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# **IFPRI** REPORT 1986

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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## INTRODUCTION

The International Food Policy Research Institute (IFPRI) conducts research on the world food problem through an integrated approach examining the interrelationships of technological change, agricultural growth, overall economic growth, and social welfare. IFPRI's approach recognizes that the world food problem reflects differing food problems among and within countries. In some countries food problems exist because of slow production growth. In others they are caused by inadequate distribution resulting from poor roads and transportation facilities and other infrastructural inadequacies. In yet others, food problems exist because the poor, lacking opportunities for employment, also lack purchasing power. The nature and degree of these problems vary as do technologies, incomes, population size, food habits, and short-term food emergencies.

At present five areas are of central importance to setting IFPRI's research agenda:

1. development strategy, addressing macroeconomic issues that have a bearing on the pivotal role of food and agriculture in the development process;
2. technology policy, reflecting the essential function of technological change in accelerating agricultural growth;
3. poverty alleviation, emphasizing IFPRI's mandated concern with the food consumption and nutritional status of low-income people and the critical importance of income generation for improving that status;
4. Africa, denoting the urgent, complex, and long-term nature of food problems in this region, the decisive role of food policy in alleviating them, and IFPRI's capacity to bring a global comparative analysis to bear on this issue; and
5. food aid, reflecting on IFPRI's concern with the massive net flows of food from developed to developing countries, the importance of increased food consumption for the short-run mitigation of hunger and the crucial wage-goods role of food in infrastructure development and agricultural growth.

The five areas serve to integrate the results of research projects undertaken within the five research programs. The annual report describes these project results for 1986.

The annual report contains the second biannual address of the director of IFPRI to the Consultative Group on International Agricultural Research (CGIAR) during International Centers Week—the formal meeting of the donors to the CGIAR and the CGIAR center directors and board chairmen. The address focuses on the current favorable global food situation and the opportunities this provides for tackling the problems of sustaining long-term agricultural growth, employment, and poverty reduction.

The results of the work undertaken during 1986 are reported in six research reports, six issues of *IFPRI Abstract*, and three issues of the newsletter, *IFPRI Report*. Other publications include two working papers, two papers in the "gray" series, a food policy statement, and reprints of 21 articles by IFPRI staff. In January IFPRI published *Crop Insurance for Agricultural Development: Issues and Experience*, edited by Peter B. R. Hazell, Carlos Pomareda, and Alberto Valdés, the second book in its series with The Johns Hopkins University Press.

The Outreach section of the annual report contains a discussion of IFPRI's collaboration with other centers in the CGIAR and a discussion of collaboration with national institutions in developing countries. In 1986 these institutions were located in Argentina, Bangladesh, Brazil, Burkina Faso, Chile, People's Republic of China, Colombia, Costa Rica, Côte d'Ivoire, Gambia, Guatemala, India, Indonesia, Kenya, Nepal, Nigeria, Pakistan, Philippines, Rwanda, Senegal, Sri Lanka, Thailand, Zaire, Zambia, and Zimbabwe.

The Outreach section also reports on a major workshop IFPRI held on the growth linkage effects of the "green revolution" in North Arcot, India and on a workshop jointly planned with the Food and Agriculture Organization of the United Nations (FAO) on data needs in developing countries.

At the invitation of the Kenyan government, IFPRI held its Board of Trustees meeting for program review in Nairobi, Kenya. IFPRI researchers and Board members participated in a day-long seminar with Kenyan researchers and policymakers to discuss food issues facing Kenya. The Board and staff visited farms in Western Kenya and met with officials of the Kenyan government.



# THE NEW GLOBAL CONTEXT FOR AGRICULTURAL RESEARCH: IMPLICATIONS FOR POLICY\*

BY JOHN W. MELLOR

I am grateful to the chairman of the CGIAR and to the Group itself for this opportunity to address you. You may recall that the External Program Review for IFPRI made two recommendations that provide the basis for this address. First, it recommended that the director of IFPRI should address the CGIAR biennially on a policy issue of relevance to the Group. This will be the second occasion for me to do so. Second, the review team urged that the director of IFPRI make carefully considered extrapolations from the factual base of IFPRI research as well as that of other research organizations and draw policy conclusions of immediate relevance to the complex food policy problems facing our society. The need for such extrapolation is particularly acute today—events have outrun the global capacity for food policy research, and hence we must extrapolate with particular vigor, care, and risk.

Although through my normal travels and those of our Board and staff, I have been exposed continuously to developing-country views on the issues I will touch on here, I was particularly grateful for the opportunity to participate in recent meetings in Italy, the United States, and the United Kingdom that brought home to me how important, difficult, and delicate are these issues. I no longer find it surprising that the facts of the global food situation are as likely to cause contention as the extrapolations. But in any case I approach these extrapolations with genuine humility and concern.

Nevertheless, my message is a simple one: of thanks, for the bounteous harvests in much of the world; of concern, that complacency will diminish that bounty; and of apprehension, that the extreme complexity of the task of using that bounty to banish hunger will turn us away from the policies for its sustenance and use.

# T

## INTRODUCTION

he apparent food abundance of today is in sharp contrast with the situation of a decade ago. Global cereal stocks in the mid-1980s have been more than twice as large as in the mid-

\*Address presented at International Centers Week, November 3, 1986, Washington, D.C.

1970s. Real world cereal prices were down 30 percent in 1985 from 1981, compared to an almost twofold increase from 1972 to 1974. Real fertilizer prices have fallen to the lows of the late 1960s after having more than quadrupled in real terms from 1971 to 1974. Lack of natural gas feedstock for the production of fertilizer is now a much less worrying problem than inadequate investment in production capacity.

Finally, on the negative side, many developing countries are diverted from long-term development efforts by overwhelming debt problems and the need for major adjustments in foreign exchange rates and their national budgets. And, the focus has switched from food shortages in Asia to those in Africa, which remain acute.

In a similar address two years ago, I discussed the importance and difficulty of transferring the concepts of agricultural success from Asia to Africa. That challenge persists. Today, however, I focus my remarks on the dynamic global food supply/demand balance, an area of major concern, which links the interests of developed and developing countries and has important implications for foreign assistance and agricultural research policy.

## **D** UNDERLYING TRENDS

During the period 1961-80, developing countries' cereal production grew at an annual rate of 2.9 percent per year, while consumption grew at the considerably faster rate of 3.2 percent per year. Hence, net annual cereal imports of the developing countries increased more than fourfold in 20 years from about 15 million metric tons to 64 million tons.

Cereal imports by developing countries grew slowly in the 1960s and then accelerated sharply after 1972, with that accelerated growth showing no sign of decline, at least to 1984. Developing countries have increased their share of total world imports of cereals from a 1961-63 average of 36 percent to a 1981-83 average of 43 percent—an absolute increase of 315 percent. The developing countries represent the only major cereal market capable of rapid growth.

From 1961 to 1980 cereal production in the developed countries grew 3.1 percent per year and consumption, at a much slower 2.5 percent per year. The difference represented the rapidly growing exportable surplus to the developing countries. Developed-country imports and exports dropped sharply from 1981 to 1984, with a substantial recovery in 1985.

## **P** THE FUTURE: PROJECTIONS TO 2000

Projection of past trends for food supply and demand, though an uncertain indicator of the future, has three features that recommend it: it smooths the effects of short-term influences, such as weather; it illuminates the effects of cumulative forces; and it shows potential changes in a country's position from net importer to net exporter and vice versa, arising from given supply and demand changes. Such projections are particularly revealing for food, for

which underlying structural forces of supply and demand change only slowly.

A standard projection to 2000 for developing countries, assuming that trends in output and income from the 1960s to 1980s continue, states an increase of 40 million tons in the shortfall (or imports) of staple food crops from 1980. 1984 actual net imports were on the projected trend line.

Growth in the demand for livestock products is a major source of growth in demand for basic food staples. Although in developing countries waste and by-products initially sustain the bulk of livestock, accelerated growth of livestock output quickly surpasses the inelastic supply of such feed. Further increments to production are made largely on concentrate feeds, particularly cereals. These projections assume constant feeding rates in livestock production.

If, however, we project the trend growth of feed use during the base period and further assume market relationships for livestock products at constant relative prices, the production shortfall in developing countries increases by another 40 million tons. It must be emphasized that this projection of feed use requires a return to the per capita income growth of the 1966-80 period. The debt crisis and the structural adjustment crisis must be met and passed beyond.

Developing countries have been expanding imports of livestock products at a rapid pace. Since livestock production is generally labor intensive, it is logical for developing countries to displace projected imports with domestic production. Success in such an effort could conservatively add another 40 million tons to imports of major staples, largely for use as feed.

If these favorable circumstances prevail—in essence, if developing countries improve their development strategy to return to the growth rates of the 1960s and 1970s—developing-country imports would grow at a rate similar to or somewhat higher than in the past two decades.

Three caveats must be noted about use of such projections. First, one must take these numbers in aggregated form and not look at individual countries. That is because so many of the unpredictable events in the world benefit some and not others. For example, in the 1970s growth in most of the oil-producing countries surged ahead, it is said, at the expense of many oil-importing developing countries: perhaps the reverse will happen in the 1990s. Countries differ in their natural resources—Argentina and Thailand have different ratios of people to agricultural production resources than Taiwan or Bangladesh. On all these matters, grouping countries helps us see central tendencies; at times we *do* want to see the forest and not the trees.

Second, and very important, when we look at food gaps and trade figures, we are looking at small residuals from large consumption and production estimates, but small differences in production and consumption data give relatively large differences in trade. It is rash indeed to predict trade volumes and their effects on global prices.

Third, we are poorly placed to judge the future effects of scientific breakthroughs in biology on agricultural production. Keep in mind that whereas such breakthroughs add to demand as well as supply in developing countries, they add only to supply in developed countries.

## B THEORY

Before drawing conclusions, it is useful to briefly outline the theory that lies behind the trends and relationships just presented. It is that theory that gives substantial credibility to such projections.

In developed countries, the demand for food is virtually satiated and hence does not increase with income. In contrast, growth in food output is institutionalized through research and various complementary institutions. Without export growth, the benefit of technological change can only be realized by undertaking the socially difficult task of rapidly withdrawing resources (land and people) from agriculture.

In sharp contrast, in developing countries, rising incomes of low-income people, derived from employment growth, are converted by remarkably high demand elasticities to increased effective demand for food: 60 to 80 percent of incremental income is so spent. Thus in developing countries increased food supplies and increased employment are two sides of the same coin; one cannot proceed long without the other.

Further, accelerated growth of food production has the potential for setting in motion powerful multiplier forces on income and especially employment in other sectors. That, coupled with added growth arising autonomously in the other sectors, results in the normal picture of fast growth in basic food staple production being accompanied by even faster growth in food consumption.

It is these relationships that make reasonable the remarkable finding that from the late 1960s to the late 1970s, the 29 developing countries with the fastest growth rates in basic food staple production increased their imports of basic food staples by 360 percent in the same period. It is this potential for developing countries to expand demand for food faster than even high rates of growth of food production that needs to be understood and nurtured and which offers such exciting prospects for the reduction of poverty and malnourishment.

## F IMPLICATIONS

### DEVELOPED COUNTRIES

For developed countries, the much larger fluctuations in production reduce the credibility of trend-based projections compared to developing countries. However, a simple projection to 2000 of domestic use and production for the period 1961-80 shows an exportable surplus from developed countries more than double the largest projected level of developing-country net imports. Such estimates assume no diminution of growth rates for livestock feed in the Soviet bloc from the high levels of 1961-80.

Such estimates are extraordinarily fragile. If, for example, the production growth rate in developed countries were to drop to the level of 1972-83 and consumption growth rates were maintained, then the developed countries would actually become net importers. Unfortunately, while prediction of developed-country exports is highly uncertain, it matters immensely to the choice of development strategy in developing countries.

Because the production trends in developed countries are so subject to policy, it is well to keep in mind the following points. First, developing countries as a group will prosper more if they do not face rapidly rising food prices driven by their own demand. But, conversely, intermittent dumping on international markets and consequent unpredictable periods of sharply depressed prices are deleterious to their long-term efforts at rural growth.

Second, demand is much more responsive to price in developing countries than in developed countries, whereas supply is more responsive in developed countries than in developing countries. Thus, to simplify, rising global food prices foster developed-country surpluses and reduce demand in developing countries primarily through effects on the poor.

But, third, the pace at which export surpluses are generated in developed countries now appears to be rapid enough to severely depress international prices, suggesting a need for structural adjustments in developed countries despite the rapidly growing Third World market.

Fourth, given the social costs in developed countries of drastically reduced food production and the potentials to raise food demand in developing countries through food aid-based employment growth, it is logical to develop such programs on a much larger scale than at present.

#### DEVELOPING-COUNTRY EXPORTERS

Today, only a few developing countries are net exporters of food. Two countries, Argentina and Thailand, which have favorable land-to-person ratios, accounted for 68 percent of total developing-country cereal exports in 1979-83 and will be considerably larger exporters by 2000. There are probably one or two other developing countries that have similar land resources and export potentials but unfavorable policies that hold back their agriculture. These few countries are severely injured by food dumping by high-income countries.

Poor, high-population-pressure countries are another story. It is striking that in projections to 2000, countries with per capita incomes below U.S. \$500 provide 83 percent of developing-country net major staple food exports other than those of Thailand and Argentina. In particular, four countries—China, India, Indonesia, and Pakistan—account for 71 percent of projected developing country net exports, excluding Argentina and Thailand.

Exports of food clearly represent a failure in employment generation and poverty alleviation for countries with per capita incomes below U.S. \$500. They have half or more of their population deficient in food intake. The countries in the low-income group projected to become exporters tend to be large and populous, to have a high percentage of total GDP in nonagricultural sectors, but a large percentage of total labor force in agriculture; the former typically twice the latter. Their low per capita GNPs are, in general, increasing slowly. These characteristics suggest that they have capital-intensive investment policies causing low growth in employment, to the particular deprivation of their low-income people. A change in investment strategy would foster faster and more equitable growth, would accelerate the food production growth rate, and would change these countries from food exporters to food importers.

## DEVELOPING-COUNTRY IMPORTERS

It is notable that developing countries with per capita incomes over U.S. \$500 are generally able to generate demand for food more rapidly than domestic production growth. Developing-country importers with per capita incomes less than U.S. \$500 also manage to increase employment and hence effective demand more rapidly than production. Of course, the least developed countries with the lowest incomes simply have low growth rates in food production. Foreign assistance and food aid keep consumption somewhat higher than would otherwise be possible in these countries.

The number one policy need for net food-importing countries is an international environment in which food supplies are reliable over the long run. If they are to expand employment more rapidly than food production, they must believe that the shortfalls generated by these divergent trends can be met without steadily rising prices. That means there must be a reliable, growing international market. They also need to be protected from radical short-run fluctuations in domestic and international supplies and prices. For the latter, one needs a source of international finance such as a well-operating International Monetary Fund cereal facility. Whether enlarged stocks are needed as well is a moot point.

For employment growth to increase demand for food more rapidly than domestic supply requires wide participation in the development process. This, in turn, requires a rural infrastructure that brings most of the people into close contact with the improved markets and technology necessary for the modernization of agriculture. There also is a need for the development of employment linkages between agriculture and the rest of the economy so that growing agricultural incomes will result in expenditure patterns and responses to those patterns favorable to the growth of rural industry and employment. Agricultural growth through cost-decreasing technological change, a product of agricultural research in the national and international systems, is the basic engine for such growth.

## F A NOTE ON FOREIGN ASSISTANCE POLICY

Foreign assistance policies that support agricultural production and employment-oriented strategies of growth are concurrently favorable to growth and poverty alleviation in developing countries and to increased markets for food exporters. What are the broad policy outlines of such strategies?

First and foremost is investment in agricultural research and its support services to start the engine of growth.

Second is assistance to growth of infrastructure. That is to ensure breadth of participation in growth. In a world of food surpluses, hungry people, and inadequate rural employment, infrastructure investment offers immense potential for effective use of food aid, particularly in the low-income countries. It is puzzling that hunger, lack of labor and food resources for building infrastructure, and huge food surpluses can coexist.

Third is increasing food security nationally and internationally. That is needed because a strategy relying on food and employment growth is terribly vulnerable to the effects of normal fluctuation in food production.

Behind all these processes is rapid expansion of trained people—a high-employment strategy of growth is accompanied by extraordinarily rapid growth in demand for educated people at all levels. Foreign assistance has its greatest comparative advantage in helping meet that demand.

## **T** AGRICULTURAL RESEARCH POLICY

The new environment of apparent global abundance of food brings somewhat differing requirements for food production research.

First, there must be an even greater emphasis than in the past on reducing costs of production. In Asia, that reduction occurs by raising yields per acre. In Africa, the problem is more complex. Labor productivity is the greatest limitation to production increases in Africa. We can already substantiate that, in general, the appropriate way to raise labor productivity in Africa is through yield-increasing technology but with a particular concern for the effect of such technology on labor productivity.

The national and international agricultural research systems have done yeoman work in recent years to broaden the range of conditions suitable to high-yielding varieties. This work has gone sufficiently far that one can truly talk about saturation of large areas with high-yielding varieties. How then will growth rates of the recent past be maintained into the next decades? That will soon be a serious problem in Asia. All the impressions of food abundance will disappear within a decade or two without further breakthroughs in yield potential.

Second, with a more bountiful food supply in the world, we have the opportunity to take more meaningful steps toward sustaining growth in agriculture. On the one hand, we must increasingly shift higher-yielding, more productive farming systems into environments whose ecosystems can sustain such increased intensity. That should allow gradual increase in the proportion of population in more sustainable areas, while concurrently reducing population pressures in areas that cannot sustain arable agriculture. We must ask ourselves what are the implications of this to two related research questions. One is: under what circumstances and by what mechanisms can we use the increased abundance of food in the world to reduce population pressures more rapidly in the areas that cannot support arable agriculture? The other is: should that then push our research resources more toward the perennial grasses and tree crops that can be sustained in such areas?

Third, when the abundance of food is increasing, we must increase the emphasis on maximizing the linkages between agricultural growth and employment growth in nonagricultural sectors. That too requires research. Increasingly, lack of effective demand for food is proving to be a constraint for developing countries with per capita incomes under U.S. \$500, in spite of progress in agricultural production. We have done a good job of documenting the existence of linkages between agricultural growth and employment in other sectors, but we have not gone far in diagnosing the policy prescriptions for maximizing the size of those linkages.

