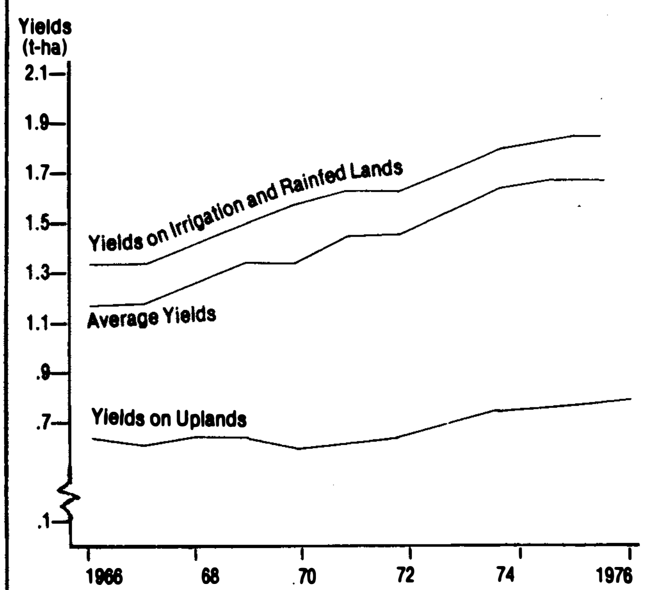
Table 3 shows at a glance the basic problem. The huge swings in rice production — from 1.07 mt in 1974 down to 690,000, a 36 percent decrease, and then back up 1.2 mt estimated for 1977, a 74 percent increase — result from Sri Lanka's status as a small island with no possible snow-melt to maintain river flow during dry spells, and its dependency on the monsoon. Locally developed strains of HYVs are in use, but there is no prospect for substantially altering the near-total dependence of rice cultivation on an unreliable rainy season. Large food imports are likely to be a perennial part of Sri Lanka's foreign trade.

Southeast Asia

Indonesia

Indonesia is the only large country in Asia to have sustained a rise in per capita foodgrains production since 1969-70, and has also managed to minimize the year-to-year fluctuations of production since 1968. Foodgrains production has risen 20.5 percent from 1970 to 1976, from 15.7 to 18.9 mt. Discounting for population increases of 15 percent during the same period, a net increase of 5 percent per capita production was achieved over the period.

Graph 6
Yields of Rice in Indonesia



The increases are based largely on Indonesia's fairly stable and ample rainfall pattern, increasing fertilizer use, and the expansion of the Government's BIMAS and INMAS agricultural extension and credit programs. Together these programs have resulted in a steady increase in the average yield of rice, the main crop, to about 2 tons per hectare, the highest in South and Southeast Asia.

Graph 6 shows the yields for irrigated and rainfed rice, for upland rice, and the composite average yield. Table 4 shows total production for 1966-76. The graph reveals a steady increase in yields from the rainfed or irrigated lands and the composite index, and even from the upland areas. This growth parallels the expansion of the BIMAS-INMAS programs from 2.2 million hectares covered in 1970 to 4.7 million hectares in 1975, and more in 1976.

The BIMAS program provides for expanding and improving irrigation facilities, encouraging more extensive use of HYVs, fertilizers, and insecticides by providing extension services to farmers, and making available agricultural credits. INMAS does the same but lacks credit facilities.

Since 1968, 800,000 hectares have been added to the rainfed and irrigated lands, 400,000 by irrigating upland areas. Fertilizer use grew from 142,000 tons nutrient (NPK) in 1967 to 444,000 in 1973. Since 1973, use of nitrogen fertilizer, the preponderant component, has stagnated at just under 350,000 tons nutrient.

Yields on the BIMAS lands rose from 2.4 tons per hectare in 1970 to 3.0 t-ha in 1975. According to the World Bank, on lands for which water supply is assured and BIMAS or World Bank programs implemented, yields of

Table 4
Rice and Corn Production in Indonesia

(1,000 TONS)

	RICE PRODUCTION	TOTAL AREA IN RICE(1)	CORN PRODUCTION	TOTAL FOOD GRAINS
1966	10,311	7,691	3,717	14,028
1967	10,168	7,516	2,369	12,537
1968	11,426	8,021	3,166	14,592
1969	11,997	8,014	2,293	14,290
1970	12,862	8,135	2,825	15,694
1971	13,441	8,325	2,607	16,048
1972	12,912	7,987	2,254	15,166
1973	14,306	8,383	2,912	17,218
1974	15,300	8,395	3,239	18,539
1975	15,350	8,400	3,500	18,850
1976	15,400	8,400	3,500	18,900

SOURCE: WORLD BANK; USDA, AND ADJUSTMENTS BY THE AUTHOR

(1) 1974-6 ESTIMATED

3.5-4 t-ha are common. The HYV seeds being used have a potential yield of 5.5-6.0 t-ha.

