INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE 1989 REPORT

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IFPRI REPORT 1989

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

CONTENTS

5 Introduction

8 Emphasizing Agriculture in Economic Development—Is It a Risky Business?

Research Results

16 ● Food Data Evaluation Program

16 Changes in the Trends of Food Production Growth in Developing Countries

18 Trends in Cassava Production and Consumption

20 Food Production in China

22 ● Food Production Policy Program

22 Generation and Diffusion of Modern Agricultural Technology

27 Accelerating Growth with Equity

30 Agricultural Resources and the Environment

33 ● Agricultural Growth Linkages Program

33 Growth and Equity in Rural Areas

36 Resource Transfers in the National Economy

37 ● Food Consumption and Nutrition Policy Program

37 Food Subsidies in Developing Countries

38 Effects of Commercialization on Smallholder Agriculture

40 Policies for Famine Prevention

42 Seasonal Fluctuations in Food Consumption

44 Nutritional Effects of Technological Change

44 Agriculture, Health, and Nutrition

46 ● International Trade and Food Security Program

46 National Food Supply Management

46 Trade and Exchange Rate Policies

49 Agricultural Protectionism and Multilateral Trade Negotiations

51 Food Aid

52 Outreach

66 Publications and Papers

85 Personnel

90 Board of Trustees

93 Financial Statements

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 inadequacies of infrastructure. In yet others, food problems exist because the poor, lacking opportunities for employment, also lack purchasing power. Generally the impediments to an increase in production and provision of purchasing power to the poor are closely intertwined. 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 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 IFPRI's concern with the massive 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.

Policy formulation requires the analysis of research results from a number of research disciplines. The five areas serve to integrate the results of research projects undertaken within five research programs. The annual report describes the research programs and the individual projects that define their work focus for 1989.

Many of the projects involve the collection of data in the field by IFPRI staff in collaboration with staff from national institutions. Data on food production, consumption, and distribution are collected at the household and farm levels. It is this microeconomic focus that characterizes much of IFPRI's approach to research.

By identifying the processes that occur in development, methods to accelerate them can be identified.

IFPRI Report 1989 includes discussion of two new areas of research attention: the environment and health. During 1989, IFPRI initiated a major effort to identify environmental components of ongoing research efforts and to plan new research initiatives with an environmental focus. IFPRI's approach to research brings it into direct contact with key environmental problems. IFPRI recognizes that significant policy changes at the national and subnational levels are necessary to encourage the pattern of growth and poverty alleviation that can bring about improvement in the environment and overall sustainable agriculture. Building on its prior work in nutrition, IFPRI's research effort has begun to examine the role of health in issues related to malnutrition.

The annual report contains an address by IFPRI's director given at the World Bank's Tenth Agricultural Symposium. The paper focuses on how a successful agriculture-led growth strategy can reduce the risk of poverty for many of the world's poor. Accelerated growth and diversification in high potential agricultural areas can reduce microeconomic risks to poor households while reducing macroeconomic risks associated with agricultural growth. Rapid cost-decreasing technological change in agriculture, massive expansion of physical infrastructure, and widespread participation in education are three requisites. The paper shows that these are indeed risky strategies for governments, thereby explaining much of why governments are reluctant to undertake such strategies. It then shows how the international community can help shift and reduce those risks—to the benefit of the poor, the environment, and long-term growth.

The results of the work undertaken during 1989 are reported in seven research reports, seven issues of *IFPRI Abstract*, and four issues of the newsletter, *IFPRI Report*. Other publications include five working papers, two papers in the "gray" report series, three food policy statements, and reprints of 31 articles by IFPRI staff. In *IFPRI Policy Briefs*, the publications series initiated last year, IFPRI published *Japan and Third World Agricultural Development*. In addition, during the year IFPRI published *Variability in Grain Yields: Implications for Agricultural Research and Policy in Developing Countries*, edited by Jock R. Anderson and Peter B. R. Hazell, and *Seasonal Variability in Third World Agriculture: The Consequences for Food Security*, edited by David E. Sahn, the sixth and seventh books in its series with The Johns Hopkins University Press. An earlier book in this series, *Agricultural Price Policy for Developing Countries*, edited by John W. Mellor and Raisuddin Ahmed and published in 1988, was awarded an honorable mention in 1989 in the American Agricultural Economic Association's quality of communication category.

The Outreach section contains a discussion of IFPRI's collaboration with other centers in the CGIAR and national insti-

tutions in developing countries. During 1989 IFPRI further strengthened its collaborative links with national agricultural research systems. Its collaborative efforts involve a partnership between IFPRI staff and researchers in the Third World that provides IFPRI with information relevant to policy design and implementation while helping to build institutional capacity to conduct food policy analysis. In 1989 institutions with which IFPRI collaborated were located in Argentina, Bangladesh, Botswana, Brazil, Burkina Faso, Chile, People's Republic of China, Costa Rica, El Salvador, Ethiopia, The Gambia, Guatemala, Honduras, India, Indonesia, Kenya, Lesotho, Nicaragua, Niger, Nigeria, Pakistan, Peru, the Philippines, Rwanda, Senegal, Sierra Leone, Sri Lanka, Sudan, Syria, Tanzania, Thailand, Tunisia, Zaire, Zambia, and Zimbabwe. A list of collaborating multilateral agencies and institutions in developed countries is also included. As part of IFPRI's increased collaborative activities with national institutions and other centers in the international agricultural research system, IFPRI has outposted eight members of the research staff, four specifically to international agricultural research centers and four to national institutions in developing countries.

During 1989 IFPRI opened a European liaison office in The Hague, Netherlands. The office coordinates a cooperative program on food and agricultural policy issues involving researchers from developing countries, Europe, and IFPRI. The basis of this collaborative effort is a seminar program that establishes a valuable three-way relationship between IFPRI's research program, the research interests of Europeans, and the research needs of the developing countries. In conjunction with this, an advisory committee of Third World and European experts has been established to provide feedback on current activities and to establish future needs. The advisory committee met twice during 1989. A list of the advisory committee members appears in the Personnel section.

Also contained in the Outreach section is a report on workshops and seminars held in 1989. These included meetings on commercialization of agriculture, the effect of trade and macroeconomic policies on agriculture in Latin America, seasonality and nutrition, and growth and equity in Zambian agriculture. A meeting of Japanese policymakers and researchers and IFPRI board members and senior staff was also held in conjunction with the Board of Trustees meeting in Tokyo in April. The agenda focused on the relevance of Japanese development experience to the economic strategies of Third World countries.