Fourth, where food is more abundant, we can turn more vigorously to increasing employment by developing smallholder livestock production. Here we face elastic demand for the product and hence a substantial increase in demand from a small decline in prices. There are, however, clear technical problems, not only in production but also in marketing. Because of the inelasticity of waste and by-product feed supplies, research must have a twofold emphasis on increasing the productivity of grasslands and improving our knowledge about the productive use of concentrate feeds. Any enhancement of livestock production will also help to solve the difficult problem of inferior grains, such as millets and sorghums, and even maize. These cereals are well-suited to large areas and have good possibilities for increasing yields, and yet the demand for them is highly inelastic except as livestock feed.

Fifth, with an increasing abundance of food, we need to focus our attention more on the problems of the poorest countries and the poorest people within those countries. However, these two sets of problems call for somewhat different treatment. With respect to the poorest countries, there undoubtedly needs to be an emphasis on the better areas within those countries in order to increase the returns to investment in agriculture and to generate the funds for tackling the much more difficult problems of the more backward areas.

With respect to the poorest people in the poorest regions, we need to be much more innovative in developing research approaches. We must differentiate clearly between short-term needs to mitigate the problems of the very poor and longer-term adjustments that can be made as population densities are gradually reduced through more intensive and sustainable development in other areas.

## CONCLUSION

**L**et us hope that the present abundance of food is not an illusion or a quickly passing aberration. Let us recognize abundance for the blessing it is: by raising incomes in developing countries with new, cost-effective food production technology; by using food surpluses to support labor-intensive investment in the infrastructure that broadens participation in growth; by providing food security measures that reduce the risks to governments of caring about poverty and acting on those concerns; and by learning now how to bring the lower-income countries to the stage of development where effective demand for food outruns effective agricultural development policies.

## FOOD DATA EVALUATION PROGRAM

Research in the Food Data Evaluation Program largely involves the analysis of trends in food production, consumption, and trade, and, based partly on these trends, the projections of food output and consumption in the Third World. This work builds on the agricultural and economic data provided by other international organizations, primarily the Food and Agriculture Organization of the United Nations (FAO). The studies attempt to identify the major factors underlying the observed trends and the geographical areas and country groups of critical concern in future food problems.

During 1986 the focus of research shifted from analyses of pooled data on major food staples to those for smaller commodity groups and individual commodities. This approach complements trend studies in earlier years and provides more opportunities for collaboration with the commodity-focused centers in the CGIAR.

In addition to its food gap studies, the program also organizes and shares with members of the IFPRI staff statistics on the production, consumption, and trade of major food crops and livestock products. Particular emphasis has been given to the organization of national and provincial data on food production and inputs to agriculture in the People's Republic of China. During 1986 research focused on evolving Chinese demand for chemical fertilizers and systemic and policy adjustments in the administration of fertilizer production, marketing, allocation, and distribution systems. Research was also initiated on rural employment promotion strategies and data were gathered on the major current shifts in Chinese rural employment patterns.

An increased concern of the program is the weak data collection systems of many developing countries, particularly in Sub-Saharan Africa. Studies regarding the gathering, evaluation, and use of data for food policy research in the Third World can lead to the improvement in the quality and nature of collected statistics and thus, improvement of food policy decisions that are based on them.

During 1986 the program published research reports on trends and projections to the year 2000 of major food crops and of cereal feed use in the Third World. The analysis of updated agricultural statistics on China and of national data on food production and consumption in selected Third World countries continued.

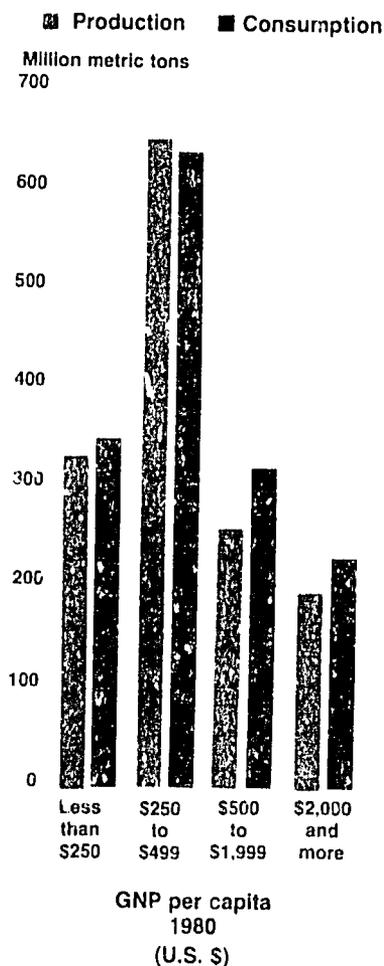


## FOOD PROJECTIONS TO 2000

What will be the likely scenario for the production and consumption of basic food staples (cereals, roots and tubers, pulses, groundnuts, and bananas and plantains) in the Third World in the year 2000? What will be the size and geographical focus of the Third World's food problem? These questions are addressed in *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52, by Leonardo Paulino, published in 1986. The analysis is based on production data for 1961-80 and consumption and trade data for 1966-80 for 105 countries in the Third World. Study results are presented for Asia, Sub-Saharan Africa, Latin America, and North Africa/Middle East and their 11 subregions.

Based on past trends, the study projects a Third World net production shortfall in basic food staples of about 70 million metric tons (80 million tons excluding China), with the bulk of this deficit

Figure 1  
Projections of Third World production and consumption of major food crops to 2000, by country GNP per capita, 1980



Source: Leonardo A. Paulino, *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52 (Washington, D.C.: IFPRI, 1986).

occurring in North Africa/Middle East (60 million tons) and Sub-Saharan Africa (50 million tons). Latin America is projected to have a 10-million-ton production shortfall, while, in contrast, Asia is projected to have a net surplus of 50 million tons.

The 20 poorest countries (with 1980 per capita incomes of less than U.S. \$250) are projected to face a deficit of 10 million tons (see Figure 1). Half of these countries are in Sub-Saharan Africa. Deficits two to three times greater than their 1980 shortfalls are projected for countries with per capita incomes greater than U.S. \$500.

When developing countries are classified according to income growth during 1961-80, the production-demand projections show only one group in a food surplus position by the end of the century. Projected output exceeds projected demand in the slow growth countries (1.0-2.9 percent annual growth rate in GNP per capita) by about 25 million tons or six-and-a-half times their net surplus in 1980 (see Table 1). Compared to the 1980 levels, countries with less than 1.0 percent annual growth rate in GNP per capita will triple their food deficits, while those with growth rates of 5.0 percent or higher are expected to double their deficits.

To fill these gaps, the report suggests that food trade will have to play a greater role than in the past. Net imports of basic food staples tripled from 1966-70 to 1976-80, expanding from a yearly average of 12 million tons to 38 million tons. A major concern is the ability of the poorest countries with the lowest rates in income growth, which have a projected aggregate shortfall of about 17 percent of the Third World total, to pay the costs of imports. The report suggests that food aid will continue to play an important role in filling these needs, particularly in Africa. In addition, as area expansion in food production continues to decline, future increments in food production will increasingly depend on the spread of improved agricultural technology.

Table 1  
Projections of Third World production and consumption of major food crops, by country income growth in 1961-80

Country Group Based on Income Growth In 1961-80	Projections to 2000		
	Production	Consumption	Net Surplus/ Deficit
	(million metric tons)		
Less than 1.0 percent	111	140	-29
1.0-2.9 percent	448	422	26
3.0-4.9 percent	798	812	-14
More than 5.0 percent	114	165	-51

Source: Leonardo A. Paulino, *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52 (Washington, D.C.: IFPRI, 1986).



## LIVESTOCK FEED

The projected deficit of basic food staples in the Third World by the turn of the century assumes that developing countries will maintain past trends in food production and income and the rates

of growth in the use of basic staples for animal feed. However, depending on the method of projection, feed use in the Third World could range from 245 to 285 million tons of cereals by 2000 (excluding China). If the upper limit of 285 million tons of feed use were to occur, the projected food deficit would increase by 40 million tons.

Projections of the amount of cereals needed for animal feed were reported in *Cereal Feed Use in the Third World: Past Trends and Projections to 2000*, Research Report 57, by J. S. Sarma, which examines trends in the use of cereals for feed in 104 developing countries, relates these trends to those in the output of livestock products (including poultry), and makes projections to the turn of the century. The five methods used to project demand for cereal feed to 2000 are based on different assumptions regarding the past growth in feed use and in output of livestock products. Estimates of the growth in demand for cereal feed vary from 4.7 to 5.5 percent a year. Using the projected feeding ratios based on the past relationship between feed use and livestock output, the requirements for cereal feed in 2000 to achieve the projected livestock output in that year would be about 245 million tons, or about two and a half times that in 1980 (see Figure 2).

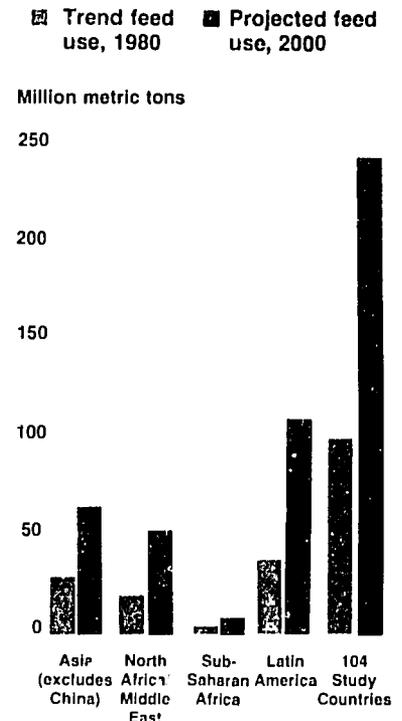
The report indicates that for middle- and high-income developing countries with fewer foreign exchange constraints, the shortfalls could be met from imports of cereals from developed or other developing countries. In other countries where this is not the case, other measures are necessary, including improving feed-grain yields through research and development. Also, there is scope for substituting protein-supplemented noncereals, like cassava, for cereals in mixed feeds.

As per capita incomes continue to rise, demand for feeds and fodder will increase, resulting in higher competition for land. This will require more intensive land use, research on new sources of feed, and making better use of agricultural by-products in compound and mixed feeds. These efforts will require increased resources at the national and international levels.

## FOOD TRENDS AND PROJECTIONS WORK FOR DEVELOPING COUNTRIES UNDER-TAKEN WITHIN THE PROGRAM HAS HIGHLIGHTED THAT THE FOCUS OF ATTENTION OF THE FUTURE WORLD FOOD PROBLEM WILL BE ON SUB-SAHARAN AFRICA. PAST FOOD PRODUCTION PERFORMANCE SUGGESTS THAT IN ORDER TO ALLEVIATE THE PROBLEM, CONSIDERABLE ACCELERATION OF AGRICULTURAL GROWTH IS NEEDED IN THIS REGION. THE FORMULATION AND IMPLEMENTATION OF POLICIES AND PROGRAMS TO ACHIEVE THIS GROWTH REQUIRES A GOOD AGRICULTURAL DATA BASE, COMPRISING AREA AND PRODUCTION FIGURES FOR FOOD AND CASH CROPS. IN SUB-SAHARAN AFRICA DATA ARE WEAK AND IN MANY CASES LACK TIMELINESS, RELIABILITY, COMPLETENESS, AND COMPARABILITY OVER TIME. IN ADDITION, IN SOME COUNTRIES, DIFFERENT SETS OF CROP ESTIMATES ARE AVAILABLE FROM DIFFERENT STATE AGENCIES. IN SOME OTHERS, THE COUNTRY DATA DIFFER GREATLY FROM THE FAO SERIES. IDENTIFICATION OF THE NATURE OF THE DEFICIENCY IS NECESSARY FOR THE FORMULATION OF MEASURES FOR THE IMPROVEMENT OF DATA.

The measures needed to strengthen the basic agricultural statistics system differ with conditions among countries. In col-

Figure 2  
Trend and projected feed use of cereals in 104 countries by region, 1980 and 2000



Source: J. S. Sarma, *Cereal Feed Use in the Third World: Past Trends and Projections to 2000*, Research Report 57 (Washington, D.C.: IFPRI, 1986).

laboration with FAO, program staff are identifying typologies for data needs and the types of improvements necessary for each. Formulating the required improvement schemes will require a country-by-country analysis within the identified typologies. This will facilitate prioritization among the countries needing technical and financial assistance.

## **R** FERTILIZER ADMINISTRATION IN CHINA

Research undertaken by the program in this area has focused on current and future issues related to China's agricultural growth in the context of the country's development of fertilizer use to date and apparent plans for the future. Past program research noted that during the last decade, consumption of fertilizer (primarily nitrogen) in China grew rapidly, averaging 14.2 percent a year, suggesting future periods of much slower growth due to excessively skewed distribution and application of fertilizer among and within provinces and institutional development insufficient to keep pace with requirements created by rapid growth in supply. In addition, it suggested that China needed to continue to expand manufactured nitrogen supplies, despite the current nutrient application imbalance favoring nitrogen. The research highlighted the inequities and inefficiencies involved in the marketing and allocation system and the importance of the small-plant-production sector, despite continued need for growth in production capacity of higher-quality products in efficient-sized factories.

China has recently augmented its plans for capacity expansion in nitrogen as well as phosphate and potash production, and has engaged in an overhaul of the fertilizer marketing (pricing, allocation, and distribution) systems. Research analyzing the lack of growth in Chinese nitrogen use in 1985 and the inventory accumulation for certain nitrogen fertilizers found little evidence to support the contention of fundamental stagnation in potential demand for nitrogen. Causes of the lack of growth include dislocations due to the massive changes in farm-product and fertilizer marketing in 1985, coupled with rural financing difficulties associated with the aftermath of the large 1983 and 1984 bumper crops, and the overly rapid development of small-plant fertilizer production without complementary distribution network growth.

Although China's centralized restraints on nitrogen imports have not been fully lifted and the 1986 domestic production plan was modest, nitrogen use rebounded quickly in 1986, causing scattered shortages, particularly in import-dependent areas. Research indicates that this type of across-the-board central policy adjustment may be the major source of increased cereal production variability in China. However, China is pressing forward with its partial decentralization and liberalization of the fertilizer marketing system, complemented by an increased allocative emphasis on medium- and, to a limited extent, low-application areas. This initiative should not only dampen some of the regionally unwelcome effects of sudden policy shifts on the fertilizer and farm production sectors, but should reduce inequities and increase allocative efficiency in the system as a whole.

## FOOD PRODUCTION POLICY PROGRAM

Accelerating the pace of growth of food crops is the principal objective of agricultural policies in developing countries. However, growth must be achieved through price, supply, and employment stability and with equity.

Although augmentation of traditional resources is an obvious source of growth, many developing countries have reached the border of exploiting land and its complementary resources for agricultural growth in an efficient manner. Thus research in the Food Production Policy Program focuses on accelerating agricultural production through technological change. The development of high-yielding seed-fertilizer-irrigation technology is expanded through appropriate institutions and adequate incentives. Institutions, particularly institutions for financial services and marketing of agricultural inputs, which are closely linked to expanded use of new technologies, generally develop very slowly when left to autonomous forces. Research on the development of such institutions is conducted in the context of studies on specific factors of production that embody modern technology. Providing farmers with incentives for production includes not only improving technology but developing institutions and infrastructures for its adoption.

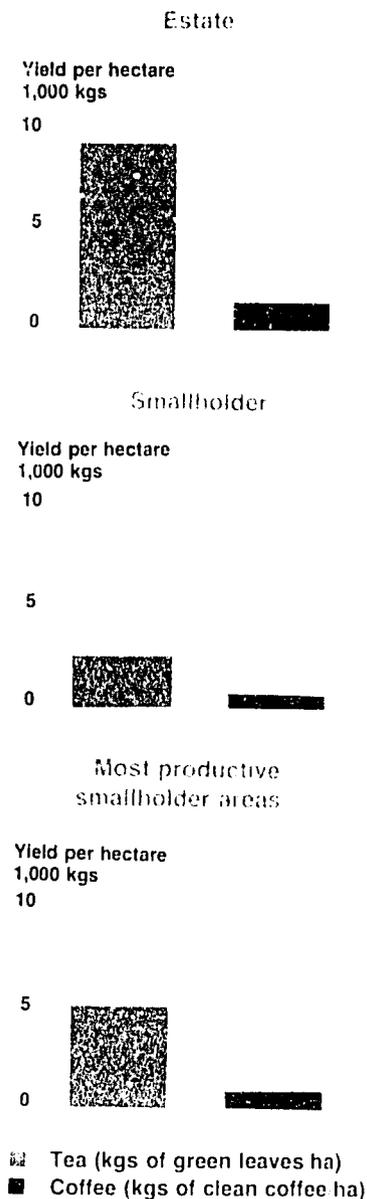
Where technology options are not so encouraging, at least in the immediate future, resource allocation and efficient use of traditional land and labor resources are the principal areas of policy focus. In Africa particularly, production policy research focuses more on the use of land, labor, indigenous technology, and an appropriate mechanism of providing farm-level incentives than on irrigation-based modern technology. Although development of a new and more productive technology is a long-term goal, current policies for accelerating the growth of agricultural production that make the best use of available technology and resources through incentives are the immediate short-term focus.

Research conducted in the Production Program during 1986 focused on two broad areas: the generation and diffusion of technology and incentives for accelerating growth with stability. Projects in the first area examined the factors of production, including research allocation, fertilizer use, and irrigation, and the effect of technological diffusion. Projects in the second area focused on food crop production in Africa, seasonal price variation, and variability. Three completed studies were published in various IFPRI series.

## **B** GENERATION AND DIFFUSION RESEARCH AND RESOURCE ALLOCATION

Both developing countries and donors lack guidelines in determining the allocation of limited research resources and the benefits from alternative research strategies. An ongoing project, involving work at IFPRI and the Australian Centre for International Agricultural Research (ACIAR), is focusing on ways to assess priorities for the Third World as a whole. The framework that has been developed can be used by international and national economic planners to allocate agricultural research resources among commodities and regions. Crop and climate zones have been delineated for 24 major food and nonfood crops and ruminant livestock for about 100 developing countries in order to calculate

Figure 3  
Average yields of tea and coffee on estates and smallholder farms in Kenya, various years



Source: *Farm Management Handbook of Kenya* (Nairobi: Ministry of Agriculture, various years).

direct and indirect (spillover) benefits of agricultural research on these commodities and of their distribution among producers and consumers.