However, several problems presently limit the prospects for near-term continued growth. One is that many peasants who have received BIMAS credits are unable to repay the loans. After two years of default, they are dropped from the program. Yields will begin to fall if this problem is not solved. Second, Indonesia is faced with a fertilizer glut. The crash PUSRI fertilizer production program has already constructed the PUSRI I complex with 120,000 tons a year of urea capacity, PUSRI II with 400,000 tons a year capacity, and PUSRI III is just now coming onstream, with 620,000 tons a year urea capacity. This total of 1.14 mt tons urea is well above current consumption of 340,000 tons nitrogen content (800,000 tons of urea), but PUSRI IV, also with 620,000 tons capacity, is 40-50 percent complete and scheduled to come onstream by early 1978.

The problem is not that the fertilizer cannot be physically absorbed by Indonesian agriculture. It should be if output is to continue rising. But the market economies of fertilizer use today discourage increased consumption — with adequate rice production, rice prices are relatively low, while the Indonesian government is seeking to reduce the fertilizer price subsidy, raising fertilizer prices. The increased demand for fertilizer does not exist at these relative price levels. The government's problem is compounded by an estimated 2 million tons of urea currently in storage from an importing spree in 1974-75. That alone is more than two years' current consumption. The government has gone into the export market, but world fertilizer prices are also depressed. While 75,888 tons is being purchased by the Philippines, prospects are not bright.

Indonesia is out of the immediate danger of food shortage. However, the country seems headed for another round of a problem once dubbed "agricultural involution" by a noted anthropologist. Since the arrival of the Dutch several centuries ago, Indonesian agricultural productivity has advanced by a series of quantum steps based on advancing technology and farming competence. Yet this progress has never been accompanied by a shift of workers out of agriculture into manufacturing . Since the net result is always an increase in yield per hectare and a stagnation in yield per rural inhabitant, the increased output is squandered in sustaining more peasants, not a growing urban, industrial population.

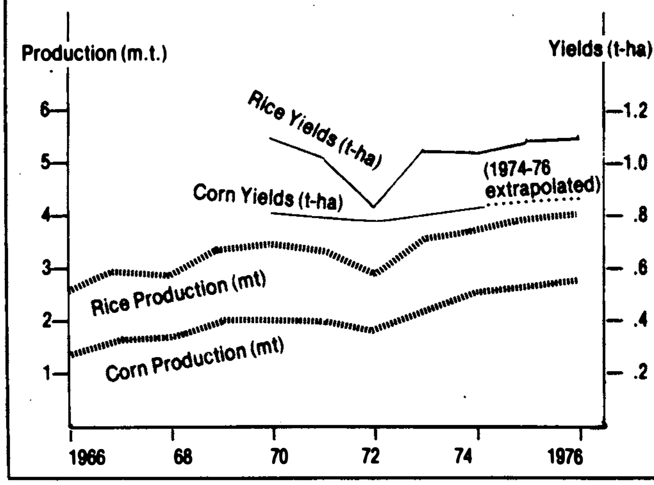
With the collapse of Indonesia's state-oil company Pertamina as a spark for industrialization, and the siphoning off of much of the country's oil revenues to pay foreign debts and the consequent starvation of the national development plans, the agricultural advances appear doomed to be consumed again in the countryside by the growth of superfluous additional agrarian workers.

Philippines

The Philippines is the home of the Rockefeller Foundation and Ford-Foundation-established International Rice Research Institute, which has developed all the HYVs of rice for Asia. Yet the Philippines has one of the lowest yields for rice in Asia — below that of Bangladesh.