The diversity and training of IFPRI's research staff contributes to the definition of major food policy problems and provides a wide range of research methods and tools to analyze these problems. As the personnel list indicates, almost half of IFPRI's senior research staff and more than half of its core group of senior researchers come from developing countries. (About two-thirds of the support staff in the research programs are from developing countries.)

EMPHASIZING AGRICULTURE IN ECONOMIC DEVELOPMENT —IS IT A RISKY BUSINESS?*

BY JOHN W. MELLOR

Risk in agriculture is usually examined by agriculturalists from a micro, production economics perspective and includes issues such as risks faced by individual farmers, the effects of those risks on their production, and how to reduce such risks. Risk in agriculture also has a macroeconomic aspect and a consumer, particularly a low-income consumer, aspect. Five principal points are made below:

i An agriculture-led growth strategy entails large short- and medium-term risks even though it is the low-risk strategy over the long run.

ii Some three-quarters of a billion people in developing countries face the ultimate risk, short of death itself, of living below an absolute poverty line that indicates income that is inadequate to ensure sufficient calories for an active, healthy life.

iii The most effective means of reducing the above two risks is to accelerate the agricultural growth rate through technological advance and ensure broad participation in improved rural productivity.

iv Also critical are international agreements to finance food trade, supplemented by food reserve, supply, and pricing policies in both developed and developing countries.

v In contrast to the record in the 1950s and 1960s in Asia, the foreign assistance donor community, particularly in Africa, is currently providing ample rhetoric, but deteriorating leadership, in moving forward these two means of reducing the risks of an agriculture-led growth strategy and poverty.

RISK IN AN AGRICULTURE-LED GROWTH STRATEGY

Is an agriculture-led growth strategy risky? The inherent risks of such a strategy are apparent and quantifiable. In an agriculture-led strategy, a dynamic performance in the basic food sector is growth at half a percentage point more than the population growth rate, or, say, a 2.5 to 3.5 percent growth rate, and, for agriculture overall, 2 or 3 percentage points more than the population growth rate, or 4 to 6 percent. These agricultural growth rates are, of course, high and probably will not occur until overall economic growth, particularly in the nonagricultural sector, picks up. Rapid growth in demand is needed to stimulate rapid growth in these sectors. The difference between an agricultural sector growing at these rates and one growing at the population growth rate is of profound economic significance. Within a 10-year period, however, the economic difference between the higher and lower growth rates cannot be statistically significant because year-to-year fluctuations in production are large relative to the difference in growth rates. This means there is roughly better than a 30 percent probability that the configuration of weather in a 10-year period will eliminate the growth that the underlying forces of an agriculture-led strategy would otherwise create.

*An earlier version of this statement was presented at the Tenth Agricultural Symposium, "Risk in Agriculture," at the World Bank, Washington, D.C., January 9, 1990. I am grateful to Uma Lele for substantive suggestions and Rajul Pandya-Lorch for research assistance and editing.

The pioneering work of Shakuntala Mehra and Peter Hazell at IFPRI shows that in recent decades these risks have been increasing for production and even more so for prices, and that this increased variability is associated with growth-accelerating processes. The association with improved technology may no doubt be due to bad policies, which are also a real part of the imperfect world of development.

Accelerated growth in agricultural production benefits the laboring class and the poor relatively more than many other groups in society. In poor countries these groups are large in number, often quiescent politically, but liable to be massively unstable if their expectations are raised and then dashed—as would happen if an agriculture-led, high-employment strategy proceeded well for a few years but then was cut off by a period of inclement weather and consequent food shortage.

These risk factors cause governments to be chary of an agriculture-led strategy or the use of food aid to back high-employment development on the one hand, and, on the other hand, to want to control food prices, stocks, and imports. These latter efforts often lead to a diversion of government expenditure that is inimical to accelerated rural growth.

In view of the risks, why would governments undertake an agriculture-led, high-employment, high food-demand development strategy? There are basically five reasons: (i) a government may recognize that despite the short- and medium-term risks, this strategy produces much higher growth rates than do others, and may be the only workable strategy; (ii) a government may care about the risks the poor face and opt for a strategy that will do the most for the poor over the long run; (iii) farm lobbies may push governments towards an agricultural strategy as part of farmers' efforts toward growth, risk reduction, and a better way of life; (iv) foreign donors may stipulate that policies move toward such a strategy—in essence increasing the risks of alternative strategies; and (v) national governments in concert with the international community may devise programs and policies that transfer a portion of the risks inherent in an agriculture-led strategy from the developing country to the larger community.

THE RISK OF POVERTY AND ITS RELATION TO AGRICULTURAL GROWTH

While an agriculture-led growth strategy entails substantial risks, its success greatly reduces the most onerous risk humans face—the risk of dropping below the poverty line. At least three-quarters of a billion people are already below such a line, and many more are just above that line and at risk of falling below it. The nominal income of these poor, at-risk people is largely dependent on work closely related to agricultural production and the value of their income is largely determined by the price of food.

Once we accept Amartya Sen's well-argued position that in poor countries it is absolute poverty that drives equity concerns, not the broad distribution of income, the equity issue is converted

into issues of risk and development strategy. For people so close to the margin, risk is an ever-present monstrosity. That risk arises from weather and is felt through agricultural production and prices. Its reduction is most determined by the choice of development strategy. There are three basic means of reducing the critical sources of risk threatening the mass of poor people.

By far the most important means is to raise incomes well above a defined absolute poverty line. With a given amount of variance in income, the probability of falling below an absolute poverty line decreases as average income is raised. Poverty estimates by S. Mahendra Dev show that the proportion of rural people living below the poverty line dropped by half in a two-decade period in the four Indian states with the highest growth rates in agriculture.

The second means of reducing risk in this context is to diversify the sources of income—first, away from agriculture to sectors less dependent on the weather; and second, within agriculture to commodities and production methods less adversely affected by weather. Such diversification requires generally higher incomes to provide markets for these more labor-intensive, highly income-elastic commodities. As documented below, accelerated agricultural growth in turn accelerates such diversification.

The third means is to abandon intensive, arable agriculture in areas that tend to be relatively arid, where population densities are low, incomes average close to the poverty line, a high degree of variability in the weather and hence in production exists, and the risks of falling below the poverty line are greatest. This requires raising income and opportunities outside agriculture and increasing commercialization of agriculture in more favorable areas. Such processes of specialization and intensification reduce the risk of poverty.