The study looks at both the expected present value of average international benefits from research and at the aggregate benefits accruing to research on the same commodities for the major geographical regions. The results indicate that the choice of commodity priorities for research may be significantly different depending on the distributive objective. If the goal is to maximize total international and spillover benefits, research on rice, potatoes, wheat, and milk would produce a high payoff. However, to achieve an equitable distribution of benefits among producers and consumers, with those benefits accruing primarily to developing countries, research on bananas and plantains, cassava, coconuts, pulses, sweet potatoes, and groundnuts would be appropriate. But the total international benefits from research on most of these commodities would be substantially lower than those from rice, wheat, or milk, and therefore the opportunity costs of giving considerable weight to distributive effects may be substantial.

The study notes that the proportion of the research benefits derived from spillover to regions other than that where the research is initially undertaken is large, varying from 60 to 80 percent of the total. While national decisionmakers would not normally be influenced by considerations of spillover effects, there could be considerable underinvestment in research if they are neglected by international planners.

Ongoing research on research resource allocation in Africa has focused on the growth of agricultural research systems in Kenya, Malawi, and Senegal since the 1960s. Preliminary results indicate an expansion of the number of commodities under research, an increase in the number of research stations and scientists, and a focus on biological technology.

In Kenya, during the last 15 years commodity research has expanded from tea, coffee, pyrethrum, maize, and wheat to include cotton, sugarcane, rice, grain legumes, roots and tubers, sorghum, millet, cotton, and oilseeds. In Malawi, the program started with tea, groundnuts, cotton, and maize, but now includes rice, wheat, grain legumes, tobacco, tree crops, and some sorghum millet. In Senegal, the activities now include rice, maize, vegetables, soybeans, and sorghum in addition to the first crops—groundnuts, millets, and cowpeas.

The number of research stations has increased in these countries, and the expanded commodity and regional coverage has contributed to a thin disbursement of these resources in a number of cases. In 6 out of 18 major stations in Kenya, 7 out of 10 in Malawi, and 4 out of 18 in Senegal, there were fewer than 15 researchers in the early 1980s. The study indicates that research efforts have not given priority to labor constraints, except in Senegal, but have focused narrowly on high-yielding technologies without extensive field trials.

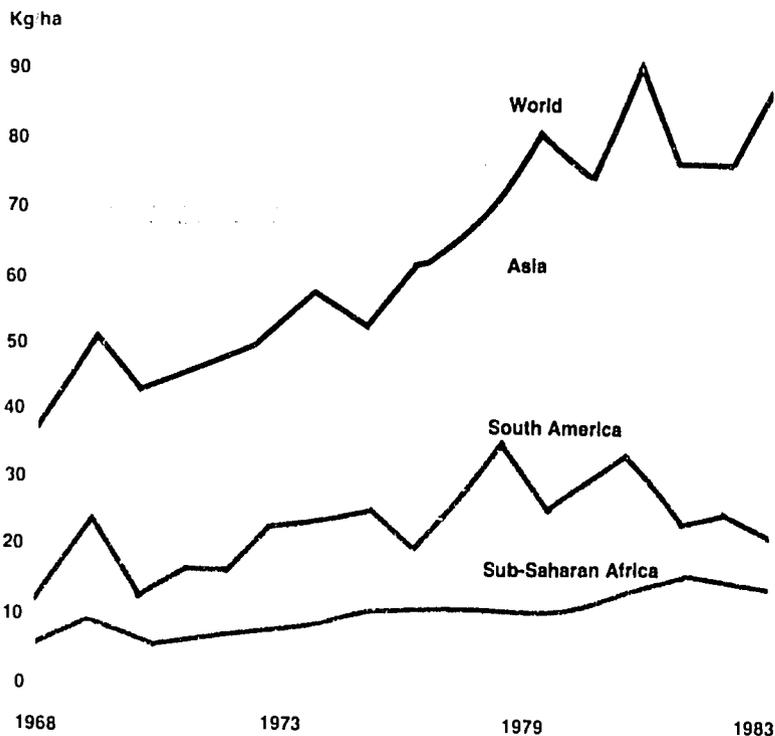
The study also points out the need for strengthening research on nonfood crops grown by smallholders. In the case of Kenya, for example, although smallholder production of export crops has been an important element of the agricultural strategy, smallholder productivity was substantially lower than in the estate sector (see Figure 3). Average land productivity of smallholders growing tea

was 70 percent lower than that for the estate sector. Even the average yield of the most productive smallholder tea farms was 45 percent lower than the estate sector. For coffee, average smallholder yields were 45 percent lower and the best yields were 66 percent of the average estate yields.

## FERTILIZER POLICIES

In recent years, IFPRI's research on fertilizer policies focused on Asia, specifically India, Bangladesh, the Philippines, Indonesia, and China. The focus is now shifting to Africa, where fertilizer is expected to play a key role in increasing production, particularly in the short and intermediate run. Fertilizer use in Sub-Saharan Africa is the lowest in the world and is growing only at a rate of 9 percent, much less rapidly than in the rest of the world (see Figure 4). In African countries where efforts to increase use have been made, concentration has been on large commercial farms, nonfood crops, and high potential areas. Research on policies to increase fertilizer use on food crops is essential for increased production, increased labor productivity, and long-term yield stabilization. A study of the use of fertilizers in Rwanda, where population density is parallel to that of Bangladesh, was initiated in 1986. It will attempt to identify factors that will increase growth in consumption by smallholders.

Figure 4  
Fertilizer consumption per cultivated land area, 1968-84



## IRRIGATION

Expanded use of irrigation, coupled with the adoption of modern rice varieties and increased fertilizer use, has led to increased rice production in much of Asia: past IFPRI research has documented that a major investment in irrigation will be necessary to increase production to maintain or improve per capita consumption of rice in Southeast Asia. However, several good crop years in the Philippines and Indonesia, together with declining real world prices of rice, have led some policymakers to call for a slowing of investment in irrigation. IFPRI research, done in collaboration with the International Rice Research Institute, the International Irrigation Management Institute, and the University of the Philippines at Los Baños, has been examining aggregate requirements and the appropriate allocation of investment among different kinds of irrigation systems as well as between new system development and the improvement of existing systems in the Philippines.

Completed in 1986, this research suggests that the construction of new systems generally has higher returns than the rehabilitation of old systems. In addition, the benefits of rehabilitation go to farmers who are already benefiting from irrigation, while new system construction benefits mainly rainfed farmers. When comparing types of systems, the study found that although communal (farmer-operated) systems and small-scale national (government-operated) systems often had lower rice yield levels and cropping intensities than larger-scale systems, the lower investment costs for smaller systems resulted in higher economic returns overall (see Table 2).

Table 2  
Internal economic rates of return on an investment by type of irrigation system, Philippines, 1985 prices

Irrigation System	Number of Systems	Internal Economic Rate of Return	Number of Systems with Internal Economic Rate of Return	
			More Than 12 Percent	Less Than 12 Percent
		(percent)		
Reservoir	3	3.7	0	3
National	23	12.5	8	15
Large	9	10.8	2	7
Medium	6	14.0	3	3
Small	8	13.7	3	5
Communal	25	33.3	20	5
Large	13	28.5	10	3
Medium	6	38.3	4	2
Small	6	38.6	6	0
Pump	45	13.0	14	31
Deep tubewell	9	1.8	0	9
Shallow tubewell	16	13.6	5	11
Surface pump	20	17.7	9	11
Large	5	3.3	1	4
Medium	6	13.5	3	3
Small	9	28.5	5	4

Source: Based on calculations by M. W. Rosegrant, L. A. Gonzales, H. E. Bouis, and J. F. Sison.

The study indicates that rehabilitation of existing irrigation systems can also have substantial payoffs but that the choice of systems to be rehabilitated is important, with the return highly dependent on the relative water supply in the system. Rehabilitation projects to date have been relatively costly; it may be possible to gain much of the benefits from rehabilitation with less costly rehabilitation investments.

## TECHNOLOGY DIFFUSION

Bangladesh has made progress in the diffusion of high-yielding varieties since independence in 1971, largely through public investment in irrigation and flood control and distribution of fertilizers at highly subsidized prices. IFPRI, in collaboration with the Bangladesh Institute for Development Studies, is evaluating the effect of this technological progress on the growth of production, efficiency in the use of resources, employment in farm and nonfarm activities, and the distribution of incomes.

Preliminary research indicates that the rice varieties produce, on average, about 1.2 times the output and employ 50 percent more labor per unit of land compared to the traditional varieties. The cost of production per unit of output is about 18 percent lower and value added per unit of labor about 30 percent higher for the new varieties. More than two-thirds of the farmers cultivate holdings of less than one hectare. However, small farmers devote a larger proportion of land to the new varieties and use more fertilizer per unit of land compared to large farmers. Although small farmers pay higher prices for irrigation and labor, fertilizer prices are almost the same across farm size. In addition, the new varieties generated more demand for labor, which was shared proportionately by family and hired workers. The wage rate was also found to be positively associated with the diffusion of the new technology. The new crops are also grown proportionately more on the tenanted land. Thus some of the benefits of the new technology reach the poor through the labor and tenancy markets.

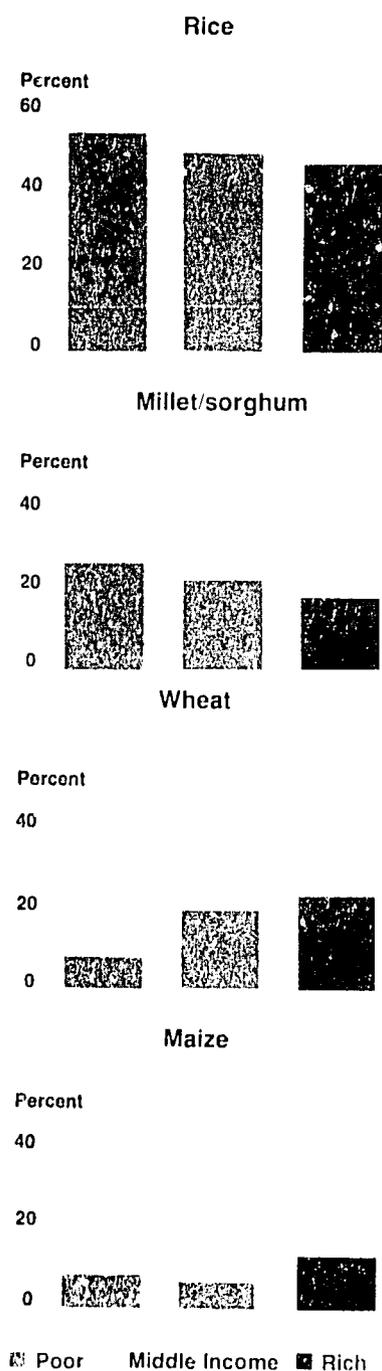


## INCENTIVES AND STABILITY FOR GROWTH FOOD CROP PRODUCTION IN AFRICA

**Cereal Substitution in West Africa.** In West Africa, consumption of traditional food staples, millet and sorghum, is declining while the consumption of wheat and rice is increasing. This has added considerably to import bills and has policy implications for domestic production patterns of maize and rice.

In collaboration with the University of Ouagadougou and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), IFPRI has been studying the demand and supply of traditional and nontraditional cereals in Burkina Faso. Urban and rural household data collected in 1984-85 are being analyzed to understand the substitution patterns for these grains. Preliminary results for the rainy season indicate that urban rice consumption represents 54 percent of the cereal budget of the poor, 49 percent of middle-income consumers, and 46 percent of the high-income

Figure 5  
Shares in cereal budget, urban  
Burkina Faso, June-July 1985



Source: Based on calculations by Thomas Reardon and Christopher L. Delgado using preliminary results from a joint IFPRI/ICRISAT survey.

Note: The data are calculated for the budget of an adult equivalent.

consumers (see Figure 5). (Rice production represents only 5 percent of the total cultivated area in Burkina Faso.) By contrast wheat ascends in importance with income, representing 9 percent of the consumption of the poor, 20 percent of the middle-income groups, and 23 percent of the consumption of the high-income groups. Consumption of millet and sorghum declines with rising income and maize remains constant.

The research indicates that a high proportion of the poor's rice expenditure is on the purchase of prepared rice—a major convenience food for the working class. In addition, the preparation time of rice in the home is much less than that of coarse grains. Women's time allocation and work patterns appear to favor rice consumption.

**Food Crop Production in Zaire.** Since the 1970s a growing gap between the consumption and production of food crops in Zaire has become evident, due mainly to population and per capita income growth. Imports of foodstuffs have increased dramatically. In 1986 IFPRI continued research on a project to identify the technical and economic factors associated with the production of rice and other staple food crops (maize, cassava, and plantains) by smallholder Zairian farmers in order to suggest policy changes that may lead to improved food production. The basic factors in much of the agricultural production in Sub-Saharan Africa are labor and land.

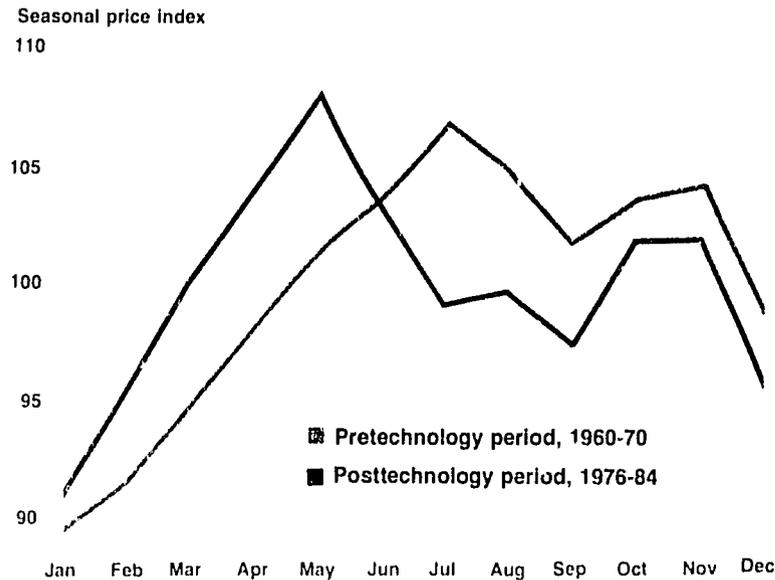
This is particularly true in Zaire. The study has surveyed farming households in the Zaire Basin to determine not only the relationships between farm inputs and food production, but also the factors affecting the allocation of labor to farming. Preliminary results indicate that only about 280 person-hours per working unit were allocated to farming during the 1982-83 crop year, representing 15.5 percent of the potential labor time that can be allocated to agriculture per year under tropical conditions. The study found that the inadequacy of the road network has resulted in the disruption of distribution and marketing channels, and this has been the most disturbing factor that has led farmers to divert labor away from farming.

#### SEASONAL PRICE VARIATIONS

The seasonal fluctuation of foodgrain prices, which can affect political stability and the environment for uninterrupted economic growth, is a key concern for policymakers. Developing country governments often adopt costly stock policies and other measures to counter price instability. Modern seed varieties, which can be grown in all seasons, can generate a more even distribution of supply and prices over seasons. In research initiated in 1986, IFPRI is attempting to analyze the pattern and underlying causes of rice price fluctuations and means for their stabilization in Bangladesh.

Preliminary analysis indicates that the widespread adoption of high-yielding varieties has shifted the peak period of high prices to May and reduced the July to December rice price fluctuations overall (see Figure 6). This change in the pattern of seasonal prices has implications for marketing and government intervention in price setting. Ongoing research will focus on development of a framework to contain seasonal and annual fluctuations in rice prices within a band.

Figure 6  
**Relationship of technology to seasonality of prices, Bangladesh, 1960-70 and 1976-84**



Source: Based on calculations by Raisuridin Ahmed and Andrew Bernard.

## FOODGRAIN PRODUCTION VARIABILITY

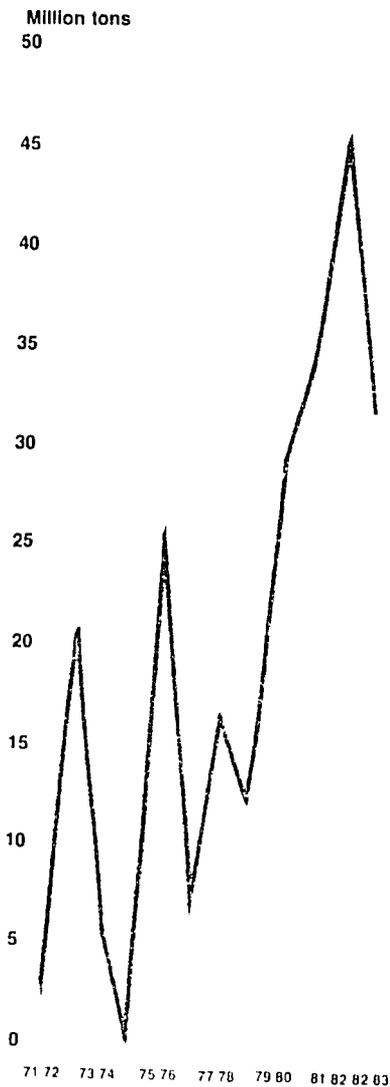
**Modern Technologies.** Many countries have achieved impressive rates of growth in national foodgrain production in recent years through adoption of high-yielding varieties. At the same time, the variability of world foodgrain production around trend also increased as measured by the coefficient of variation in production. This increased variability is reflected in increased market and price instability, which poses difficult problems for farmers and poor consumers alike. Past IFPRI research has been concerned with the link between technologically improved agriculture and variability.

*Summary Proceedings of a Workshop on Cereal Yield Variability*, edited by Peter B. R. Hazell, presents the discussions of biologists, social scientists, and policymakers that attempt to approach the variability issue as it pertains to plant breeding, farming systems, and management of irrigation, fertilizers, and pesticides. The proceedings, based on a conference sponsored in collaboration with Deutsche Stiftung für Internationale Entwicklung (DSE), suggest that national policies to assure input supplies such as improved seed varieties, fertilizers, and irrigation; to distribute them widely; to stabilize prices; and to encourage regional and crop diversification should contribute to the reduction of variability.

**Crop Insurance.** Variability may be also associated with farmers' risks. Threatened by droughts, volatile prices, or other natural and economic uncertainties, farmers tend to act conservatively, diversifying their crops and adopting higher-yielding techniques at slower than optimal rates. To encourage more modern, efficient, and expanded agricultural production by reducing risk, governments have set up multiple-risk crop insurance programs.