Graph 7

Production and Yields of Rice in the Phillippines



Graph 7 shows rice and corn production, and the yields on each (yield figures before 1970 n.a.) from 1966-76. As can be seen, rice yields maintain a miserable 1.05-1.15 t-ha level. Yields on corn, the second major foodgrains crop, are worse, at under .85 t-ha. The modest increase in total rice production from 3.56 mt in 1970 (12 percent), less than population increase, was entirely accounted for by increases in rice acreage, not yields. The steady growth of corn is also based entirely in expanding acreage.

A major reason for low output level is Philippine weather, which brings tropical storms during much of the growing season that frequently cause extensive flooding. There is also very little irrigation farming.

Fertilizer use reached a high of about 200,000 nutrient tons in 1970 and remained at that level through 1973. 1974 saw a sizeable jump, but in 1975 fertilizer use fell 24 percent, approaching the previous low level. Figures for 1976 are not yet available.

Government measures to raise production have included credit programs for farmers, but heavy defaulting over the past year has cast a pall over the program. There is the potential to double and triple output by reaching yields of 2.5-3.0 t-ha, based on use of HYVs. But attaining this target will take measures apparently not now on the planning board to vastly up the acreage under irrigation and extensive fertilizer use.

Thailand

Thailand is in an enviable position for an Asian country with ample foodgrains production to feed its population and sizeable quantities for export. Production of rice, its principal crop, fell marginally in 1976 to 9.9 mt (see Table 5). Corn, the second principal crop (mostly for export), fell from 3.0 to 2.7 mt, a 10 percent drop. Since 1966, the average rice output has only risen 20 percent from a 1966-68 average of 8.2 mt to the 1976 level; population has increased 38 percent. Nonetheless. per capita rice production is well over 200 kg-per-person-per-year, the

Table 5

Foodgrain Production in Thailand

(THOUSANDS OF TONS)

	RICE PRODUCTION	CORN PRODUCTION
1966	8,910	1,122
1967	7,391	1,315
1968	8,191	1,503
1969	8,851	1,700
1970	8,956	1,938
1971	8,718	2,300
1972	8,065	1,315
1973	9,471	2,350
1974	9,570	2,450
1975	10,032	3,000
1976	9,900	2,700

Table 6

Foodgrain Production in South Korea

(THOUSANDS OF TONS)

	RICE PRODUCTION	OTHER GRAINS	TOTAL(1)
1966	3,919	1,962	5,881
1967	3,603	1,862	5,465
1968	3,195	2,028	5,223
1969	4,090	2,032	6,122
1970	3,939	1,945	5,884
1971	3,997	1,316	5,813
1972	3,957	1,836	5,793
1973	4,211	1,613	5,324
1974	4,445	1,531	5,976
1975	4,700	1,812	6,512
1976	5,215	1,852	7,067

(1) EXCLUDING SORGHUM, MILLET, CORN AND PALSES, ALL VERY SMALL QUANTITIES.

SOURCE: USDA

highest in Asia. Over the same period, corn has surged from 1.1 mt in 1966 to 3 mt in 1975, adding to Thailand's export capacity. The basis for Thai production is adequate rainfall and land, as yields remain low, well below 1.5 t-ha, and fertilizer use is almost nil in rice production.

Malaysia

Malaysia is not an important foodgrains producer. Three quarters of the country's cultivated land is devoted to perennial tree crops: 1.7 mil ha of rubber trees, 0.5 mil ha of palm trees for palm oil, and 0.2 mil ha of coconut trees for coconut oil. Only 800,000 hectares, about 25 percent of the total, is in other crops, with about 600,000 in rice. Yields average approximately 2 t-ha, as an extensive irrigation network has enabled some areas to exceed 2.5 t-ha. Malaysia is likely to remain a food importer for the foreseeable future.

Burma

As Table 1 indicates, Burma's rice output has risen over 7 percent since 1974, with most of the increase in 1975. The potential for greatly expanded rice output and yields is well-known, but depends on the development of infrastructure, of fertilizer use, and raising the cultural level of the farmers, all of which are still a long way off in Burma.

East Asia

South Korea

South Korea is the success story of Asia in high yields for rice. Production in 1976 reached 5.2 mt, an all-time record and an 11 percent increase over 1975. Yields were 4.3 t-ha, a 12 percent increase over 1975, and one of the highest in the world. The basis for these levels is a high degree of irrigation, widespread scientific farming, and very large use of fertilizer, consumption of which has risen steadily from over 400,000 tons in 1967 to 920,000 tons in 1976, by far the highest in Asia outside Japan.