RISK REDUCTION THROUGH AGRICULTURAL GROWTH

The three means by which risk to the poor can be reduced also represent the basic means by which agricultural growth itself gradually reduces the risks inherent in an agriculture-led strategy.

ACCELERATED GROWTH

Accelerated agricultural growth hastens decline in the relative size of agriculture by fostering more rapid growth in the nonagricultural sector. While agriculture is itself an innately slow-growing sector, its contribution to accelerated overall growth comes from its large initial size and from the powerful stimulus it provides to the growth of other sectors.

This relationship is suggested from Asian national cross-section data. With four extreme cases removed, each percent increase in the net value-added growth rate of agricultural production is associated with a 1.5 percent addition to the growth rate of the nonagricultural sector. The four cases—Philippines, Burma, Singapore, and Republic of Korea—demonstrate that

this linkage between the two sectors is not inevitable—it depends on appropriate policy. The Philippines and Burma had highly unfavorable policies for nonagricultural growth and Singapore and the Republic of Korea either lacked a significant agricultural sector or followed ineffective policies toward agriculture.

In an analogous exercise, if we array countries into four classes by per capita growth rates of agriculture and nonagriculture—(i) high growth rates in agriculture and nonagriculture, (ii) low in both, (iii) high in agriculture, low in nonagriculture, and (iv) vice versa—more than twice as many countries fall in the high-high and low-low categories as in the mixed categories of high-low and low-high.

ACCELERATED DIVERSIFICATION

Concentration of public investment in agriculture tends to accelerate diversification within agriculture as well as in the economy generally. The preceding evidence showing that when agriculture grows nonagriculture grows even faster is consistent with this observation.

One of the major findings of the World Bank's MADIA (Managing Agricultural Development in Africa) study was that countries that emphasized their agricultural comparative advantage diversified most rapidly, not only in agriculture, but in their total economy as well. For example, in Kenya, where policies accelerated growth in smallholder tea and coffee production, the rest of the agricultural sector also grew rapidly and agriculture declined as a percentage of GNP.

Risk reduction through diversification occurs in substantial part because rising incomes cause greatly diversified consumption patterns. Livestock and horticultural products are particularly important because they are labor intensive. Grasping these opportunities requires large investments in rural infrastructure, production technology, and marketing.

RETREAT FROM HIGH-RISK AGRICULTURAL ACTIVITIES

The greatest risk to family welfare in agriculture lies in the rural areas that specialize in annual food crops but are marginal to the production of these commodities. Such production strategies are doubly risky because they are often unsustainable environmentally. In these marginal areas, fluctuations in weather and production occur around the critical margin of "profitability," which, in the case of poor countries and people, means at the margin of existence.

Agricultural growth can reduce the extent of such risk by raising incomes and providing the opportunity to earn higher incomes, thus making the farming of high-risk, low-income land unnecessary and undesirable. That land can then be returned to less intensive and less risky activities. The risks of production in marginal areas can also be reduced by broadening consumption patterns and market access, thus making production more viable, which in turn would raise incomes above the margin and reduce variance in production. For instance, semiarid areas can be shifted from arable agriculture into perennial grasses. Such

shifts in production patterns are critical to environmental improvements as well.

THE PROCESS OF AGRICULTURAL GROWTH

How can agriculture be induced to grow in a manner that will reduce risk and increase human well-being? There are three requisites: rapid, cost-decreasing technological change in agriculture; massive expansion of physical infrastructure; and widespread participation in a constantly expanding educational system.

Technological change in agriculture adds substantially to net national income but is complex and requires a wide-ranging institutional structure. Foreign assistance is absolutely vital if such institutional structure is to be built in a 10- to 20-year time period instead of the 60 to 70 years typical of present-day developed countries. However, the quality of foreign assistance brought to these critical tasks is deteriorating at an accelerating rate.

Rural roads and other rural infrastructure as they currently exist are inadequate for modernizing agriculture and require massive investment to enable commercial trading and specialization to take place in agricultural areas at low transaction costs. In low-income countries only 10 to, at most, 30 percent of rural areas are covered by infrastructure minimally sufficient for a growing commercialization of agriculture. Providing that infrastructure requires decentralization of the political system, which in turn requires that aid be offered with appropriate conditions, given the entrenched centralized systems with which most contemporary developing countries have started. Effective aid policy in turn requires resources and sectoral policy expertise.

Rural infrastructure development is especially important in the context of risk reduction, because it not only contributes to overall growth and hence reduction of risk, but to food security as well. With good infrastructure food can be brought in during periods of bad weather, and where a higher degree of commercialization also exists farmers can use purchased inputs, rely more upon irrigation, and follow many other practices that are risk reducing.

The third leg of risk-reducing agricultural growth is education. Education accrues higher returns and becomes increasingly important to risk reduction as technology advances. For example, with education, farmers can understand the complex processes of fertilizer placement and timing that allow fertilizer to play an increasingly large role in subhumid and semiarid areas at the same time that an environmentally sound, lesser quantity of fertilizer is used for a given level of output.

FARMER LOBBIES, AGRICULTURAL GROWTH, AND RISK

As low-income nations democratize, rural people increase their political weight. From this inevitably arise farmer lobbies in one form or another. What do farmer lobbies do to risks in an agricultural development strategy? There are two courses of action such lobbies follow. They obtain higher prices through subsidies

on inputs and outputs and critical public sector investments in technology generation, infrastructure, and education. Although the former action is more noted, the latter is probably more important. Kenya, Côte d'Ivoire, Punjab in India, and Taiwan all stand out in that respect.

RISK REDUCTION THROUGH FOOD TRADE, STOCKING, AND PRICING POLICIES

Aside from the longer-term processes of accelerated agricultural growth, is there anything we can do to reduce the risks of an agriculture-led strategy in the short run? The answer is, of course, yes.

IFPRI research shows that with the costs of modern transportation, which, unfortunately, still does not prevail in much of interior Africa, it is generally cheaper to deal with local production fluctuations by transporting food from distant locations. This solution, however, is potentially risky for low-income countries with poor access to credit. The International Monetary Fund (IMF) cereal facility was originally designed to lend to poor countries experiencing sudden increases in their food imports. Unfortunately, the facility was not initially developed with a sufficiently clear view of the special role of food in development and how it is used by the poor. The facility was consequently hemmed in with restrictions that increased over time, leading to its disuse. The failure of this facility is the most important international policy change of the past decade that has been detrimental to the poor. The facility could have been devised and operated so as to blunt production fluctuation effects on the poor at the same time that it reduced risks to them generally and to an agriculture-led strategy specifically.