Published in 1986, *Crop Insurance for Agricultural Development: Issues and Experience*, edited by Peter Hazell, Carlos

Figure 7  
Net grain imports, Soviet Union,  
1971/72-1982/83



Pomareda, and Alberto Valdés, the second book in the joint IFPRI series with The Johns Hopkins University Press, addresses this issue. The book reviews crop insurance programs in the United States, Japan, Mexico, Brazil, Panama, Australia, and Costa Rica.

The authors suggest that most comprehensive crop insurance programs have not been successful. Even when well managed, they have required substantial subsidies to cover the high administrative costs. Although some programs have been associated with stabilized income and increased production, these benefits have seldom exceeded government costs.

The authors conclude that crop insurance can serve a useful but limited function if properly constructed. Suggestions for improvements include the limited use of subsidies, restricting insured risks to natural hazards (hailstorms, floods, hurricanes), and better program management. They suggest that more carefully targeted relief, such as food-for-work programs, specific farm price increases, and improved access to credit would be more cost-effective than insurance.

**Soviet Grain Variability.** The Soviet Union has a dominant presence in world grain markets, and fluctuation in Soviet grain production can have a major effect on developing country exporters and importers. In *Weather and Grain Yields in the Soviet Union*, Research Report 54, Padma Desai examines weather-induced variability in grain production in the Soviet grain belt between 1955 and 1982.

The report finds that yield fluctuations have been more frequent since the 1970s, indicating that policy and systemic effects on yields may have been more significant. Soviet imports fluctuated widely in the early 1970s but remained at their highest during the early 1980s (see Figure 7). The report suggests that the Soviet Union's effort to diversify the sources of its imports should provide another export market for developing countries with grain surpluses. The report cites Argentina as an example of a developing country that has become a major exporter to the Soviet Union. It cautions, however, that because variations have been large, Soviet grain imports could compete with grain-importing developing countries.

Source: Padma Desai, *Weather and Grain Yields in the Soviet Union*, Research Report 54 (Washington, D.C.: IFPRI, 1986).

## AGRICULTURAL GROWTH LINKAGES PROGRAM

The Agricultural Growth Linkages Program investigates the role technological change in agriculture plays in national economic growth and the welfare of the poor. Research is premised on the belief that the growth and equity effects of agricultural technology can be influenced by public policy and that policy interventions are likely to be different at various stages of national economic growth.

In order to explore the effectiveness of different policies, the Linkages Program studies the effects of agricultural technology in situations that contrast the stage of development of national economies and the kinds of policies pursued by governments. Because the number of case studies that can be undertaken is small, they are chosen to provide generalizations across countries about appropriate policy. Research ranges from the investigation of the effects that the provision and location of the various types of infrastructure have on farm and nonfarm economies to the income and employment benefits of new agricultural technology.

The issues under study are classified into three groups: growth and equity in rural areas, policies to improve growth and equity, and resource transfers in the national economy.

# R

## GROWTH AND EQUITY IN RURAL AREAS

Research now indicates that small farmers have benefited from the "green revolution," despite some initial lags, and that most households in new technology areas have benefited from increased incomes, although the distribution of income has not always improved. These studies refute earlier ones that claim the rural poor did not receive a share of the benefits. IFPRI is evaluating the short- and long-term effects of technological change on rural poverty more fully.

Preliminary evidence from studies in Africa and Asia suggests that technological change in agriculture may affect rural welfare in Sub-Saharan Africa and South Asia very differently. There are a number of reasons why Africa is different: less developed infrastructure and markets, shorter agricultural seasons related to dryland rather than irrigated agriculture, and dispersed rural population and lower population densities that are less able to sustain diverse and vibrant nonfarm activities. During 1986 studies on the linkages between agricultural and economic development in Zambia and South India continued.

The Indian study, completed in 1986, examined the effects of the new varieties on income and employment in a rice-growing district in Tamil Nadu. Data collected in 1982/83 and 1983/84 were compared to those collected a decade earlier. The results of this study, which was undertaken in collaboration with the Tamil Nadu Agricultural University, indicate that there were significant increases in agricultural production and incomes during the decade, largely as a result of the adoption of high-yielding varieties of rice, increased use of fertilizers, and expansion of irrigated area. (Also see the Food Consumption and Nutrition Policy Program section.)

The study found that with the introduction of high-yielding varieties in the early 1970s, rice production increased by about 40 percent. At the same time the average household more than

doubled the real value of its total expenditures on food and consumer goods and services during this period. The poorer households, including the landless, participated in the growth, as the increases in their employment, incomes, and consumption of higher-quality foods such as meat, fish, dairy products, vegetables, and fruits show.

Because input costs have increased sharply and the real price of paddy has fallen, real per hectare returns from paddy farming declined in recent years. However, paddy incomes have been maintained by a combination of increased irrigation and shorter-season varieties that have enabled farmers to grow a larger gross area of paddy each year. Farmers have also expanded their production of important cash crops such as groundnuts.

Final analysis of the linkage effects indicates that each dollar of increase in agricultural income induced about an 86 percent increase in nonagricultural income within the rural economy. Of this increase about 55 percent was from increased demand for agricultural inputs, marketing, and processing and 45 percent was from increased household demand for consumer goods and services. The benefits of these increases were found to be shared by small farmers and landless workers as well as urban households.

The results of this study were presented at an IFPRI workshop held at Ootacamund, India in February 1986, which was attended by policymakers and scholars from India, ICRISAT, the International Rice Research Institute (IRRI), Zambia, Costa Rica, and the United Kingdom (also see the Outreach section).

Research began in 1985 on a similar project in Eastern Province, Zambia in collaboration with the Rural Development Studies Bureau of the University of Zambia, the Zambian National Food and Nutrition Commission of the Government of Zambia, and the Eastern Province Agricultural Development Project and continued in 1986. The study is determining the effect of agricultural growth on rural welfare as measured by changes in land holdings, farm income and employment, nonfarm income and employment, nutritional status, and household consumption and expenditure patterns. During 1986 data were gathered in 330 representative households located in 10 village clusters. Data consistency tests and cleaning were initiated during the year.



## POLICIES TO IMPROVE GROWTH AND EQUITY

Government policy can enhance the growth and equity effects of agricultural technology through a number of avenues. During 1986 the Linkages Program focused attention on policies related to infrastructure. The growth in nonfarm economies is stimulated by investment in two kinds of infrastructure: those that increase agricultural productivity, including irrigation, roads, and telecommunications; and those that facilitate the flow of trade and commerce, such as transport, banks, and markets.

### BANGLADESH

In collaboration with the Bangladesh Institute of Development Studies (BIDS), a study on the role of rural infrastructure in Bangladesh was completed. Infrastructural development improves the

mobility of commodities, services, people, and information, which, in turn, stimulates the process of specialization and commercialization, technology transfer, changes in consumption and savings, utilization of rural resources, and implementation of public policies. This process occurs at costs that are substantially reduced from what they would be without infrastructure. This study measured the effects of infrastructure on agricultural production, farm and nonfarm income, employment, consumption, savings, investment, and market development. Some selected results are presented below.

The effect of infrastructure on agricultural production was measured, and a preliminary estimate indicates that it increases gross value of production by about 24 percent. In addition, differences in agricultural income associated with input use and price levels that resulted from infrastructural differences within villages were substantial. Even though the price of fertilizer was only 13.5 percent higher in villages with underdeveloped infrastructure, fertilizer use was 92 percent higher in the villages with developed infrastructure (see Table 3). This higher intensity of fertilizer use in developed villages cannot be explained by the explicit price factor alone but was associated with increased availability of fertilizers made possible by better infrastructure. In addition the wage rate in developed villages was found to be about 12 percent higher than that in underdeveloped villages and the intensity of labor use (labor productivity) was also higher. The results indicate that infrastructure affects labor and fertilizer markets differently than paddy markets and is more closely associated with improvements in these markets.

Table 3  
Effect of infrastructure on prices and inputs, Bangladesh, 1981/82

	Less Developed Infrastructure	Developed Infrastructure	Difference
<b>Prices</b>			
Rice/paddy (Tk/kg)	4.04	4.12	2%
Fertilizer (Tk/kg)	3.70	3.2	-13.5%
Wage rate (Tk/day)	18.1	20.2	11.8%
<b>Inputs</b>			
HYV-cropped area (% of total)	25	42	70%
Fertilizer (kg/ha)	78	150	92%
Labor (days/ha)	46.6	48.3	4%

Source: Based on calculations by Raisuddin Ahmed.

## INDIA

Another study completed in 1986 examined factors that influence access to and use of rural infrastructure services as well as their regional patterns of distribution. The study, undertaken in conjunction with Tamil Nadu Agricultural University, uses two survey data sets collected in 1983/84, one from 535 villages and the other from 345 sample households in North Arcot district of Tamil Nadu.

In the study area some services were uniformly highly accessible to all villages, others were uniformly highly inaccessible, and others were selectively accessible to more populated villages.

The study found that 17 service centers in the 535 villages

provided 123 of the 134 services used by the rural households in the study area. Of these 17, 9 service centers had the population size to support some of these services, yet the services were not available. In addition, there was a high correlation between the size of population of a village and its rural infrastructure. Population elasticities with respect to service provision were also high. Every 1 percent change in a village's population was associated with a 0.4 percent change in its overall structure of service provision.

Analysis of the complexity and type of service indicated that reduction in the distances of services was associated with positive changes in household expenditures. As expected, decreases in distances were associated with increases in expenditure in the less complex services used, the more frequently used services, and in food and personal services. The opposite occurred for more complex services and consumer durables.

The study indicates that where distance reduces use of services, public intervention to increase accessibility may be worthwhile. Provision of mobile units, for example, could be cost-effective. With mobile units, services such as credit and banking, animal husbandry, and marketing of agricultural produce could be provided when demand is heavy. Other services, such as communications, could be made available at regular intervals, perhaps on village market days.

Provision of services is also linked to overall development in many other ways. If service centers have the necessary transportation, banking, and credit facilities, more private retail services will locate there. Poorer farm households will benefit from an increase in employment opportunities and from better access also to production-oriented services. The increased availability of services and consumer goods will add to the quality of rural life, and the savings in time and money, spent in traveling longer distances to obtain these services, could be spent locally more productively.

## ZAMBIA

Research to identify the patterns of provision, access, and use of services in rural Zambia is part of the project under way in Eastern Province, Zambia, in collaboration with the Eastern Province Agricultural Development Project and the Rural Development Studies Bureau of the University of Zambia. A preliminary analysis of the initial data collected indicates that there is a great disparity in service provision when India and Zambia are compared. A service in India serves, on average, a population spread over a region of 24 square kilometers, whereas in Zambia the same service serves a population spread over 824 square kilometers (see Table 4). This disparity in access to services influences their use, which in Zambia is about 6 times a year per household and in India is almost 31 times a year per household.

Table 4  
Service provision and use

	India 1982/83	Zambia 1985/86
Number of services	34	85
Area served/ service	24 Km <sup>2</sup>	824 Km <sup>2</sup>
Travel on foot	25%	60%
Use of services/ year/ household	31	6

Source: Based on calculations by Sudhir Wanmali.



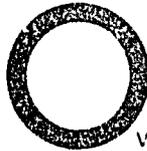
## RESOURCE TRANSFERS IN THE NATIONAL ECONOMY

During 1986, IFPRI continued to study agriculture's contribution to the capital transfers necessary for development and the increased agricultural production necessary for growing urban populations. Work continued in Punjab, India and Chile.

# FOOD CONSUMPTION AND NUTRITION POLICY PROGRAM

Public policies affect real incomes, food consumption, and nutrition of low-income households and their members in a variety of ways. Research in the Food Consumption and Nutrition Policy Program examines these effects through conceptual and empirical studies that contribute to policy formation and implementation. Research emphasizes national policies and issues and focuses on low-income households. Case studies provide the basis for generalizable findings.

During 1986 the Food Consumption Program focused its research efforts on the effects of food price and subsidy policies and increasing commercialization of semisubsistence agriculture on incomes, food consumption, and nutritional status among low-income households. In addition, studies were completed on the consumption and nutrition effects of technological change and on variability in food production. Research was carried out on countries in Asia, Latin America, and Sub-Saharan Africa.



## FOOD PRICE AND SUBSIDY POLICIES

Overall, IFPRI has completed studies of consumer food subsidies in 11 countries. In 1986 studies on the Philippines and Sri Lanka were completed and research continued on various aspects of household-level food security in Pakistan, including an analysis of existing food subsidies.

Also in 1986, in *The Effect of Food Price and Income Changes on the Acquisition of Food by Low-Income Households*, an IFPRI "gray" report, Harold Alderman reviewed recent studies that have estimated the extent to which the poor are more responsive to price changes than wealthier consumers and discussed the econometric problems raised by the study of food demand of specific groups within a population. For each of the six commodities and commodity groups—rice, wheat, milk, root crops, coarse grains, and meat—the report suggests that the poor prove to be more price-responsive than the general population. On the assumption that government officials may not have enough data to estimate price parameters by income group, patterns of responsiveness in these studies were noted in order to establish rules of thumb that could be used in place of actual estimates of the responsiveness of the poor to prices.

### PHILIPPINES

In a pilot scheme in areas known for their high incidence of malnutrition and poverty in the rural Philippines, rice and cooking oil were discounted and nutrition education was made available to one-fourth of the households in 14 villages for one year. Other households received either discounts or education or were left out of the scheme. The subsidy accounted for more than 80 percent of the cost of the scheme and administration and retailer incentives for less than 20 percent. The results of the scheme, which was undertaken jointly with the Philippine National Nutrition Council, were compared with households included in the study that did not have the food discounts and education.

The assessment found that among participating households the scheme was successful in increasing food consumption, which

was reflected in higher calorie consumption and improved nutritional status of preschool children. However, distribution of the additional food within the households was skewed toward adults. The price subsidies on rice and cooking oil contributed to increases in purchasing power, which was the main reason food consumption increased. The study found that the propensity to spend additional amounts of price subsidy income on food was considerably higher than the marginal propensity to spend income from other sources on food. The study also found that the lower oil prices resulted in substitution of oil for other commodities. The effect of the nutrition education was more pronounced for children than the households overall.

As a result of the scheme, household calorie acquisition increased by 7 percent, or 136-138 calories per adult a day; calorie consumption by preschoolers increased by 4-6 percent, or 31-55 calories per child a day; and preschoolers showed a weight gain of 0.12-0.14 kilograms.

The study confirmed a strong relationship between malnutrition and income. The results indicated that landless farm workers, tenant farmers, and other low-income occupational groups are much more likely to be faced with malnutrition than other, higher-income groups. This is primarily due to very limited purchasing power.

## SRI LANKA

A study to assess the effects of shifting from a free-ration food subsidy program with general price subsidies to a food stamp program without price subsidies in Sri Lanka was also completed in 1986. Undertaken with the Sri Lankan government, the study examines the change in the Sri Lankan subsidy program, which formed an integral part of the set of economic policy reforms undertaken in the late 1970s. These changes were intended to increase domestic savings while attempting to protect low-income households from the effects of price increases.

The study found that the changeover to a food stamp scheme that was not tied to the consumer price index reduced the share of food subsidies in total government expenditure from 15 percent in the mid-1970s to about 3 percent in 1984.

At the changeover in 1979, food stamp benefits amounted to 83 percent of price subsidy benefits. This eroded to 43 percent by 1981/82. Prior to the changeover, price subsidies were nearly 18 percent of the average household budget of recipients of rice rations. The food stamp share in 1981/82 was only 9.6 percent.

An examination of the apparent calorie consumption by households during 1978/79, before the policy change, and during 1981/82 indicated that nearly 75 percent of the households had either maintained or increased their per capita calorie consumption. However, the per capita calorie consumption of the bottom 20 percent declined about 8 percent, from an already low 1,490 calories during 1978/79 to 1,368 calories during 1981/82.

The Sri Lankan government's attempt to target the scheme to low-income households resulted in about 50 percent of all households receiving food stamps; however not all of the recipients were in the lower half of the expenditure range. The results indicated that the lowest income quintile—the intended beneficiaries—received 38 percent of the total food stamp outlay. Under the

former scheme, this segment received only 26 percent of the total subsidy outlay.

The study found that in the Sri Lankan context there are many problems with the traditional targeting mechanisms, such as those based on child malnutrition, regional targeting, or subsidizing "inferior" foods. High participation by the people in the democratic process of representative government, the existence of a multiparty political system, relatively high literacy rates, and the existence of a comprehensive and competent public administration structure are conducive to a targeting scheme where the administrators and the community together can effectively screen applications for the income transfer.

## PAKISTAN

Rudimentary wheat marketing channels in Pakistan evolved into the present-day flour ration system, in which 3 million tons of grain are released annually to mills for processing and distribution to ration shops. This is equivalent to 30 kilograms per capita annually. With the improvement of private marketing channels, the Government of Pakistan is planning to eliminate flour rations. IFPRI is collaborating with the Pakistan Institute of Development Economics (PIDE) to evaluate the efficiency of the system nationally and its importance to low-income consumers (also see the International Food Trade and Food Security Program section).

Preliminary data from household surveys undertaken by IFPRI and PIDE indicate that only 25 percent of the urban population and 5 percent of the rural population utilize the ration system. The amounts consumed reported by households account for only 20 percent of total releases into the system.

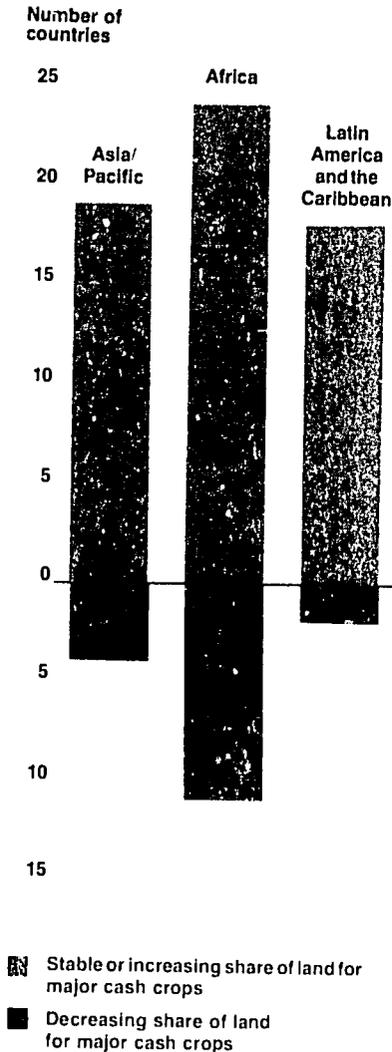
The studies indicate that utilization rates among low-income families are far higher than the average. In addition, in low-income urban neighborhoods, 43 percent of households used the system in the month prior to the wheat harvest and 30 percent in the two months subsequent to the harvest. Rationed flour provided 78 percent of all flour for these households and 40 percent of their caloric needs. Expenditures on rationed flour were 9 percent of total expenditures for these households.