Table 6 shows the growth of rice, other grains (wheat, rye, and barley) and their total. Grains other than rice have remained static or fallen, while rice production stagnated for six years from 1966-72. The spurt of growth since 1973 has raised output 32 percent over four years. The figures for per capita grain production, therefore (see Graph 8, plotted as in Graph 1), show a high in 1966 and 1969 that has only now been regained.

South Korea's high yields place it in the same position as Japan, where little more can be done to raise yields. The crash industrialization program undertaken by the Park government has already made South Korea into a semi-industrial nation that can afford not to be dependent in food production for economic survival.

Taiwan

Taiwan enjoys very high yields of rice, its principal food crop. But as Table 7 shows, the country reached a level of over 3.0 t-ha in 1966 and has remained at about this level ever since. A record 2.7 mt rice harvest last year boosted the yield of 3.4 t-ha. (The real increases occurred between 1952, when yields were 2.0 t-ha, and 1965 when they first rose to 3.0). This record 8.4 percent increase in rice production was mainly due to extremely favorable weather. Fertlizer use has risen only moderately since 1967.

China

Table 8 shows USDA estimates of China's foodgrain production for 1974-76. For 1976, a total estimate has not yet been made, but a slight decline is expected. This author anticipates about 265 mt, a 2 percent decline. 1976 was beset with bad weather, compounded to a great degree by disruptions caused by the succession upheaval, known to have severely reduced industrial production and caused substantial chaos in the countryside.

Despite efforts to increase chemical fertilizer use, including the importation of 13 large plants from the West, to educate the peasantry in modern farming techniques, and to provide mechanized equipment, China's agricultural production has done little more than keep pace with population over the past two decades.

The two main problems have been inability to carry out the large-scale water control programs that would tame particularly the Yellow River, minimizing the danger of flooding and providing reliable irrigation water to counter the frequent droughts, especially in North China; and an inadequate rate of industrialization for machinery inputs necessary to reach high annual rates of agricultural production growth. It remains to be seen how well the new leadership in China succeeds in its stated goal of significant mechanization of agriculture by 1980. As in India, the development of agriculture can only be sustained if it accompanies swift industrial growth. In China, this means returning to the focus abandoned in the late 1950s of placing primacy on heavy industry — a change that will require abrogation of Mao's dictum on its subordinate place.

—Peter Rush

Table 7
Rice Production and Yields in Taiwan
(1,000 TONS)

	RICE PRODUCTION	RICE YIELDS T/HA
1966	2,380	3.0
1967	2,414	3.1
1968	2,518	3.2
1969	2,322	3.0
1970	2,463	3.2
1971	2,314	3.1
1972	2,440	3.3
1973	2,225	3.1
1974	2,452	3.2
1975	2,494	3.2
1976	2,700	3.4

SOURCE: USDA

Graph 8
Index of Per Capita Foodgrain Production in South Korea

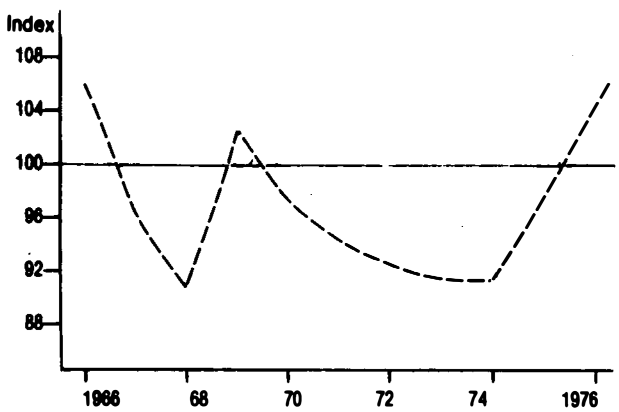


Table 8
Foodgrain Production in China
(THOUSANDS OF TONS)

	WHEAT	RICE	ALL FOOD GRAINS
1974	37,000	120,000	265,000
1975	40,000	119,000	270,000
1976	43,000	118,000	*

* USDA ESTIMATES A SLIGHT OVERALL DECREASE. THIS AUTHOR ESTIMATES 265 MILLION.

SOURCE: USDA