However, even a cereal import finance facility cannot do the job of risk reduction without the support of domestic policies in developing and developed countries. Developing countries need national stocking policies to take care of food needs in times of adversity, especially for the period between the onset of adversity and the arrival of foreign supplies, which is often several months. Countries isolated by poor transportation links may need stocks to meet their entire emergency needs—but they should concurrently be improving those transport links. Developed countries need to orient their domestic production policies toward a responsible position as suppliers—quickly relaxing output restrictions in years of bad weather. Such policy changes are now determined in at best an ad hoc manner.

Domestic risk-reducing policies require careful, sophisticated analyses of food supply, demand, stocking, and trade relations, all in the context of a well-articulated national price policy. Foreign assistance has a major opportunity to build those analytical capacities in sound institutional structures.

AGRICULTURAL GROWTH, FOREIGN AID, AND RISK

Given that rapid growth is the key to reducing risk associated with agricultural growth, foreign assistance can play a critical role. Foreign aid in Asia in the 1950s and 1960s clearly emphasized macro, sectoral, and subsectoral policies favorable to agriculture with dramatic results. This has been less true in the 1970s and 1980s, particularly in Africa. What are the reasons for this and what are the implications for agriculture and risk? Why is it that at the present time the foreign assistance donor community seems to be turning away from an agricultural development strategy so important to growth, environmental enhancement, poverty reduction, and reduction of the risk of poverty? I believe the answers lie in three sets of forces.

First, resources are being removed from the agricultural sector of developed countries at a politically and economically uncomfortable speed. Growing agricultural exports reduce the required speed of this adjustment. In this context, it is natural, though false, for developed countries to see agricultural development in developing countries as competitive with their own agricultural sector and slow growth in Third World agriculture as a partial solution to their own agricultural adjustment problems. There is now clear documentation by IFPRI researchers, and many others as well, that in fact accelerated agricultural growth of poor countries increases their food imports.

Second, we have seen in foreign assistance agencies a rapid rise of generalists and a decline of technical specialists both in numbers and influence. This change has been both the result of and the cause of fadism in foreign assistance and an emphasis on the short-run (or discounted) rate of return. This emphasis, concurrent with high world interest rates, militates against activities that provide a return more than five or at most ten years in the future. The loss of technical capacity has resulted in poorer performance in the agricultural sector on the one hand, but on the other hand technical people have been slow to adopt the rhetoric so essential to carrying the faddists. The result has been a decline in the quality of assistance to agriculture that has hit the African countries particularly hard.

The third factor, just now coming into prominence and turning attention away from agriculture, is current projections of urban populations, particularly of the concentration of populations in a few major cities in each country. The conclusion that is increasingly being drawn is that foreign aid of the future must place a greater emphasis on the processes of urbanization and mitigation of urbanization's harmful effects.

The rise of massive megalopolises is associated with a lack of broad-based agricultural growth. Conversely, a broad-based agricultural growth process leads to the development of large numbers of small urban growth centers. In a diffused structural context these centers eventually take on a life of their own and lead not only to accelerated urbanization, but to a much more dispersed pattern of urbanization that is less expensive and economically healthier.

Implied here is the comparative advantage of foreign aid in facilitating agricultural growth. Why is that so? Most important, perhaps, is that agricultural growth is particularly dependent on public sector activities—research, extension, rural credit institutions, roads, education, and so on. Developed countries have extensive experience and large numbers of trained people in these activities. Foreign aid is by definition a public sector activity. Also important, developed countries have a wealth of experience in building institutions to support a broad-based, politically active, small-farm population. The capacity for such activities has generally become underutilized with the rapid decline of the number of farmers and the geographic area in agriculture. However, these institutions can still be mobilized for foreign assistance.

CONCLUSION

While the success of an agriculture-led development strategy greatly reduces the risks of the population falling below an absolute poverty line, the risks inherent in the strategy itself reduce its probability of acceptance. Foreign assistance can greatly reduce the latter risks by (i) assisting acceleration of agricultural growth with well-thought-out projects for developing the institutions for advancing agricultural technology, rural infrastructure, and rural education; (ii) as part of the latter step, first getting its own house in order by finding means to redevelop a high level of intellectual integrity and competence for technical functions; (iii) stipulating conditions that would decentralize political and administrative systems, a move that is essential for agricultural growth; (iv) treating the surplus food production capacity of developed countries as a resource that can reduce risk for poor people and support increased employment, particularly to build rural roads and schools; and (v) rehabilitating and improving the IMF cereal facility to reduce the risk of an agriculture-led, high-employment development strategy. All of these require a sophisticated understanding of the favorable effects of broad-based rural development on overall growth rates, employment, poverty reduction, and environmental enhancement.

FOOD DATA EVALUATION PROGRAM

Research in the Food Data Evaluation Program largely involves the analysis of trends in the production, consumption, and trade of basic food staples in developing countries and, based on these trends, projection of output and demand for the different regions in the Third World. This work builds on the agricultural and economic data from other international organizations, primarily the Food and Agriculture Organization of the United Nations (FAO) and the World Bank. As opportunities arise, the program conducts research on the more detailed, nationally available statistics on agriculture in selected developing countries. Special attention is given to national and provincial data on food production and inputs to agriculture in the People's Republic of China. As an in-house service for other projects in the Institute, the Program also assembles requested processed and semi-processed statistics on food production, consumption, and trade in developing countries.

In the work on cassava production and consumption trends, which included case studies in six developing countries, the working papers that focus on Nigeria, Thailand, and Zaire were published in 1989. In the program's China studies, which involve significant collaboration within and outside IFPRI, activities in 1989 largely consisted of data collection on inputs, outputs, trade, institutions, and poverty related to Chinese food production at national, provincial, and regional levels. Two studies were started by the Program in 1989: the economics of barley in North Africa/Middle East and the growth of horticultural exports of Asian developing countries to Japan. The second study looks into the trends and potential growth of this horticultural trade.

CHANGES IN THE TRENDS OF FOOD PRODUCTION GROWTH IN DEVELOPING COUNTRIES

IFPRI's 1986 food gap study *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52, assumed the continuation of the 1961-80 country trends in major food-crop production for the projections of Third World food output to the end of the century. For those countries that exhibited negative trends, however, it was assumed that no further decline in output would occur after 1980.