These preliminary results, which reinforce earlier studies, indicate that flour subsidies could be better targeted. The need for such a modified program and the potential effects of such targets are being studied.

## COMMERCIALIZATION OF SEMISUBSISTENCE AGRICULTURE

Increased commercialization of semisubsistence agriculture is an important element of efforts to increase incomes and improve living standards in rural areas in many developing countries. The effects on incomes, food consumption, and the nutritional status of the rural poor depend on the design and implementation of projects and the response by the rural poor. The Food Consumption Program has been studying these effects for a number of years. During 1986 research included studies in six countries—Gambia, Guatemala, India, Kenya, the Philippines, Rwanda, and

Figure 8  
Changes in the share of land used  
for major cash crops, by continent,  
1968-82



Source: Joachim von Braun and Eileen Kennedy, *Commercialization of Subsistence Agriculture: Income and Nutrition Effects in Developing Countries*, Working Paper on Commercialization of Agriculture and Nutrition 1 (Washington, D.C.: IFPRI, 1986).

Zambia. In addition, the first working paper in a series on commercialization of agriculture, *Commercialization of Subsistence Agriculture: Income and Nutritional Effects in Developing Countries*, by Joachim von Braun and Eileen Kennedy, was published.

The study examines cash cropping in 78 developing countries, including 35 African countries. Almost half of these countries allocate area to cash crops that corresponds to more than 50 percent of the staple food crop area. It finds that the share of cash crops in agricultural production is more stable in middle-income than in low-income countries. Most of the countries moving away from cash cropping are in Africa, whereas a majority of Asian and Latin American countries show stable or increased shares of land use for cash crops (Figure 8). The study finds that countries tend to either manage growth in both the cash crop and staple food crop sectors or fail to achieve growth in either.

#### INDIA

Dairy development is a major component of strategies to expand agricultural output in many developing countries. And many forms of dairy development promote milk as a cash crop. During 1986 IFPRI and the World Bank completed a study of the dairy development projects of Operation Flood in Karnataka, India, which since 1974 has attempted to integrate 10 million rural milk producers into a network of small cooperatives, processors, and marketing unions. Of vital interest in the study is whether dairy development has led to increased production or only changes in marketing patterns, if there have been benefits and, if so, the equity of their distribution, and if there have been changes in the producers' nutrition. The projects attempt to increase milk production by encouraging the adoption of more productive animals. To supplement the program, milk powder and butter oil provided as aid have been processed and marketed during periods of slack milk production (also see the International Food Trade and Food Security Program section).

The results indicate that although the development projects led to higher milk prices as well as a shift of demand patterns away from the consumption of milk, net nutrient consumption increased for both producers and nonproducers in Karnataka. This is, in part, due to offsetting increased consumption of other foods as milk prices increased.

#### KENYA

The subject of the appropriate role of cash crops and export crops in many developing countries is politically volatile. In Kenya the government has promoted production of sugarcane in South Nyanza district. The government hopes the movement from maize production into commercial agriculture in this district with the highest birth to second-year mortality rate—216/1,000—will improve the health of the low-income farming households.

The results of the study, which was undertaken with Kenyatta University and the National Council for Science and Technology, indicate that commercial agriculture has a positive effect on household income. Farmers' incomes in the sugarcane outgrowers' scheme were 670 KSh per capita, or 35 percent higher than the nonsugar farmers in the same area. Most of this difference was due to agricultural sales, of which 65 to 70 percent can be attributed

to sugar production. The net returns to household labor for sugarcane production were about three times higher than the daily agricultural wage rate. In addition, the study found that farmers who did well in sugar sales also did well in sales of other commercial crops.

A number of results relating to income and food consumption were found. Farmers who were paid for their crop allocated an average of 54 percent of their budget to food, compared to the nonsugar producers, who allocated between 65 and 68 percent. The percent of income from sugarcane production was associated with increasing household food intake, and women's income had a positive effect on calorie consumption.

The analysis suggests that the intrafamilial distribution of food may be as or more important in influencing health and nutritional status than the absolute amount of food available within the household. The income-calorie relationship in the household did not have a strong effect on the nutritional status of children. The data suggest that preventive, rather than curative, strategies may have more positive effects on child health.

## GUATEMALA

In a related study, IFPRI and the Institute of Nutrition of Central America and Panama (INCAP) have been examining the effect of increased export vegetable production on employment, income, and food security of households in the western highlands in Guatemala. In this poorest area of the country, small farmers of Indian origin cultivate an average of about 0.7 hectares of land, of which 78 percent is allocated to maize and beans grown largely for their own consumption. In the past cash needs were met by traditional vegetable production and temporary off-farm work, especially in urban services and in the large-scale, export-oriented farm sector in the coastal regions. Recently private sector companies and farmers' cooperatives introduced new vegetables for export from Guatemala.

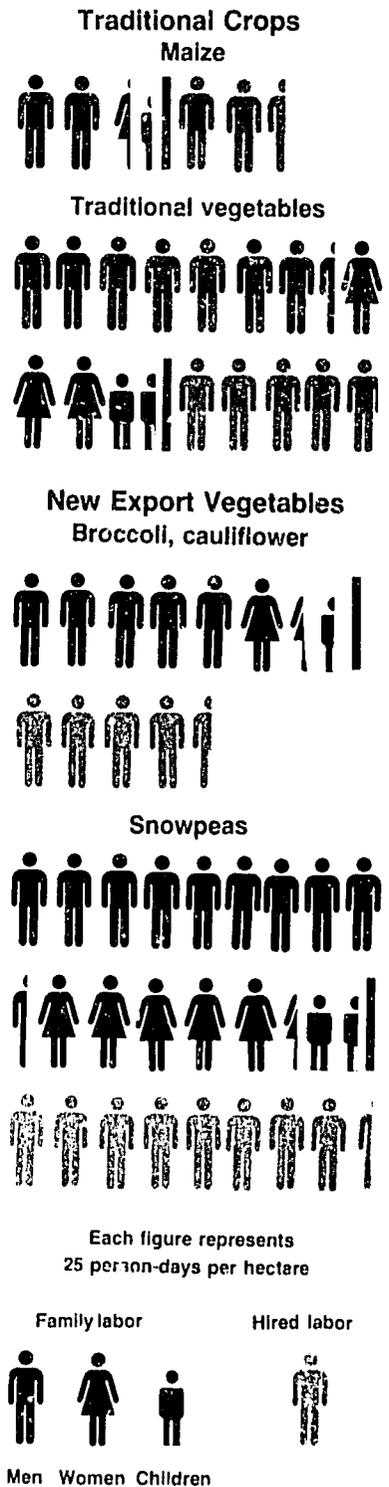
The survey data show that snow peas, the principal new export vegetable, are being rapidly adopted by farmers and producing higher returns to land and labor than maize and beans. Returns per family labor day were 51 percent higher than that for maize and 46 percent higher than that for beans. As a result, in the study region farmers reduced the share of area under subsistence crops from 78 to 52 percent.

The introduction of the new crops had positive effects on employment. Labor input in agriculture increased in the farms producing export crops by 45 percent (81 days per crop season), an increase that was shared equally by family labor and hired labor (see Figure 9). In the smallest farms, virtually all of the net increase in labor input came from family labor, and total labor input in farms of less than a quarter hectare more than doubled. On larger farms, increases in hired labor were necessary. Thirty-eight percent of the increased family labor was met by women.

## GUINEA

In a related study in Gambia, IFPRI and the Gambian Program, Planning and Monitoring Unit for the Agricultural Sector are examining the effect of the commercialization of traditional rice production through technological change. In addition to examining the

Figure 9  
Labor inputs in traditional crops and new export vegetables, Guatemala, 1985



Source: Based on calculations by Joachim von Braun, from the INCAP IFPRI survey, 1985.

effects on employment, income, consumption, and nutrition of commercialization, this study traces the related effects on intra-household decisionmaking in rice production of the different ethnic groups at the study location.

Survey results indicate that women—the traditional rice producers—lose responsibility for rice fields as technology levels and, thus, yields per hectare, input intensity, and cash needs for production such as hiring labor and transportation, increase (see Table 5). However, relatively more rice was sold from the produce associated with fields under the control of women. The traditional rice was found to be a cash crop for women's individual cash needs. The more productive new rice fields in the projects were taken over to a large extent by the male heads of the extended families. Yet, most of the rice from these fields was found to be consumed within the household.

Women are involved in cash crop production to a substantial degree. Thirty-seven percent of the groundnut fields and 38 percent of the cotton fields in the study area are under women's control. The contribution of women to family food supply from the upland cereals including millet, maize, and sorghum was found to be substantial, and only 5 percent of that is sold.

Clearly, complex changes in sexual division of labor and control over agriculture and crops are induced by technological change and increased commercialization of traditional West African agriculture. The simplistic dichotomy that "women produce food crops and men produce cash crops," which is frequently stated for Africa, does not seem to be the case in this area.

Table 5

**Control over fields by women farmers associated with different rice technologies and marketed surplus, Gambia, 1985**

Rice Technologies	Yields/ Hectare	Percent of Fields Under Women's Responsibility	Percent Sold From Total Produce
Traditional swamp	1.2	95	29.8
Partly water controlled- tidal irrigated	2.1	70	21.4
Irrigation in old schemes	2.9	54	17.5
Fully water controlled	6.6	14	13.8

Source: Calculations by Joachim von Braun based on survey data.

## **T** TECHNOLOGICAL CHANGE AND CONSUMPTION

The replacement of traditional with modern crop varieties and introduction of irrigation has been very effective in increasing the yields of various crops—notably rice and wheat—as well as incomes of farmers in developing countries. However, the effect on food consumption and nutrition is poorly documented. There are many factors that technological change affects and that, in turn, affect nutrition. The most important ones are household incomes and food prices. Thus, if the effect on these factors can be estimated, it may be possible to provide at least a rough estimate of the nutrition impact.

## NORTH ARCOT, INDIA

A study of technological change in rice production in the North Arcot region of Tamil Nadu, India, which was based on data collected from household surveys in 1973/74 and 1983/84, showed dramatic increases in incomes and food consumption during the study period (also see the Agricultural Growth Linkages Program section).

By the end of the last study year, virtually all rice farming households consumed more than 80 percent of recommended calorie levels as opposed to only about 20 percent of small rice farmers and 60 percent of large rice farmers 10 years earlier. On the average, daily calorie consumption per adult equivalent unit increased from 1,746 to 2,909—an increase of 67 percent. The increase was smallest for the landless and 10-15 percent of this group still consumed less than 80 percent of calorie requirements during the last months of the study.

Large increases in incomes during the period are responsible for the major share of the improvements in calorie and protein consumption. Total expenditures on food and other consumption goods—usually a reliable proxy for incomes—tripled after accounting for inflation. Calorie consumption increased by about 1,000-1,200 calories per person per day or about 70 percent of the 1973/74 consumption level. It was estimated that about 38 percent of the income increase was due to increasing rice production. Thus, an increase of about 450 calories per person per day is estimated to be due to increased rice production. Other factors such as price changes also influenced calorie consumption during the period (see Figure 10).

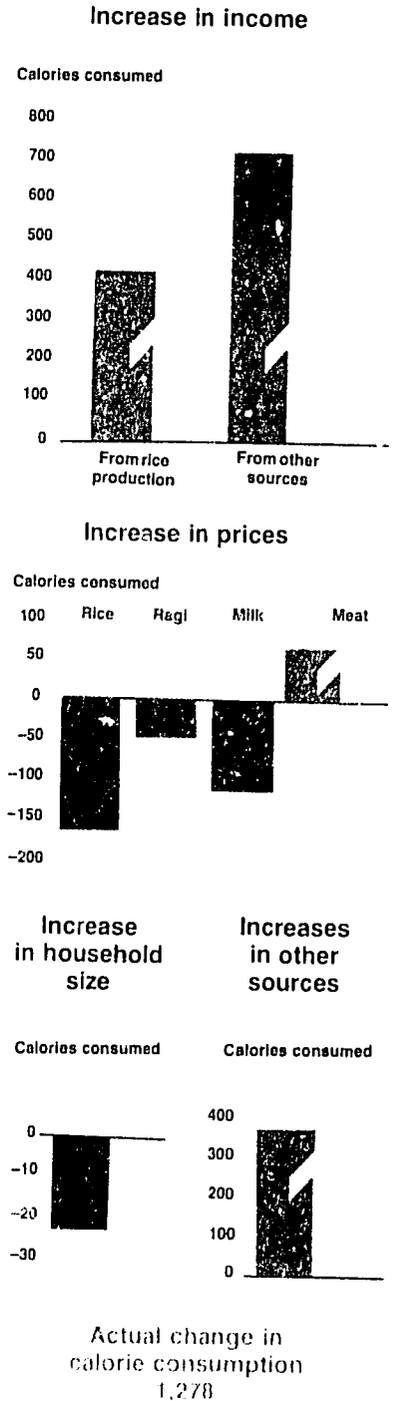
## P CONSUMPTION EFFECTS OF VARIABILITY IN PRODUCTION

Previous work at IFPRI has presented evidence that year-to-year variability in world foodgrain production has been increasing. Therefore, the question arises as to whether instability in food consumption is increasing and to what extent this is attributable to increased instability in cereal production.

Results of this research indicate that during the past 25 years, variability (as measured using the coefficient of variation) in per capita calorie consumption has declined in 23 out of 38 developing countries selected on the basis of the quality of available data and geographic diversity. This despite the fact that production instability increased in two-thirds of the countries.

In order to understand the determinants of consumption variability, measured at the national level, a cross-country analysis revealed that increased variability in cereal production does translate into increased calorie consumption variability, although with a declining effect as production variability increases. But more important, the data reveal that growth in per capita income of developing countries not only increases levels of calorie intake but also leads to more stability in consumption. This implies that although adoption of new agricultural technology may increase production instability, the economic growth it promotes will serve to reduce variability in levels of calorie consumption.

Figure 10  
Sources of change in calorie consumption, 1973/74-1983/84, North Arcot, India



Source: Based on calculations by Per Pinstrup-Andersen.

Note: Calories consumed are on a daily per capita basis.

## INTERNATIONAL FOOD TRADE AND FOOD SECURITY PROGRAM

How a developing country chooses its trade policies affects its ability to meet short-term food consumption needs as well as its long-run incentives for growth in the agricultural and nonagricultural sectors. Because of the important role that agriculture plays in developing country economies, world market conditions and the behavior of food exporters and importers greatly influence these domestic policies. Research undertaken in the International Food Trade and Food Security Program examines both the domestic and international issues associated with agricultural trade.

During 1986 research focused on national and regional food security; the long-run implications of trade and exchange rate policies in Africa, Latin America, and Asia; as well as food aid and its implications for filling import gaps and domestic demand. The research output was heavily focused on Africa, with two research reports on specific trade and exchange rate policies and one on regional food security in Southern Africa.

## A NATIONAL AND REGIONAL FOOD SUPPLY MANAGEMENT

Appropriate policies for managing food supplies are essential for national food security. On a regional level, integration of food markets through trade can be a means of improving food security. During 1986 IFPRI examined the procurement, storage, and trade operations related to specific national policy objectives in Pakistan and published a report on regional cooperation for food security in Southern Africa.

### PAKISTAN

The size of Pakistan's food subsidies and the policy options for food consumption within the country are governed by its ability to produce and store its own surplus as well as to purchase food imports. The Trade Program has been examining the setting and prospects for wheat production and consumption in Pakistan and appropriate trade, storage, and price policies to offset fluctuations in production (also see the Food Consumption and Nutrition Policy Program section).

Preliminary research indicates that past increases in wheat yields have resulted principally from increased use of high-yielding varieties (HYVs), which now account for more than 90 percent of the area planted. In the major producing province, however, yields of HYVs have not increased in recent years, suggesting that both areas and yields may grow more slowly in future years. Area is constrained to a large extent by water availability, which cannot continue to increase at the historical rate because of limitations on the supply of groundwater.

In lieu of improved technologies, the study model, which incorporates price adjustments, suggests that if domestic prices rise toward import-parity levels, Pakistan would be able to balance supply and demand without imports for the next 15 years, when annual production does not drop below trend.

If a country is either an importer or an exporter every year, there is little rationale for holding carryover stocks from one market year to the next. The decision on the appropriate closing stock level, however, is much more complex when the country is normally self-sufficient and there are large differences between import and

export parity prices. Assuming that the country is self-sufficient in a normal production year, the study tests for different combinations of price, storage, and trade policies that the government could use to stabilize prices. It suggests that in the absence of government intervention, prices would be considerably more unstable than in the past. The initial decreases in price fluctuations from the free-market level are not costly, but the costs of the program rise dramatically as prices move toward complete stability.

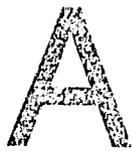
### SUB-SAHARAN AFRICA

Fluctuations in cereal production are greater on the national than on the regional level in Sub-Saharan Africa. In *Regional Cooperation to Improve Food Security in Southern and Eastern African Countries*, Research Report 53, Ulrich Koester examines the case for regional cooperation in the nine countries of the Southern African Development Coordination Conference (SADCC), seven of which have production fluctuations of more than 10 percent (see Table 6).

The report finds that interregional trade would increase stability of supply, reduce the transportation costs associated with overseas trade, and lead to improved transportation and storage facilities.

The report estimates that regional stocks could be about 41 percent smaller than the sum of national stocks, providing a savings of U.S. \$68 million, and achieving the same level of food security. If the costs were pooled by country according to its share of production and level of variability of production, those countries with the greatest risk would pay the highest costs.

The report concludes that the potential benefits can be achieved if countries are willing to give up some national autonomy in designing and implementing their domestic food policies.



## TRADE AND EXCHANGE RATE POLICIES

A major area of research within the program is the effect on production incentives, growth, and employment in agriculture of trade and exchange rate policies. During 1986 two studies were published focusing on Africa, and studies focusing on the Philippines and Colombia were completed. In addition research comparing policies in the South American countries was undertaken.

### NIGERIA

Agriculture's contribution to Nigeria's GDP declined from 60 percent in the 1950s to about 20 percent in the 1980s. During the 1960s the manufacturing sector was the focus of Nigeria's development policy. To fuel the development of manufacturing and infrastructure, resources, primarily labor, were extracted from agriculture. The oil boom of the 1970s added to the resource transfers. In addition, policy changes contributed to the decline of agricultural producer prices relative to prices in the nonagricultural sector.

In *The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria*, Research Report 55, a study undertaken with the University of Ibadan, T. Ademola Oyejide examines the decline of Nigeria's agriculture during 1960-82, a period of aggregate economic growth. During this period agricultural production was in-

Table 6  
Instability in cereal production,  
SADCC countries, 1960-80

Country	Production Share Within Region	Instability Index
(percent)		
Angola	8	10
Botswana	1	69
Lesotho	3	20
Malawi	18	12
Mozambique	10	13
Swaziland	1	26
Tanzania	20	9
Zambia	15	13
Zimbabwe	25	22

Source: Ulrich Koester, *Regional Cooperation to Improve Food Security in Southern and Eastern African Countries*, Research Report 53 (Washington, D.C.: IFPRI, 1986).

Notes: The instability index for the region was 9 and that for the rest of the world was 2.4.

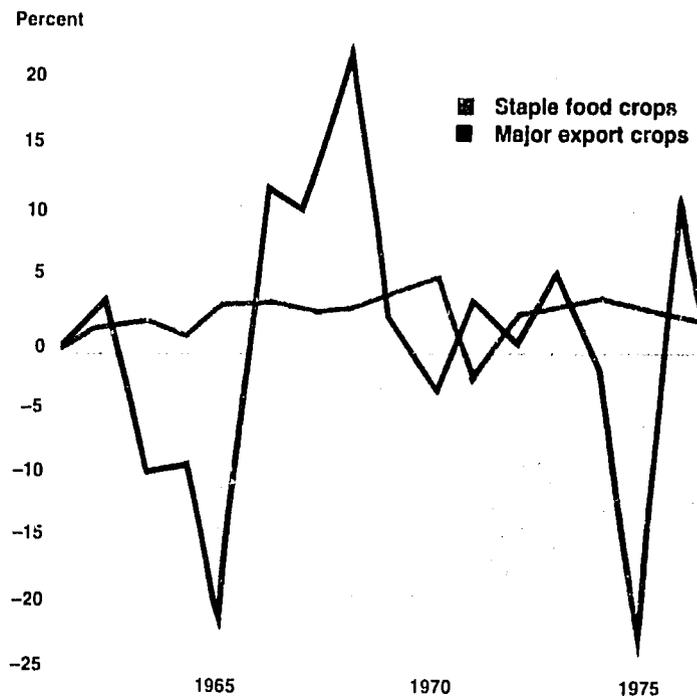
creasingly encouraged through increased tariffs on agricultural imports and subsidies on inputs, while the exchange rate policies led to increased currency overvaluation that reduced agricultural production incentives, particularly in the export sector. Between 1970 and 1982, agriculture's share of exports fell from 72 percent to less than 3 percent and its share of employment from 75 percent to 34 percent. Nigeria's trade and exchange rate policies, designed for protecting import-competing activities, have substantially reduced relative production incentives for agricultural import-competing commodities and exportables. In addition, the adverse effect of the oil boom was stronger on agriculture than on manufacturing because of the special labor constraints of agriculture and because manufacturing received more explicit import protection than tradables in agriculture.

### ZAIRE

A related study, *The Effects of Trade and Exchange Rate Policies on Agriculture in Zaire*, Research Report 56, by Tshikala B. Tshibaka, shows that trade and exchange rate policies have been used to promote industrialization, to reduce government deficits, and to help stabilize the balance of payments.

During 1961-82 agriculture contributed 40 percent to Zaire's GDP. Since independence, Zaire's economy has gone through three periods during which policies and conditions affected agricultural production. In the first, 1960-65, Zaire was entrenched in civil war, which led to a decline in farm output, crop exports, and overall economic activity. Major export crop production dropped by almost 10 percent a year (see Figure 11). During the second, 1966-70,

Figure 11  
Growth of agricultural output in Zaire, 1961-78



Source: Tshikala B. Tshibaka, *The Effects of Trade and Exchange Rate Policies on Agriculture in Zaire*, Research Report 56 (Washington, D.C.: IFPRI, 1986).

less restrictive trade and exchange rate policies were implemented along with economic reforms. Staple food production grew an average of 4 percent a year, and major exports grew by 9 percent. In the third period, 1971-1982, restrictive trade and exchange rate policies were reintroduced. The annual growth rate of staple food crops dropped to below 2 percent a year and, with the exception of coffee, the volume of major export crops fell significantly.

Agriculture's share of foreign exchange earnings fell from 39 percent in 1959 to a low of 5 percent during the 1970s and to 10 percent during 1980/81. Agriculture's falling share of exports has reflected the taxation of agriculture, particularly of export crops. The report finds that the effect of a 10 percent tariff on all imports was equivalent to a 5.2 percent tax on all exports. Thus almost half the burden of protecting importable goods against foreign competition was borne by exportables.

## PHILIPPINES

A completed study on Philippine agriculture from the 1950s to 1980s shows that government underpricing of agricultural products, especially export crops, has affected production incentives negatively. Government monopoly of the trade of staple foodgrains and direct price controls have been used to regulate domestic price levels. As a result of production levies, export taxes, and government marketing intervention, producer prices of export crops have been significantly depressed compared to world prices. In addition overvaluation of the Philippine peso since the early 1960s has contributed to the disincentive for agricultural export production.

The study indicates that although a more outward-looking development strategy was adopted by the Philippine government in the early 1970s, the fiscal incentives and other selective export promotion measures favored only manufacturing producers, partially compensating them for the bias against exports of the existing tariff system. Heavy foreign borrowing in the mid-1970s together with the protective tariff system sustained the unrealistic exchange rate into the early 1980s, when the peso was overvalued by an average of 17-20 percent. This effectively lowered the domestic agricultural price relative to home goods by 19 percent and relative to nonagricultural products by 25 percent.

## COLOMBIA

In the case of Colombia, ongoing research with the Colombian Agricultural Farmers Association (SAC) has been examining economic development between 1960 and 1984, focusing on the implications of the coffee boom—high export prices for coffee—that began in the mid-1970s. This development has been affected by Colombia's growing fiscal deficit that has greatly reduced foreign earnings. The source of Colombia's stagnating agricultural sector is probably not the increased levels of imports but specific policies that have discriminated against exports.

## LATIN AMERICA

Research with the World Bank comparing policies in a number of Latin American countries suggests that export and import-competing crops have been directly taxed through trade policies and indirectly through economywide fiscal and monetary policies designed to

cope with unemployment, protection of the industrial sector, and foreign capital flows. The examples of wheat and one other export crop in Argentina, Chile, and Colombia illustrate the effects of these policies.

In Argentina during 1960-84 indirect interventions on wheat and beef exports in some years more than doubled the tax effect (see Table 7). In Chile between 1960 and 1980 wheat growers received some positive nominal protection except in 1971-75, when world prices were high, which generally was more than offset by substantial indirect taxation. Dairy farmers received a high level of direct protection, which was greatly reduced by the overall inter-

Table 7  
Average annual direct and total price interventions affecting agricultural producers, selected Latin American countries

Argentina				
Years	Direct Price Interventions		Total Interventions	
	Wheat	Beef	Wheat	Beef
	(percent)		(percent)	
1960-65	-19.7	-35.3	-41.6	-53.0
1966-70	-12.3	-26.9	-37.8	-47.7
1971-75	-42.3	-28.8	-55.8	-46.1
1976-80	-22.6	-11.1	-48.1	-39.7
1981-84	-17.3	-13.8	-46.5	-53.3
Chile				
Years	Direct Price Interventions		Total Interventions	
	Wheat	Milk	Wheat	Milk
	(percent)		(percent)	
1960-65	7.6	214.8	-42.5	67.4
1966-70	9.2	166.2	-29.3	73.6
1971-75	-17.3	86.1	-49.9	25.3
1976-80	16.5	113.4	20.8	90.0
Colombia				
Years	Direct Price Interventions		Total Interventions	
	Wheat	Coffee	Wheat	Coffee
	(percent)		(percent)	
1960-65	24.2	-18.0	11.6	-10.1
1966-70	24.3	-34.6	9.7	-11.7
1971-75	-8.3	-35.0	-16.1	-8.5
1976-80	4.9	-49.1	-7.2	-11.4
1981-83	20.2	-34.4	1.3	-15.6

Source: Based on calculations by Alberto Valdés.

Notes: Total interventions include adjustment for real exchange rate misalignment. Percentage figures refer to the differences between actual and world prices corrected for domestic exchange rate misalignment.

ventions.

In Colombia from 1960 to 1983, although coffee growers were heavily taxed, the overall interventions reduced these effects. Data for wheat indicate that there was substantial nominal protection for wheat production during the period, which was substantially reduced by overall interventions. Thus the effect of economywide policies on relative prices in agriculture has been greater than the effect of sectoral price policies.

## FOOD AID

Food aid can help fill that part of a developing country's import gap that it is not able to cover through commercial imports. By doing this, food aid provides relief to that country's foreign exchange resources that can then be used for other critical purposes or adds to the availability of food in a situation where it would otherwise have been inadequate to meet domestic demand at a reasonable level of prices. Given the important role of food aid, IFPRI is researching projected food aid needs in the Third World.

During 1986 research was initiated to estimate future food aid needs for developing countries considering past demand, domestic supply, amounts of commercial cereal imports, and the nutritional requirements of the country populations.

In the first phase of the study, medium-term projections of demand-based food aid requirements—defined as the difference, in terms of cereal equivalent, between the aggregate demand for food staples and the sum of domestic production and likely net commercial imports—show that food aid needs of 87 developing countries will increase from about 9 million metric tons in 1980 to around 44 million tons in 1990, if past trends continue. In addition, commercial imports of these countries are expected to increase from 43 million tons in 1980 to 57 million in 1990. Forty-three percent of total food aid needs by 1990 will be in Sub-Saharan Africa.

Food aid to Sub-Saharan Africa has increased rapidly over the last 15 years, rising from 545,000 tons in 1970/71 to 4,943,000 tons in 1984/85. Given the current problems of economic development in general and the particular problems in food sector development faced by most countries in Sub-Saharan Africa, a study has been undertaken to examine the role of food aid in this region. This research is examining the food sector policies of four recipient countries—Camercon, Kenya, Senegal, and Tanzania—and the performance and policies of four major donors—the United States, Canada, the European Community, and the World Food Programme.

In India, IFPRI is studying two programs that may contain some useful lessons applicable to other countries in utilizing food aid effectively: Operation Flood and the Employment Guarantee Scheme. In the former, food aid is used to promote dairy development (see the Food Consumption and Nutrition Policy Program section). Dairy products received as food aid are processed and sold in the metropolitan areas and proceeds are used to promote dairy development in rural areas. In the latter, employment on rural public works is guaranteed to provide food security against seasonal fluctuations in employment and during times of drought.

## OUTREACH

In order to reach its main audience—policymakers and researchers—IFPRI publishes and disseminates its research findings; collaborates on specific projects with institutions in developing countries and other centers in the CGIAR; and holds workshops, seminars, and conferences. Through its collaborative activities and meetings, which provide a forum for decisionmakers and national researchers to alert IFPRI researchers to specific policy problems, IFPRI strengthens research capacities in developing countries and ensures that its findings are applicable.

## M PUBLICATIONS

Major studies based on data analysis and research to advance methodology, both of which are undertaken in relation to specific policy issues, are published in the anonymously refereed research report series. (A list of the referees appears at the end of the Publications and Papers section.) These are distributed to researchers and libraries around the world, and, along with abstracts that summarize the major policy conclusions, to policymakers in developing and developed countries. Other analyses are reported in two working paper series, one on food subsidies and the other, initiated this year, on the commercialization of agriculture and its effects on income and nutrition; a "gray" report series that makes available conference papers and overviews of policy issues; reprints of journal articles by IFPRI staff; and books published for IFPRI by The Johns Hopkins University Press. This latter series brings together the expertise of researchers from IFPRI and other institutions to investigate critical issues in food policy. A complete list of publications for 1986 is provided in the next section.

These publications were distributed through the mailing list and through special requests to more than 13,000 individuals and organizations, almost half of these being individuals, libraries, educational institutions, research organizations, and government agencies in the Third World. Efforts to update and increase the size of the audience, particularly in the Third World, were again made this year with a special mailing to researchers and policymakers in Sub-Saharan Africa. Development issues are communicated to a more general audience as well through press briefings and press releases. The latter were used by newspapers and magazines around the world.

IFPRI also made known its research by displaying its publications at international meetings and book fairs in New Delhi, Kingston, Frankfurt, and various cities in the United States.

## COLLABORATION WITH CENTERS IN THE CGIAR

**T**he new technologies created by the other centers in the CGIAR are most effective in increasing food production when government policies provide the proper environment for their use. IFPRI seeks to identify the policies that lead to the adoption and optimal effectiveness of the new technologies. To this end IFPRI collaborates frequently with other centers by supplying data, engaging in problem identification, and conducting joint research.

Collaborative activities with other CGIAR centers during 1986 are listed below. More detailed descriptions of some of these projects are given in the sections dealing with IFPRI's five research programs.

IFPRI is investigating the effect of investment in irrigation on rice production and farm income in Southeast Asia, the productivity of alternative investments in irrigation, and the aggregate requirements and allocation of investment funds for irrigation in Indonesia and the Philippines. The International Rice Research Institute (IRRI) is involved in the analysis of water management as it relates to this irrigation study in the Philippines.

Overall coordination of a project designed to assess the outlook for millet and sorghum in West Africa is being provided by IFPRI. The other CGIAR center involved is ICRISAT. The study is looking at the substitution in consumption of wheat and rice for traditionally grown millet and sorghum and the substitution in production of maize and rice. The magnitude, determinants, and consequences of these substitutions at the household level are being investigated.

IFPRI is studying the supply and demand prospects for cassava, with particular reference to its food and feed uses in the Third World, along with

the Centro Internacional de Agricultura Tropical (CIAT) and the International Institute of Tropical Agriculture (IITA).

In conjunction with the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), IFPRI has synthesized available data related to the agroecological zones for wheat production in the People's Republic of China. IFPRI continues to supply Chinese agricultural production data to other centers as well.

IFPRI is collaborating with other centers in the CGIAR and outside organizations to develop an intercenter approach to the characterization of agroecological zones and the integration of socioeconomic and agroecological parameters in agricultural research programs. A meeting was held in Rome this year to discuss current and future efforts in this area.

IFPRI published the edited proceedings of a workshop on the "Sources of Increased Variability in Cereal Yields: Consequences for Agricultural Research and Policy." Nine other CGIAR centers participated in the workshop.

## COLLABORATION WITH INSTITUTIONS IN DEVELOPING COUNTRIES

IFPRI collaborates in a wide variety of settings with institutions in developing countries—in data collection, conferences, and research. IFPRI staff also interact informally with policymakers and researchers from these institutions. These activities are mutually beneficial as they improve the analytical capacity of developing-country agricultural research systems, allow research results to be incorporated into policy planning, enable both IFPRI and its collaborator to improve approaches to and develop appropriate frameworks for food policy analysis, and focus IFPRI's attention on national problems and the relationship of research to these problems.

The interaction with colleagues at IFPRI, where a wide range of methodological techniques is used in an integrated approach to food policy research, allows collaborating researchers to further develop their professional skills in problem definition, project design, survey technique, and data analysis.

The overall increase in analytical capacity within a country as a result of collaboration helps governments translate un-prioritized macroeconomic agendas, such as currency devaluation, into specific policies that contribute to an overall strategy for development.

Collaborative research covers a wide range of issues related to food policy. In 1986 IFPRI collaborated with the following 47 institutions located in developing countries:

### AFRICA

#### Burkina Faso

Centre d'Etudes, de Documentation, de Recherche Economique et Sociale (CEDRES), Ouagadougou, on research on the substitution in consumption of wheat and rice for traditionally grown millet and sorghum and the substitution in production of maize and rice.

#### Côte d'Ivoire

Centre Ivoirien de Recherches Economiques et Sociales (CIRES), Abidjan, on research on the substitution in consumption of wheat and rice for traditionally grown millet and sorghum and the substitution in production of maize and rice.

#### Gambia

Programming, Planning, and Monitoring Unit for the Agricultural Sector, Banjul, on a

study of the implications for economic and nutrition-related programs and policy of increased commercialization of semisub-sistence agriculture in Gambia.

#### Kenya

Kenyatta University, Nairobi, and the National Council for Science and Technology, Nairobi, on research on the effects on food consumption and nutrition of shifts from semisub-sistence maize to commercialized sugarcane production in Kenya.

#### Nigeria

University of Ibadan, Ibadan, on research on the incidence of trade and exchange rate policies on production incentives, growth, and employment in agriculture, with an emphasis on the effects of the oil sector; research on the trade-

offs between expanding food exports and pursuing food security; and analysis of the past trends and prospects for future use of cassava as food.

### Rwanda

■ Ministry of Agriculture, Kigali, on research on the implications for economic and nutrition-related programs and policy of increased commercialization of semisubsistence agriculture in Rwanda and on policy issues for long-term growth in fertilizer use.

■ National University of Rwanda, Butare, on policy issues for long-term growth in fertilizer use.

### Senegal

■ Institut Sénégalais de Recherches Agricoles (ISRA), Dakar, on research on the substitution in consumption of wheat and rice for traditionally grown millet and sorghum and the substitution in production of maize and rice.

### Zaire

■ Ministry of Agriculture, Kinshasa, on policy issues for long-term growth in fertilizer use.

■ University of Kinshasa, Kinshasa, on policy issues for long-term growth in fertilizer use and analysis of the past trends and prospects for future use of cassava as food.

### Zambia

■ Eastern Province Agricultural Development Project, Chipata, on a study of the effects of technological change in agriculture on rural welfare and the impact of rural infrastructure on agricultural development in Zambia.

■ National Food and Nutrition Commission, Lusaka, on a study of the effects of technological change in agriculture on rural welfare and research on the food consumption and nutrition

implications of maize price and marketing policies in Zambia.

■ Rural Development Studies Bureau of the University of Zambia, Lusaka, on a study of the effects of technological change in agriculture on rural welfare and the impact of rural infrastructure on agricultural development in Zambia and an investigation of the food consumption and nutrition implications of maize price and marketing policies in Zambia.