What changes in these trends have occurred since that study was made? With the additional production data available in 1989, the Food Data Evaluation Program examined the changing trends in the production of major food crops since 1980. Semi-logarithmic equations were fitted to FAO production data for countries, subregions, regions, and the developing countries as a whole for the 1961-80 and 1961-87 periods and comparisons were made of the corresponding growth rates that are drawn from the resulting equations.

COUNTRY TRENDS

The growth rates of major food-crop production in developing countries (excluding China) for 1961-87 compared to 1961-80

show that output growth accelerated during the later period in 29 countries, including Bangladesh, Indonesia, and Nigeria. However, production growth slowed in 46 countries, notably Brazil and Pakistan. These two country groups represented 50 percent of the 1976-80 production of developing countries. Production trends were maintained in 16 developing countries, a group that accounted for nearly half of the 1976-80 developing-country output and includes such significant producers as Argentina, India, Mexico, Thailand, and Turkey. The remaining 13 countries, most of them in West Asia and Sub-Saharan Africa, showed negative trends for both periods that reflect continuing declines in their absolute output levels. (In the case of China, based on a comparison of output growth rates with both reference periods starting in 1952, the trends indicate growth acceleration.)

Work on the revision of food demand projections for these periods will be necessary to complete the food scenario for the updated period and could lead to revisions of earlier projections for the year 2000.

COUNTRY GROUP TRENDS

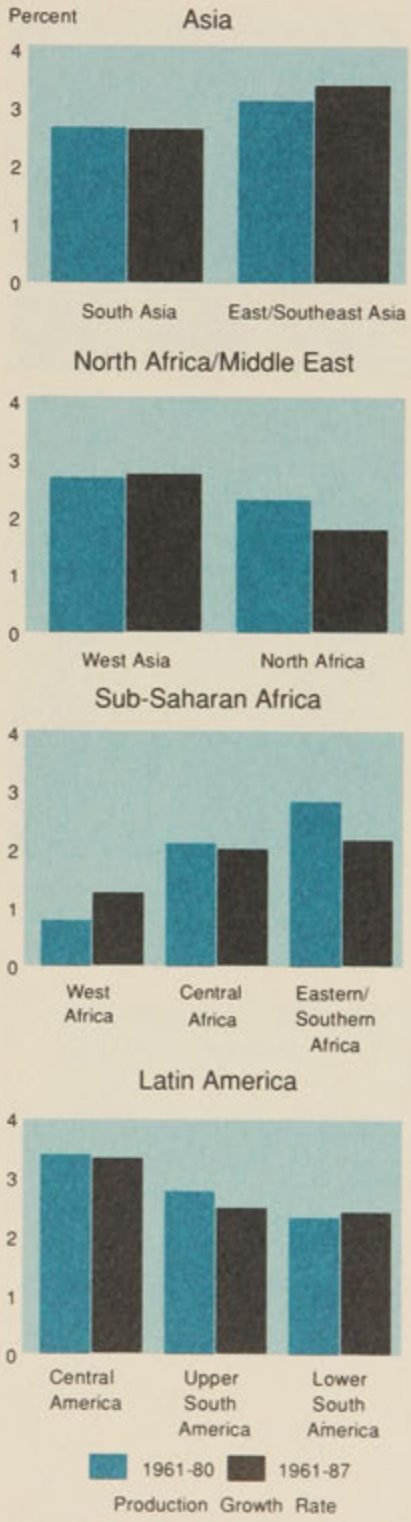
The average annual rate of growth in the production of major food crops in developing countries remained essentially at 2.6 percent with the additional seven years of data. However, there were significant changes among the developing regions and subregions (see Figure 1). Food production expanded at a faster pace during the second period only in the Asian region. This was due to a significant growth acceleration in East and Southeast Asia where increases in food production averaged 3.4 percent annually, an acceleration of nearly 9 percent in the growth rate after seven years.

A 15 percent slowdown in food production growth occurred in North Africa/Middle East, the largest decline among the three other developing regions. The slowdown resulted from the poor production performance of North Africa, where the annual growth rate dropped by more than 20 percent. Some growth acceleration in West Asia softened the decline in the production rate for the region as a whole. Sub-Saharan Africa had a 3 percent deceleration of the food output rate, which is attributed to the large decline in the rate of production increases in Eastern and Southern Africa and the slight slowdown in Central Africa. Together, these changes more than offset the significant improvement in the annual average output growth in West Africa of more than 60 percent but at low rates of growth.

The 4 percent decline of the food output growth rate that occurred in Latin America could be traced to the 10 percent slowdown of production growth in upper South America, which accounts for half the output of the whole region. Central America, which includes Mexico and the Caribbean, showed a slight decline of output growth rates. Lower South America, recorded an acceleration in production growth of more than 4 percent.

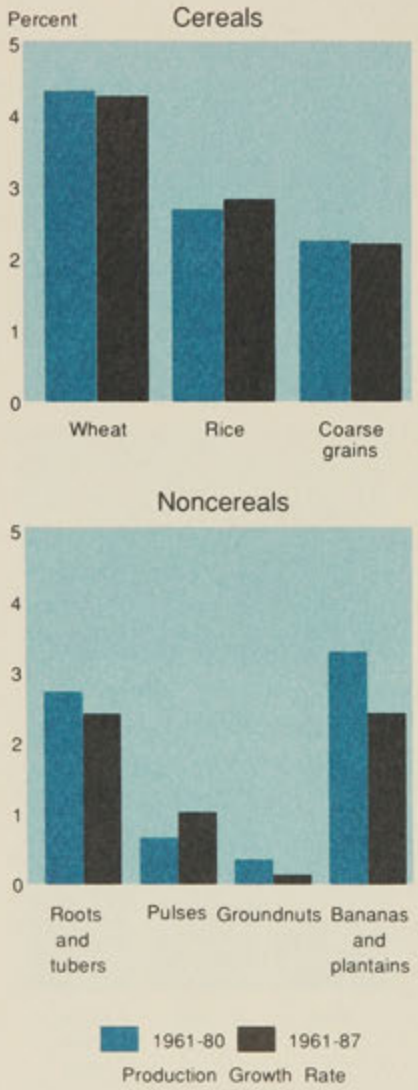
Although there are encouraging signs from the fast growth of food output in East and Southeast Asia and, despite slow output growth, from West Asia, there is need for concern about the significant slowdowns in North Africa and in Eastern and Southern Africa. The growth decelerations of more than 20 per-

Figure 1
Production trends of major food crops in developing countries, by region and subregion, 1961-80 and 1961-87



Source: Basic data from Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1986 and 1989," FAO, Rome.

Figure 2
Production trends of major food crops in developing countries, by crop, 1961-80 and 1961-87



Source: Basic data from Food and Agriculture Organization of the United Nations, "Production Yearbook Tapes, 1986 and 1989," FAO, Rome.

cent in both of these subregions may lead to serious food problems in the years ahead.

CROP TRENDS

Differences in rates occurred for crop groups and, especially, individual crops. Cereals appear to continue to increase in importance in developing-country food production as output growth of this crop group accelerated, although slightly, while that of the noncereals slowed by more than 9 percent (see Figure 2).

Wheat production has continued to expand at a rapid rate of over 4 percent annually and, like the slower-increasing coarse grains group, just about maintained the 1961-80 rate of output growth during 1961-87. Rice production, which represents more than a third of the output of major food crops, showed a 5 percent acceleration for the latter period. Within the coarse grains group, the 14 percent slowdown in the production growth of millet and sorghum more than offset the slight increase in the growth rate of maize and the significant acceleration in output growth of other coarse grains. Maize accounts for more than half and millet and sorghum about a third of coarse grain production.

In terms of cereal equivalents based on calorie content, the major noncereal food crops represent some 18 percent of the production of basic food staples in developing countries, excluding China. Data for the noncereal output growth show that, although at a low level of growth, the production of pulses grew significantly, but roots and tubers, bananas and plantains, and groundnuts all experienced slowdowns in production growth. The 1961-87 rate of growth for groundnuts suggests an almost stagnant output since the 1960s.

Wheat and rice production, the major beneficiary of "green revolution" technology, has generally increased much faster than the production of other basic food staples. Growth of maize production has likely been a response to expanding livestock production in the Third World. The wide gap between the output growth rates of cereals and noncereals is leading to a rapid decline in the share of the latter crop group in the production of major food crops in developing countries. In 1983-87, noncereal share stood at 18 percent. Unless technological improvements occur in the production of this group of food crops, their role in assisting food security in the Third World will be reduced, especially in Africa where noncereals account for a significant share in food consumption.

TRENDS IN CASSAVA PRODUCTION AND CONSUMPTION

Cultivation of cassava is largely confined to the tropics in the developing countries of Asia, Sub-Saharan Africa, and Latin America. Cassava grows on relatively poor soils, is high yielding in terms of carbohydrate production per hectare, and is thus a source of cheap calories. Cassava is often grown by small farmers and is a source of employment in rural areas, particularly

for women, in cultivation and on-farm processing of the crop. During 1989, the Food Data Evaluation Program published *Summary Proceedings of a Workshop on Trends and Prospects of Cassava in the Third World*, edited by J. S. Sarma. The workshop brought together scientists from national research programs and universities, centers in the Consultative Group on International Agricultural Research (CGIAR), and FAO to review overall trends and prospects for the crop in 2000 in the Third World, the yield potentials of cassava, and possible constraints to achieving future prospects.

The report notes that more than 70 percent of the domestic utilization of cassava in the 70 study countries of these regions was as food (see Figure 3). Average cassava yields are 9.5 metric tons of fresh cassava roots per hectare. Cassava yields on fertilized fields are generally 5.0 tons higher per hectare than those on fields that are not fertilized. The proceedings suggests that investments in inputs and research could improve yields significantly, but lack of incentives, especially low prices, is a major constraint. Increased use of cassava for animal feeds depends on higher yields and lower unit costs.

As part of the same project, a series of working papers examining national policies for cassava was completed. Three working papers were published.

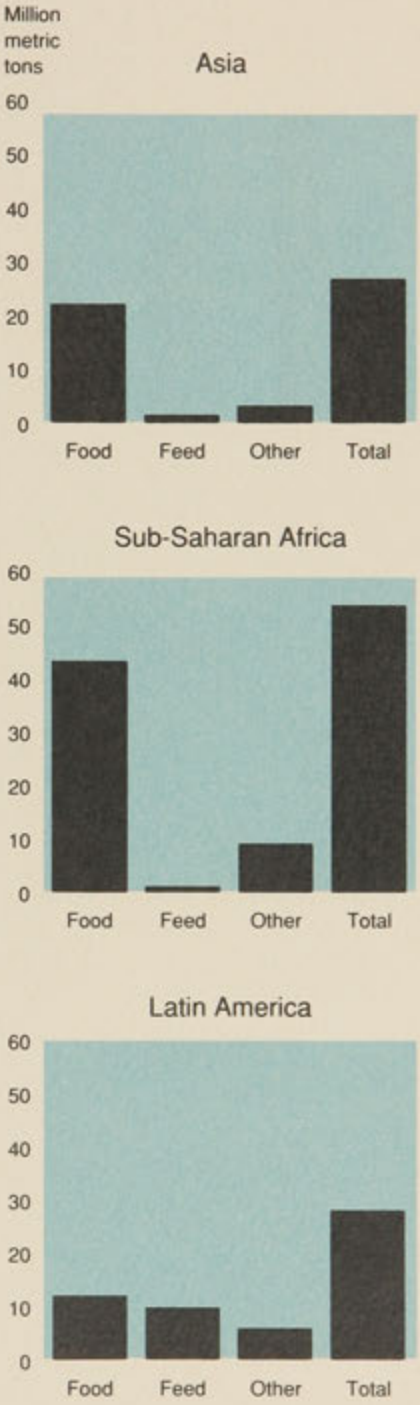
ZAIRE

In *Trends and Prospects for Cassava in Zaire*, Working Paper 4 on Cassava, Tshikala Tshibaka and Kamanda Lumpungu indicate that although 90 percent of all cassava produced in Zaire is consumed as food, cassava does not receive adequate attention in national agricultural policy. It is the most widely grown and the most important food crop in the peasant agriculture. But future prospects for cassava in Zaire are uncertain. Based on the trend annual rate of 2.8 percent in the growth of cassava area, no significant increase in yields, and under an assumption that the 1971-84 rate of consumption growth will continue, the study projects a deficit of 297,600 tons of cassava by 2000. Data indicate, however, that per capita consumption of cassava is declining at a trend annual rate of 0.3 percent. Assuming that this decline will continue, supply is projected to exceed demand by 123,600 tons in 2000, indicating that policies to encourage exports or use of cassava in feed and industrial raw materials are in order.