### Zimbabwe

■ Department of Physical Planning, Ministry of Urban and Rural Development and Local Government, Harare, on an analysis of the effect of the provision of service infrastructure on agricultural and rural development in Zimbabwe.

## ASIA

### Bangladesh

■ Bangladesh Institute of Development Studies (BIDS), Dhaka, on a study with a visiting researcher from BIDS on issues related to technological diffusion and its effect on agricultural production and economic development.

### People's Republic of China

■ Chinese Academy of Agricultural Sciences (CAAS), Beijing, on analysis with a visiting researcher from CAAS' Agricultural Economics Institute of various aspects of Chinese agriculture, including the agroclimatic delineation of Chinese wheat zones and the variability in Chinese cereal production.

■ Chinese Academy of Preventive Medicine, Beijing, and Chinese Academy of Social Sciences, Beijing, in planning a collaborative workshop on survey and analytic methodologies related to food policy and nutrition.

■ Chinese Academy of Sciences (CAS), Beijing, on research with visiting scholars from CAS' Institute of Geography on water management policy and agricultural productivity in North China.

### India

■ Centre for Development Studies, Trivandrum, on an analysis of the past trends and prospects for future use of cassava as food and feed.

■ Tamil Nadu Agricultural University, Coimbatore, on research on the effects of technological change in agriculture on rural welfare and on the role of marketing and service facilities in rural development in North Arcot district in the state of Tamil Nadu.

### Indonesia

■ Badan Urusan Logistik (BULOG), Jakarta, on an analysis of postharvest losses of rice grains in Indonesia.

■ Center for Agro-Economic Research, Bogor, on an investigation of food demand and supply prospects for Indonesia in relation to agricultural policies and strategies such as irrigation development and an analysis of the past trends and prospects for future use of cassava as food and feed.

### Nepal

■ Agricultural Projects Services Centre of the Government of Nepal (APROSC), Kathmandu, on an investigation of the ways in which the depletion of forests, which provide wood as cooking fuel, influences time allocation, nutrition, and agricultural productivity in the hill areas of Nepal.

### Pakistan

■ Applied Economic Research Centre, Karachi, Centre for Applied Economic Studies, Peshawar, Pakistan Institute of Development Economics, Islamabad, Punjab Economic Research Institute, Lahore, and the University of Baluchistan, Quetta, on research to formulate and assess policies related to food security and human nutrition at the household level in urban and rural areas in Pakistan.

### Philippines

■ Ministry of Agriculture, Manila, on an analysis of the nutritional implications of selected food and agricultural policies in the Philippines.

■ National Nutrition Council, Manila, on a pilot study of food price discount programs in the Philippines.

■ University of the Philippines, Los Baños, on an investigation of food demand and supply prospects for the Philippines in relation to agricultural policies and strategies such as irrigation development and an analysis of the past trends and prospects for future use of cassava as food and feed.

■ Xavier University, Cagayan de Oro, on a study of the food consumption and nutrition effects of the shift from semisubsistence maize to commercialized sugarcane production in the Philippines.

### Sri Lanka

■ Ministry of Plan Implementation, Colombo, on an investigation of the effect of the Sri Lankan food stamp program on the real income, food consumption, and nutritional status of low-income people.

## Thailand

■ Kasetsart University, Bangkok, on a study of the equity and income distribution effects of irrigation in Thailand and an analysis of the past trends and prospects for future use of cassava as food and feed.

■ Thailand Development Research Institute, Bangkok, on a study of the relationships that exist between and along the growth paths of agriculture and the rest of the economy in Thailand.

■ Thammasat University, Bangkok, on a study of the equity and income distribution effects of irrigation in Thailand.

## LATIN AMERICA

### Argentina

■ Fundación Mediterránea, Córdoba, on a study of the relationships that exist between and along the growth paths of agriculture and the rest of the economy in Argentina.

### Brazil

■ Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brasília, on a study of the forces influencing the adoption and diffusion of modern agricultural practices in Brazil.

■ Federal University of Viçosa, Viçosa, on analysis of data collected for the Program of Integrated Rural Development in the Zona de Mata (PRODEMATA).

## Chile

■ Pontificia Universidad Católica de Chile, Santiago, on a study of the relationships that exist between and along the growth paths of agriculture and the rest of the Chilean economy, and research on the effects of technological change in rice production on calorie consumption by low-income households in Colombia.

## Colombia

■ Agricultural Farmers Association (SAC), Bogotá, on research on the incidence of trade and exchange rate policies on production incentives, growth, and employment in agriculture in Colombia.

■ Ministry of Planning, Bogotá, on a study of the food stamp program in Colombia.

## Costa Rica

■ Center for the Promotion of Sciences and Socioeconomic Development (PRODESARROLLO), San José, and Central Bank of Costa Rica, San José, on a study of agricultural protectionism in Costa Rica.

## Guatemala

■ Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, on an investigation of the implications for economic and nutrition-related programs and policy of increased commercialization of semisubsistence agriculture in Guatemala.

## MEETINGS

In 1986 IFPRI provided opportunities for interaction between developing country decisionmakers and IFPRI researchers on food policy issues through seminars and workshops. These meetings provided the opportunity to disseminate research results directly and to test their relevance to the practical issues that policymakers face. In addition, plans were developed for future policy seminars on the growth of global food surpluses in the developed countries and their consequences for access to food by low-income people in developing countries, on the impact of trade and macroeconomic policies on agricultural growth, and on the food policy implications of changing cereal consumption patterns in West Africa. Two major workshops and a number of seminars were held during the year.

### GROWTH LINKAGES IN NORTH ARCOT

"The Growth Linkage Effects of Green Revolution on Regional Income and Employment in North Arcot, Tamil Nadu, India," was the subject of a workshop jointly sponsored by IFPRI and Tamil Nadu Agricultural University (TNAU) in Ootacamund, February 14-16. The workshop explored the implications for policy and research of the results of a joint IFPRI-TNAU household survey of the growth linkage effects of the "green revolution" in North Arcot district.

Discussion focused on changes in income, employment, and nutrition resulting from the introduction of new technologies and assessed the linkage effects on growth in income and employment in the regional nonfarm economy. An important assumption of the research, reflected in the workshop's agenda, was the view that the distributional consequences of agricultural technology are not immutable but can be influenced by public policy. The role of policies for input supplies, public investments in infrastructure and service provision, agricultural research priorities, and policies to assist small, nonfarm businesses in rural towns were discussed. The workshop also treated the applicability of the findings to other regions of India as well as to Sub-Saharan Africa.

State and district level agricultural officials, as well as researchers and analysts from TNAU, IFPRI, and the United Kingdom participated. (Research results are reported in the sections on the Agricultural Growth Linkages Program and the Food Consumption and Nutrition Policy Program.)

### DATA NEEDS IN DEVELOPING COUNTRIES

In many developing countries, failures to realize planned agricultural and general economic targets may in large part be attributed to inadequacies and disparities in basic data and the implementation of policies dependent on such data. On November 3-6, IFPRI presented five of the six papers in the "Expert Consultation on Data Needs for Food and Agricultural Policy Analysis and Planning in Developing Countries," jointly planned with FAO. The meeting, which took place at FAO headquarters in Rome, identified information requirements for planning and policy analysis and suggested

ways to strengthen the statistical capabilities of developing countries to produce, process, analyze, and disseminate such information. Food and agricultural policies and programs require a reliable data base for initial formulation as well as for subsequent monitoring, evaluation, and modification.

Discussions addressed ways of improving the information needed for policy analysis and decision in four areas: overall trends in food and agriculture, production policy, consumption and nutrition policy, and trade and aid policy. The participants, from Chile, India, Kenya, Mexico, Sudan, and Tanzania, agreed that improvements in the type and reliability of food and agricultural data of developing countries, particularly those in Africa, require both donor assistance and the cooperation of national governments. (Also see the Food Data Evaluation Program section.)

### FOOD POLICY IN KENYA

The implications that rapid population growth, expanding fertilizer use on food crops and growth in nonagricultural employment through agricultural growth have for Kenyan food and employment policies were discussed during the meeting of IFPRI's Board of Trustees, held February 2-8 in Nairobi. These issues were discussed during a day-long seminar with Kenyan researchers and policymakers, a two-day field trip to western Kenya, and meetings with senior Kenyan officials.

Seminar participants noted that given its natural resource constraints—only 20 percent of Kenya's total land area is arable—Kenya's 4 percent population growth rate has serious implications for the country's ability to generate adequate employment and nutrition for all. It was noted that although Kenya's use of improved inputs such as high-yielding seeds, agricultural chemicals, and fertilizers is widespread compared to many other African countries, increased use of fertilizers by smallholders has the greatest potential for accelerating food and agricultural production. In a country where 60 percent of the population is below 18 years old, creating jobs from agriculture and making agriculture itself more labor intensive will be critical.

### IN-HOUSE SEMINARS

IFPRI's in-house seminar program serves the Washington, D.C. area's network of research and policymaking institutions concerned with food policy. These meetings typically involve researchers, administrators, and visiting officials from developing countries in informal discussions of the results and policy implications of IFPRI research. Seminars are also occasionally given by guest speakers. In 1986, 20 seminars were held on such topics as rural development in Xinjiang province, People's Republic of China, effects of trade and exchange rate policies on agricultural production incentives, and the direction of the patterns of development and food security in Asia.

## PUBLICATIONS AND PAPERS

### RESEARCH REPORT AND ABSTRACT SERIES

#### Research Report 52

*Food in the Third World: Past Trends and Projections to 2000*, by Leonardo Paulino, June 1986.

#### Research Report 53

*Regional Cooperation to Improve Food Security in Southern and Eastern African Countries*, by Ulrich Koester, July 1986.

#### Research Report 54

*Weather and Grain Yields in the Soviet Union*, by Padma Desai, September 1986.

#### Research Report 55

*The Effects of Trade and Exchange Rate Policies on Agriculture in Nigeria*, by T. Ademola Oyejide, October 1986.

#### Research Report 56

*The Effects of Trade and Exchange Rate Policies on Agriculture in Zaire*, by Tshikala B. Tshibaka, November 1986.

#### Research Report 57

*Cereal Feed Use in the Third World: Past Trends and Projections to 2000*, by J. S. Sarma, December 1986.

*IFPRI Abstract*, the four-page policy summaries of the research reports, are published in English, French, and Spanish.

### OTHER SERIES

#### IFPRI/The Johns Hopkins University Press Book Series

*Crop Insurance for Agricultural Development: Issues and Experience*, edited by Peter B. R. Hazell, Carlos Pomareda, and Alberto Valdés. Baltimore: The Johns Hopkins University Press for IFPRI, 1986. \$32.50.

#### "Gray" Report Series

*The Effect of Food Price and Income Changes on the Acquisition of Food by Low-Income Households*, by Harold Alderman, 1986.

*Summary Proceedings of a Workshop on Cereal Yield Variability*, edited by Peter B. R. Hazell, 1986.

#### Food Policy Statements

##### Number 6

*The New Global Context for Agricultural Research: Implications for Policy*, by John W. Mellor, December 1986.

#### Working Papers on Food Subsidies

##### Number 3

*Food Subsidy Programs in Mexico*, by Nora Lustig, January 1986.

#### Working Papers on Commercialization of Agriculture and Nutrition

##### Number 1

*Commercialization of Subsistence Agriculture: Income and Nutritional Effects in Developing Countries*, by Joachim von Braun and Eileen Kerinedy, April 1986.

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- \_\_\_\_\_. "Prediction and Prevention of Famine." Reprinted from *Federation Proceedings* (Federation of American Societies for Experimental Biology), Vol. 45, No. 10, September 1986, pp. 2427-2431.
- Olson, Mancur. "Space, Agriculture, and Organization." Reprinted from the *American Journal of Agricultural Economics* 67 (December 1985): 928-937.
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- Valdés, Alberto. "Food Policy Research and the Policy Process in the Third World." Reprinted from *Food Policy*, pp. 141-148. Edited by Charles K. Mann and Barbara Huddleston. Bloomington, Ind.: Indiana University Press, 1986.
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*Les Politiques Alimentaires Face Aux Changements dans les Modes de Consommation des Céréales en Afrique de l'Ouest—Approche Bibliographique*, by Michel Benoit-Cattin and Christopher L. Delgado. Paris and Washington, D.C.: Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD) and IFPRI, 1986.

## GENERAL INFORMATION

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- Valdés, Alberto. (With F. J. Leon.) *Política Comercial y Tarifas Verdaderas, Peru, 1940-83*. Lima: Centro de Investigación, Universidad del Pacífico, 1986.

## PAPERS PRESENTED BY IFPRI STAFF

- Ahmed, Raisuddin. "Data Requirement for Analysis of Production Policies." Paper presented at the Expert Consultation on Data Needs for Food and Agricultural Policy Analysis and Planning in Developing Countries, sponsored by the Food and Agriculture Organization of the United Nations, Rome, November 3-6, 1986.
- . "Non-farm Employment and Rural Infrastructure." Paper presented at an International Programs in Agriculture seminar, Purdue University, West Lafayette, Indiana, November 19, 1986.
- . "Role of Infrastructure in Rural Development." Paper presented at the Global Development Conference, University of Maryland, College Park, September 12-13, 1986.
- . "Transfer of Technology to Farmers in Developing Countries." Paper presented at a meeting held at the Washington Public Affairs Center, Washington, D.C., in conjunction with the Development Studies Program of the University of Southern California, July 31, 1986.
- Bautista, Romeo. "Domestic Terms of Trade and Agricultural Growth in Developing Countries." Paper presented at the Eighth World Congress of the International Economic Association, New Delhi, December 1-5, 1986.
- Delgado, Christopher. "Setting Priorities for Promoting African Food Production." Paper presented as part of the Gwendolyn Carter Lecture Series at the Center for African Studies, University of Florida, Gainesville, Florida, September 1986.
- Desai, Gunvant M. "Undertaking Fertilizer Price and Subsidy Policy Issues: Retention Price of Domestic Urea." Paper presented at the Workshop on Fertilizer Consumer Prices, Institute for Social and Economic Change, Bangalore, India, April 25-26, 1986.
- Gonzales, Leonardo A. "Rice and Corn Technology and Policy in the Philippines." Paper presented at the Eighth Annual Scientific Meeting, National Academy of Science and Technology, Manila, July 1986.
- Herd, Robert W. "Technological Potential for Increasing Crop Productivity." Paper presented at the International Agricultural Trade Research Consortium meeting, Centro Internacional de Mejoramiento de Maiz y Trigo, El Batán, Mexico, December 14-18, 1986.

- Hossain, Mahabub. "Employment Generation Through Cottage Industries—The Bangladesh Case." Paper presented at the Regional Seminar on Strategies and Policies for Employment Expansion in Asia, organized by the International Labour Organisation, New Delhi, September 24-26, 1986.
- \_\_\_\_\_. "Technological Change and Factor Productivity in Bangladesh Agriculture." Paper presented at the Global Development Conference, University of Maryland, College Park, September 12-13, 1986.
- Kumar, Shubb. "Dichotomy Between Resource Access and Time Availability for Child Feeding and its Relation to Nutrition Education." Paper presented at the International Conference on Innovations in Nutrition Education, Washington, D.C., July 10-11, 1986.
- \_\_\_\_\_. "Maize Policies and Nutrition in Zambia." Paper presented at the Workshop on Nutrition and Household Production, Chipata, Zambia, August 25-28, 1986.
- Mellor, John W. "Agricultural Development Assistance—Goals and Processes." Paper presented at a U.S. Senate briefing on Responding to the Crisis in Foreign Aid, Washington, D.C., September 11, 1986.
- \_\_\_\_\_. "Food and Development: The Critical Nexus Between Developing and Developed Countries." Paper presented at the NOMISMA International Conference on the Agro-Technological System Towards 2000: A European Perspective, Bologna, September 18-20, 1986.
- \_\_\_\_\_. "Food Production, Consumption, and Development Strategy." Paper presented at the conference on The Indian Economy: Successes, Current Policies and External Links, Boston University, Boston, October 4-7, 1986.
- \_\_\_\_\_. "General Employment Linkages Through Agricultural Growth—A Conceptual Framework." Paper presented at the Sixth Latin American Meeting of the Econometric Society, Cordoba, Argentina, July 22-25, 1986.
- \_\_\_\_\_. "Overview: World Food Situation in Historical Perspective." Paper presented at Purdue University, West Lafayette, Indiana, May 12, 1986.
- \_\_\_\_\_. "The Right to Food: Action to Address the Hunger Problem." Speech delivered at the Conference on the Legal Faces of the Hunger Problem, Howard University, Washington, D.C., October 17, 1986.
- \_\_\_\_\_. "Rural Employment Linkages Through Agricultural Growth—Concepts, Issues, and Questions." Paper presented at the Eighth World Congress of the International Economic Association, New Delhi, December 1-5, 1986.
- \_\_\_\_\_. "United States Agriculture in the Global Context." Paper presented at Western Michigan University, Kalamazoo, Michigan, November 19, 1986.
- \_\_\_\_\_. "United States Foreign Assistance—What Is the Comparative Advantage?" Testimony presented to the U.S. Senate Foreign Relations Committee hearings on the Agency for International Development, Washington, D.C., April 24, 1986.
- Mellor, John W. (With Richard Adams, Jr.) "Food and Employment Interactions—Strategic Considerations." Paper presented at the annual meeting of the American Association for the Advancement of Science, Philadelphia, May 27, 1986.
- Mundlak, Yair. "The Aggregate Agriculture Supply." Paper presented as the Marschack Lecture, Econometric Society, Cordoba, Argentina, July 1986.