NIGERIA

Cassava is important for food security in Nigeria; however, data on its production, consumption, and yield are limited and often conflicting. In *Trends and Prospects for Cassava in Nigeria*, the fifth in the working paper series on cassava, S. O. Adamu indicates that cassava cultivation declined between 1970 and 1976 when farmers migrated to cities as the result of the oil boom. However, in recent years average annual growth rates reached 8.3 percent. During 1979-83 average yields were 10.3 tons per hectare despite an overall decline in agricultural production in Nigeria.

Figure 3
Domestic utilization of cassava in the Third World, 1983-85 average



Sources: Food and Agriculture Organization of the United Nations, "Agricultural Supply/Utilization Accounts Tape, 1984," FAO, Rome; and "Standardized Commodity Balances for Cassava," FAO, Rome, 1987 (computer printout).

The paper notes that improved cassava varieties developed by the International Institute of Tropical Agriculture (IITA) and the National Root Crop Research Institute are now disseminated in Nigeria. Mechanized processing of cassava has also been introduced.

THAILAND

Thailand, unlike most of the other countries included in these studies, grows cassava as a cash crop. Most of the cassava produced each year is exported, primarily to the European Community (EC) for use as animal feed. In *Trends and Prospects for Cassava in Thailand*, the sixth working paper on cassava, Chaiwat Konjing estimates that during 1981-83 only 3.5 percent of the cassava output was used domestically. An average of 16.3 percent of Thailand's agricultural export value and 10.7 percent of all export earnings came from cassava between 1982 and 1984. The study notes, however, that the EC-imposed import quota of 5.5 million tons of pellets per year through 1992 could affect the long-run outlook for cassava production in Thailand. In addition, it notes that much of the expansion in cassava production has come as a result of cultivated area, not improved yields. The study suggests that fertilizer application could increase yields greatly by the year 2000.

FOOD PRODUCTION IN CHINA

Since the 1970s, China's growing and volatile participation in markets for agricultural products and fertilizers has increasingly concerned developing countries dependent on these products. During 1989, IFPRI's ongoing data collection and research delineated several underlying phenomena.

In the fertilizer market, China and India's share of international imports has been rapidly increasing and has become more volatile and positively correlated since the late 1970s (see Figure 4). This variable behavior has contributed to underinvestment in fertilizer plant capacity by commercial producers and generally higher and more erratic fertilizer prices for importing developing countries. China's role in the fertilizer market is both a cause and effect of China's growing, erratic participation in markets for farm products.

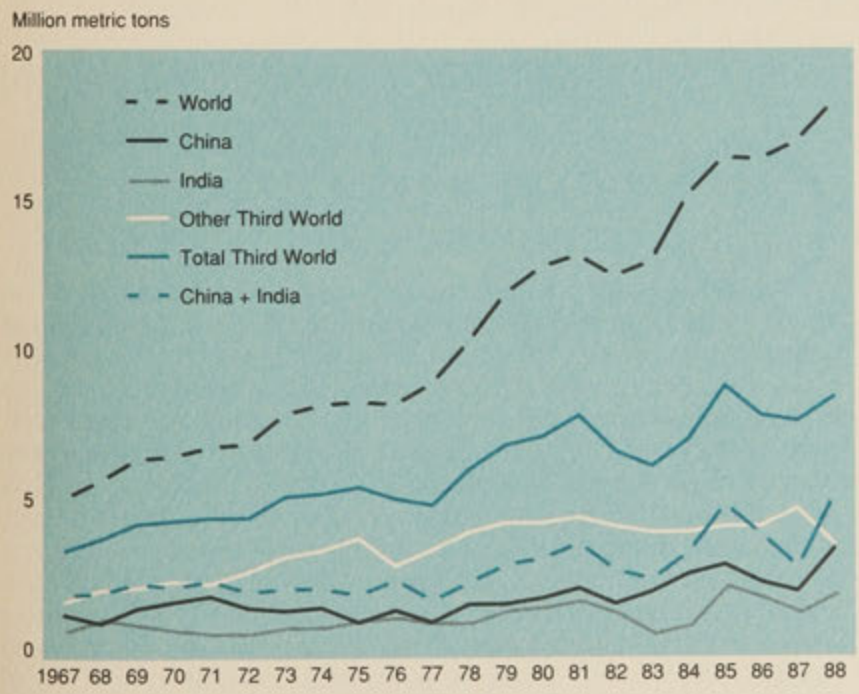
Variability in China's food-crop production as a whole has been increasing during the last few decades. This has been largely the result of increased correlation among provinces in year-to-year changes in food-crop production and yields. While areas experiencing bad harvests tended to average out with those experiencing good harvests during the 1930s and 1950s, this has occurred to a lesser extent in the 1980s. Yields in major producing areas moved together in response to changes in national policies and in supplies and allocation of inputs.

The proportional increase in production variability has not been large. Efforts to concentrate production in stable environments and to protect yields in major producing areas from environmental adversity have been relatively successful, thereby

reducing weather-related food-crop production variability, which is still, region by region, the largest source of variation around trend. This increasing local insulation during the last several decades has partially counteracted the increase in aggregate variability associated with increased interprovincial correlations. Yet even small proportional increases in variability are problematic due to China's size and the close relation between production fluctuations and participation in international markets.

China's highly centralist policies and institutions, affecting all provinces simultaneously, have tended to increase aggregate variability inadvertently as well as through intentional adjustments. Other discreet policy initiatives have had more temporary destabilizing effects. In the future, policy-induced variability is liable to increase as the Chinese government struggles to deal with temporary problems of undersupply, oversupply, and supply adjustment while endeavoring to develop domestic demand in a system historically geared toward dynamic supply and demand suppression. Although China has experimented with limited decentralization in several fields, measures taken during the last two years to tighten central control are ultimately apt to increase variability in international markets.

Figure 4
Nitrogen fertilizer imports, 1967 to 1988



Sources: Bruce Stone and Gunvant Desai.

FOOD PRODUCTION POLICY PROGRAM

Research in the Food Production Policy Program is primarily concerned with policies to accelerate food production in developing countries. This acceleration must be achieved while maintaining stable prices, supply, and employment and ensuring equity. One source of growth is increased production through expanded use of traditional resources such as land. But in many areas the limits of land have been reached. Thus the focus of the research effort is on the diffusion and adoption of new technologies. Such adoption requires improved infrastructure, institutional development, and increased incentives for production. It also requires a focus on managing environmental concerns.