- Mundlak, Yair. (With Domingo Cavallo.) "On the Nature and Implications of Factor Adjustment—Argentina, 1913-1984." Paper presented at the Eighth World Congress of the International Economic Association, New Delhi, December 1-5, 1986.
- Oram, Peter. "Methods of Combining Socio-Economic Data with Biophysical Environmental Data." Paper presented at a Workshop on Agro-Ecological Characterization, Classification, Mapping, Rome, April 1986.
- Paulino, Leonardo. "Data Needs for Analysis and Assessment of Overall Food Trends in Developing Countries." Paper presented at the Expert Consultation on Data Needs for Food and Agricultural Policy Analysis and Planning in Developing Countries, sponsored by the Food and Agriculture Organization of the United Nations, Rome, November 3-6, 1986.
- Pinstrup-Andersen, Per. "Assuring Food Security and Adequate Nutrition for the Poor During Periods of Economic Crisis and Macroeconomic Adjustments: Policy Options and Experience with Food Subsidies and Transfer Programs." Paper presented at the Second Takemi Symposium on International Health, Harvard University, Cambridge, Mass., May 20-22, 1986.
- . "Changing Patterns of Consumption Underlying Changes in Trade and Agricultural Development." Paper presented at the International Agricultural Trade Research Consortium meeting, Centro Internacional de Mejoramiento de Maíz y Trigo, El Batán, Mexico, December 14-18, 1986.
- . "Macroeconomic Adjustment Policies and Human Nutrition: Available Evidence and Research Needs." Paper presented at the 12th Session of the UN Administrative Committee on Co-ordination/Sub-Committee on Nutrition, Tokyo, April 7-11, 1986.
- Ranade, C. G. "Agricultural Marketing and Pricing in Malawi." Paper presented at a workshop of MADIA project researchers, World Bank, Washington, D.C., January 20-27, 1986.
- Ranade, C. G. (With Sidi Jammeh.) "Agricultural Marketing and Pricing in Senegal." Paper presented at a workshop of MADIA project researchers, World Bank, Washington, D.C., January 20-27, 1986.
- Ranade, C. G. (With Ademola Oyejide.) "Agricultural Pricing and Marketing: Analytical Framework and Preliminary Results." Paper presented at a workshop of MADIA project researchers, World Bank, Washington, D.C., January 20-27, 1986.
- Reardon, Thomas A. "Farm Household Economy and Market Research Role in Improving the Design and Management of Technology." Paper presented at an International Irrigation Management Institute/Rockefeller Foundation workshop on Social Science Perspectives on Managing Agricultural Technology, Lahore, Pakistan, September 24-27, 1986.
- Rubin, Deborah. "Interdisciplinary Research on Intercropping Sugarcane and Food Crops in South Nyanza, Kenya." Paper presented at an International Irrigation Management Institute/Rockefeller Foundation workshop on Social Science Perspectives on Managing Agricultural Technology, Lahore, Pakistan, September 24-27, 1986.
- Sahn, David E. "Cost Effectiveness Considerations in Selecting Food Aid Commodities." Keynote address presented at the Workshop on Targeted Food Aid: Criteria for Commodity Choice, International Agricultural Centre, Wageningen, the Netherlands, September 23, 1986.

- \_\_\_\_\_. "Dietary Patterns, Food Demand Parameters, and the Impact of Selected Food Policies." Paper presented at a meeting of staff from IFPRI and the Food and Nutrition Policy Planning Division, Ministry of Plan Implementation, Colombo, January 29-30, 1986.
- \_\_\_\_\_. "Health and Nutritional Aspects of Agricultural Development." Paper presented at the 10th Session of the Joint Food and Agriculture Organization of the United Nations/World Health Organization Expert Committee on Nutrition, Rome, November 10-14, 1986.
- \_\_\_\_\_. "Malnutrition and Food Consumption in Sri Lanka: Changes from 1969-1982." Paper presented to the Consortium of Development Economists, Yale University, New Haven, May 10, 1986.
- Sarma, J. S. "Improvements in Basic Agricultural Statistics in Support of African Food Strategies and Policies and the Role of Donor Agencies." Paper presented at a workshop on Statistics in Support of African Food Strategies and Policies, organized by the Statistical Office of the European Communities and the World Food Council, Brussels, May 13-16, 1986.
- \_\_\_\_\_. "Minimum Statistical Programs for Countries with the Least Developed Statistical Capability." Paper presented at the Expert Consultation on Data Needs for Food and Agriculture Policy Analysis and Planning in Developing Countries, sponsored by the Food and Agriculture Organization of the United Nations, Rome, November 3-6, 1986.
- Stone, Bruce. "Food and Agriculture in the Context of Rural Employment Generation Problems of China and Other Developing Countries: Emerging Constraints and Required Research." Paper presented at the International Seminar on Rural Employment Promotion Strategies organized by the International Labour Office, the Chinese Ministry of Labor and Personnel, and the Research Center for Rural Development, Beijing, April 8-13, 1986.
- Svendsen, Mark. "Irrigation System Recurrent Cost Recovery: A Pragmatic Approach." Paper presented at the Expert Consultation on Irrigation Water Charges held by the Food and Agriculture Organization of the United Nations, Rome, September 22-26, 1986.
- Valdés, Alberto. "Agriculture in the Uruguay Rounds: Developing Country Interests." Paper presented at the World Bank/Thailand Development Research Institute Conference on the Role of Interests of the Developing Countries in the Multilateral Trade Negotiations, Bangkok, October 30-November 11, 1986.
- \_\_\_\_\_. "Constraints to Adjustments through International Trade: An Analysis of the Relationship between Industrial and Developing Countries." Paper presented at the NOMISMA International Conference on The Agro-Technological System Towards 2000: A European Perspective, Bologna, September 18-20, 1986.
- \_\_\_\_\_. "Data Needs for Food Trade and Aid Policy Analysis in Developing Countries." Paper presented at the Expert Consultation on Data Needs for Food and Agricultural Policy Analysis and Planning in Developing Countries, sponsored by the Food and Agriculture Organization of the United Nations, Rome, November 3-6, 1986.
- \_\_\_\_\_. "Latin American Regional Paper." Paper presented at a conference on U.S. Agricultural Exports and Third World Development organized by the Curry Foundation, Washington, D.C., April 1986.
- Valdés, Alberto. (With M. Schiff.) "The Impact of Sector-Specific versus Economy-Wide Policies on Incentives for Agriculture." Paper presented at the Sixth Latin American Meeting of the Econometric Society, Cordoba, Argentina, July 22-25, 1986.

- Valdés, Alberto. (With Thomas Pinckney.) "Trade and Macroeconomic Policies' Impact on Agricultural Growth: Evidence to Date." Paper presented at the International Development Research Centre's Conference on Economic Structure and Macroeconomic Policy, Harare, December 8-12, 1986.
- Wanmali, Sudhir. "Regional Policy and Changing Rural Settlement Systems in India: A Study of Miryalguda Taluka, Andhra Pradesh." Paper presented at a regional conference of the International Geographical Union's Commission on Changing Rural Systems, Granada and Barcelona, August 25-September 5, 1986.
- \_\_\_\_\_. "Rural Infrastructure and Agricultural Development in Zambia: An Outline of Ongoing Research." Paper presented to a workshop on Research and Training for the Development of Service and Growth Centers in Rural Areas, Lilongwe, September 15-20, 1986.

## REFEREES

IFPRI is most grateful for the efforts of the following people who reviewed manuscripts for the research report series during 1985 and 1986.

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More than 50 researchers visiting from around the world spent time at IFPRI during 1986. In addition to the visiting research fellows listed above, who are on leave from their home organizations for one or more years, the visiting researchers listed below spent periods of a month or more at IFPRI.

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List includes part-time staff members. Country indicates citizenship.

# FINANCIAL STATEMENTS

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

### BALANCE SHEET as of December 31, 1986 and 1985

#### ASSETS

	<u>1986</u>	<u>1985</u>
<b>Current Assets:</b>		
Cash and short-term investments	\$1,991,137	\$1,690,489
Grants receivable	101,650	227,744
Contracts receivable	1,013,125	679,796
Travel advances and other receivables	81,125	90,487
Prepaid expenses and other current assets	111,641	107,088
	<u>3,298,678</u>	<u>2,795,604</u>
<b>Property and Equipment:</b>		
Furniture and equipment	712,562	373,593
Leasehold improvements	102,536	76,439
	<u>815,098</u>	<u>450,032</u>
Less – accumulated depreciation	323,158	245,666
	<u>491,940</u>	<u>204,166</u>
<b>TOTAL ASSETS</b>	<u><u>\$3,790,618</u></u>	<u><u>\$2,999,770</u></u>

#### LIABILITIES AND FUND BALANCE

<b>Current Liabilities:</b>		
Accounts payable	\$ 144,689	\$ 183,156
Current portion of long-term debt	10,930	9,773
Accrued vacations and other liabilities	255,084	234,231
Advance payment of grant funds	1,600,000	1,299,354
Unexpended contract funds	930,775	619,145
	<u>2,941,478</u>	<u>2,345,659</u>
<b>Long-term Debt</b>	<u>27,112</u>	<u>38,042</u>
<b>Fund Balance:</b>		
Working capital fund	334,172	389,680
Equipment replacement fund	50,000	
General fund	437,856	226,389
	<u>822,028</u>	<u>616,069</u>
<b>TOTAL LIABILITIES AND FUND BALANCE</b>	<u><u>\$3,790,618</u></u>	<u><u>\$2,999,770</u></u>

The accompanying notes are an integral part of these statements.

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

STATEMENT OF REVENUE, EXPENSE AND GENERAL  
FUND BALANCE

For the Years Ended December 31, 1986 and 1985

	<u>1986</u>	<u>1985</u>
<b>Revenue:</b>		
Grant income	\$4,877,359	\$4,311,485
Special project income	2,588,062	2,507,377
Expense reimbursements and other income	101,706	139,264
Investment income	62,591	53,788
	<u>7,629,718</u>	<u>7,011,914</u>
<b>Expenses:</b>		
Personnel	3,184,258	2,932,710
Employee benefits	1,002,410	806,020
Field and collaborative research	1,088,246	1,100,753
Travel	356,777	325,629
Computer services	224,334	267,835
Publications and conferences	353,917	376,446
Trustees' expenses	135,914	99,331
Office operation and administration	980,426	680,933
Depreciation	97,477	55,179
Nonpayment of previous grant pledge		69,200
	<u>7,423,759</u>	<u>6,714,036</u>
<b>Excess of Revenue Over Expenses</b>	205,959	297,878
Change in working capital fund	55,508	(364,680)
Change in equipment replacement fund	(50,000)	
Increase (decrease) in general fund balance	211,467	(66,802)
<b>General Fund Balance, Beginning</b>	<u>226,389</u>	<u>293,191</u>
<b>GENERAL FUND BALANCE, ENDING</b>	<u>\$ 437,856</u>	<u>\$ 226,389</u>

The accompanying notes are an integral part of these statements.

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

STATEMENT OF CHANGES IN FINANCIAL POSITION  
For the Years Ended December 31, 1986 and 1985

	<u>1986</u>	<u>1985</u>
<b>Funds Provided by (Used in) Operations:</b>		
Excess of revenue over expenses	\$205,959	\$297,878
Items not requiring funds:		
Depreciation	97,477	55,179
	<u>303,436</u>	<u>353,057</u>
<b>Funds Provided by (Used in) Changes in Operating Working Capital (Except Cash and Short-term Investments):</b>		
Grants receivable	126,094	106,542
Contracts receivable	(333,329)	(234,322)
Travel advances and other receivables	9,362	27,099
Prepaid expenses and other current assets	(4,553)	(67,207)
Accounts payable	(38,467)	61,527
Accrued vacations and other liabilities	20,853	38,656
Advance payment of grant funds	300,646	1,223,627
Unexpended contract funds	311,630	290,123
	<u>392,236</u>	<u>1,446,045</u>
<b>Funds Provided by Operations</b>	<u>695,672</u>	<u>1,799,102</u>
<b>Funds (Used in) Provided by Investment Transactions:</b>		
Acquisition of property and equipment	(388,108)	(110,070)
Disposal of property and equipment	2,857	
	<u>(385,251)</u>	<u>(110,070)</u>
<b>Funds (Used in) Provided by Financing Transactions:</b>		
Repayment of short-term debt		(320,000)
Repayment of long-term debt	(9,773)	(8,045)
	<u>(9,773)</u>	<u>(328,045)</u>
<b>INCREASE IN CASH AND SHORT-TERM INVESTMENTS</b>	<u>\$300,648</u>	<u>\$1,360,987</u>

The accompanying notes are an integral part of these statements.

# INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

## NOTES TO FINANCIAL STATEMENTS December 31, 1986 and 1985

### Note 1. Summary of Significant Accounting Policies

#### Organization

By Executive Order 12359, the Institute is a public international organization entitled to certain privileges, exemptions and immunities conferred by the International Organizations Immunities Act, including exemption from Federal income tax under Sec. 501(c)(3).

#### Revenue

Grant income is core program support received from agencies participating in the Consultative Group on International Agricultural Research and is recorded as revenue in the period stipulated by the donor. Grants which have been pledged for the current year but not received at year end are recognized as revenue and the related receivables are recorded. Grants received for funding of future periods are recorded as liabilities.

Special project income is recorded as the related costs are incurred. Contracts receivable represents income which has been earned but for which funds have not yet been received. Unexpended contract funds represents funds received for which costs have not yet been incurred. A substantial portion of special project revenue is with agencies of the U.S. government, and is subject to audit by cognizant government audit agencies. The Institute's cost records have been audited through 1985. Adjustments, which were not material, were reflected in current income. The receivables as stated are considered fully realizable.

Other income is recorded when earned.

#### Property and Equipment

Property and equipment is stated at cost. Depreciation is provided over an estimated useful life of 5 years. Expenditures for additions are capitalized and expenditures for maintenance and repairs are charged to operations as incurred. When properties are retired or otherwise disposed of, the cost and the related accumulated depreciation are removed from the respective accounts and the resulting gain or loss is reflected in earnings.

Some special project sponsors allow equipment to be purchased for use on a particular project. Predominantly, these purchases have been in the field, and the items will be left in the countries involved in the studies. However, some equipment will be retained by the Institute at the conclusion of the project and will be available for continued use as donated property. This equipment has not been capitalized, but has been charged as an expense of the related project in the year of purchase. The total of these purchases is \$75,043 and \$70,740 for 1986 and 1985 respectively.

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

**NOTES TO FINANCIAL STATEMENTS**  
**December 31, 1986 and 1985**  
**(continued)**

**Note 2. Working Capital Fund**

Under guidelines of the Consultative Group on International Agricultural Research (CGIAR), the Institute is encouraged to establish a working capital fund equivalent to 30 days income. The working capital fund would be comprised of cash and short-term investments and certain receivables less certain liabilities, prepaid grant funds and contract funds received in advance.

The budgeted working capital fund balance, using the CGIAR criteria, was \$634,455 at December 31, 1986. The Institute had designated \$304,172 of available net assets for the working capital fund. Therefore, the working capital fund was \$300,283 less than the working capital fund balance using CGIAR criteria.

**Note 3. Equipment Replacement Fund**

As of December 31, 1986, the Institute has established a restricted equipment replacement fund within the fund balance in the amount of \$50,000. While the Institute allocates a portion of its annual funding towards capital needs, this is intended for the purchase of new equipment. The equipment replacement fund represents a reserve for the future replacement of the Institute's existing property and equipment.

**Note 4. Accounts Receivable**

Accounts receivable consists of the following:

	1986	1985
Amounts billed	\$ 746,470	\$326,281
Recoverable costs, not yet billed	266,655	353,515
	<u>\$1,013,125</u>	<u>\$679,796</u>

**Note 5. Leases**

The Institute occupies office space under various leases expiring through 1990. The leases provide for additional rents based on increases in building operating costs and the Consumer Price Index.

Minimum lease payments for all noncancellable leases having a remaining term in excess of one year at December 31, 1986, are as follows:

1987	\$ 558,540
1988	554,348
1989	554,348
1990	369,565
	<u>\$2,036,801</u>

## INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

**NOTES TO FINANCIAL STATEMENTS**  
**December 31, 1986 and 1985**  
**(continued)**

**Note 6. Retirement Plan**

The Institute maintains a deferred contribution retirement plan for substantially all full time employees under which the Institute contributes 5% – 20% of an employee's base compensation depending on age and length of service. Contributions for U.S. employees are made to the Teachers Insurance and Annuity Association and the College Retirement Equities Fund. Contributions for the international staff are made to the American International Reinsurance Company in Bermuda and Alliance Capital Management International in London. Total contributions were \$402,500 and \$339,000 for 1986 and 1985 respectively.

**Note 7. Restricted Foreign Account**

As part of a Special Project in Pakistan, two bank accounts have been opened to receive payments from the U.S. government in the local currency, rupees. The funds must be spent in Pakistan, and cannot be removed from the country. Due to the restrictions on their use, the rupees deposited into this account are not recognized as an asset. Income will be recognized only when expenses are paid. No disbursements were made in 1985. Disbursements amounting to 4,476,500 rupees (\$279,781) were made during 1986, and the balance at December 31, 1986 was 1,933,500 rupees (\$120,800).

**Note 8. Long-term Debt**

Long-term debt consists of an installment note, dated December 9, 1984 for \$55,860, payable to Eastman Kodak Company in 60 monthly installments of \$1,221, including interest at 11.25% per annum. A Kodak Ektaprint copier serves as the collateral for this note.

	<u>1986</u>	<u>1985</u>
Note payable	\$38,042	\$47,815
Current portion	<u>10,930</u>	<u>9,773</u>
Long-term debt	<u>\$27,112</u>	<u>\$38,042</u>

Future payments of principal are as follows:

1987	\$10,930
1988	12,226
1989	13,674
1990	1,212

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CERTIFIED PUBLIC ACCOUNTANTS

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February 20, 1987

Officers and Trustees  
International Food Policy Research Institute  
1776 Massachusetts Avenue, NW  
Washington, DC 20036

We have examined the balance sheet of the INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE as of December 31, 1986 and 1985, and the related statements of revenue and expense and changes in financial position for the years then ended. Our examination was made in accordance with generally accepted auditing standards and accordingly, included such tests of the accounting records and such other auditing procedures as we considered necessary in the circumstances.

In our opinion the financial statements present fairly the financial position of the Institute as of December 31, 1986 and 1985, and the results of its operations and the changes in its financial position for the years then ended in conformity with generally accepted accounting principles applied on a consistent basis.

*Raymond E. Lang + Associates, P.A.*

The International Food Policy Research Institute (IFPRI) was established to identify and analyze alternative national and international strategies and policies for meeting food needs in the world, with particular emphasis on low-income countries and on the poorer groups in those countries. While the research effort is geared to the precise objective of contributing to the reduction of hunger and malnutrition, the factors involved are many and wide-ranging, requiring analysis of underlying processes and extending beyond a narrowly defined food sector. The Institute's research program reflects worldwide interaction with policymakers, administrators, and others concerned with increasing food production and with improving the equity of its distribution. Research results are published and distributed to officials and others concerned with national and international food and agricultural policy. As a constituent of the Consultative Group on International Agricultural Research, IFPRI receives support for its integrated program of research from a number of governments, multilateral organizations, foundations, and other sources.

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