During 1989 work in the Production Program focused on the issues concerning generation and diffusion of agricultural technology and acceleration of growth with stability and equity. In addition, the Production Program added a new area of focus: agricultural resources and the environment. In the first area, results are reported on adoption and use of agricultural technology in South America and Sub-Saharan Africa, fertilizer policies in Sub-Saharan Africa and Asia, and irrigation initiatives in Asia. In the second, research continued on commodity priorities in Sub-Saharan Africa, income strategies of producers in Sub-Saharan Africa, price stabilization in Asia, and production variability throughout the developing world. Also during the year, IFPRI initiated a major effort to identify environmental components of its research. Specifically, results are reported on work in Peru and West Asia/North Africa.

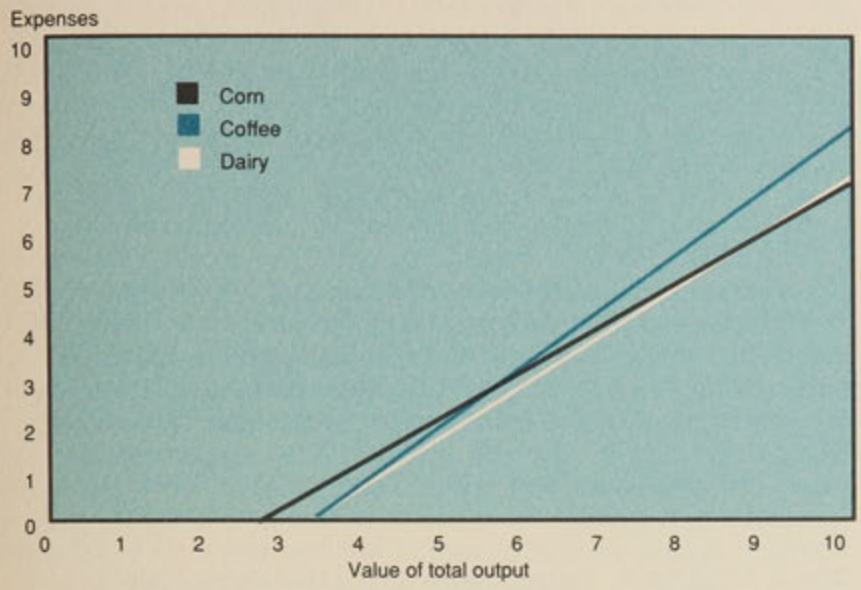
GENERATION AND DIFFUSION OF MODERN AGRICULTURAL TECHNOLOGY

ADOPTION AND USE OF AGRICULTURAL TECHNOLOGY

Ongoing research continued on understanding the forces underlying the adoption and use of modern agricultural practices and inputs in Zona da Mata, Minas Gerais, a poor area of eastern Brazil where the principal agricultural products are maize, coffee, rice, and dairy products. In addition, about one-sixth of the farms in the study area derive their primary income from off-farm labor. Findings indicate that contrary to what is generally assumed, expenditures on technology per unit of total output were approximately the same regardless of the crop mix or output diversification of the farm. A 1 percent increase in total output was associated with a 1 percent increase in expenditures on modern inputs for all farm types in the area (see Figure 5). In addition, in the study areas, no economies of scale in agricultural production were found for any crop mix.

The preliminary results also indicate that farmers who make changes in their crop mix over time do not always make these changes to take advantage of new technology or in response to policy incentives. Farmers who made major changes in their crop mix on average had lower total output and lower aggregate household calorie intake than those who did not make changes. This suggests that some switches in crop mix were in response to crises and not in response to economic incentives. It was also

Figure 5
Use of modern inputs versus gross product value (double log), Zona da Mata, Brazil



Source: Stephen Vosti and Marc Nerlove.

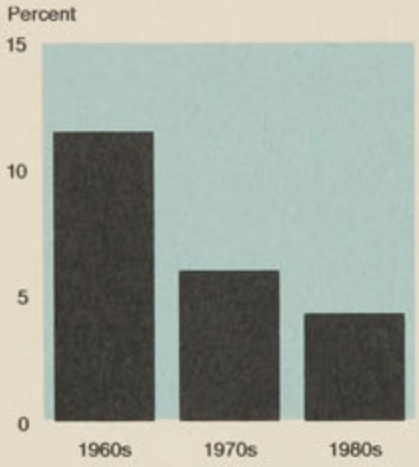
found that farms with off-farm labor as their primary source of income had below average yields and registered the lowest average expenditures on modern inputs per unit of output. For example, coffee farmers spent the equivalent of 13 percent of the value of their total output on modern technology, whereas farms with off-farm employment as their principal output spent less than 5 percent of their total agricultural output on modern inputs. These results, although specific to an area in eastern Brazil, suggest the need for similar research in other developing countries.

IFPRI's research in Sub-Saharan Africa on technology adoption focused on the constraints facing smallholder farmers in Zaire's tropical rain forest. In *Food Production in a Land-Surplus, Labor-Scarce Economy: The Zairian Basin*, Research Report 74, Tshikala B. Tshibaka examines these constraints in Zaire, where the average growth rate of food supply fell from 4.1 percent a year in the late 1960s to 1.8 percent a year in the 1970s. The report finds that the amount of resources, particularly labor, allocated to agriculture is extremely small and that the productivity of these resources is low.

In the study area, only about 35 percent of labor time was directed to farming. Of the crops farmed, rice, the principal cash crop, received more labor time than cassava, the major food staple. A shortage of labor in peak periods, a serious problem in other parts of Africa, was not found to be a problem in the Zairian Basin. The report indicates that labor productivity in the area can be increased by 25 percent through increased time spent on land preparation and on subsequent farm operations. This would require increased capital input.

The study finds that a 1 percent increase in the amount of capital input per farmer would lead to a 0.3 percent increase in

Figure 6
Growth rate of fertilizer consumption in Sub-Saharan Africa, 1960s to 1980s



Sources: Gunvant Desai and Vasant Gandhi.

labor time allocated to farming. In addition, a 1 percent increase in farmgate prices relative to nonfarm prices in the preplanting period would increase labor time allocated to farming by 0.4 percent. It notes that such an increase in farm prices is dependent on improved transportation, distribution, and marketing channels. As for capital, increases in this input require, in addition to the above, improved tools and equipment, rural credit markets, seeds, and fertilizer delivery systems. The latter offer some opportunity for improvement in production, particularly for cereals in the area.

FERTILIZER POLICIES

Sustaining rapid growth in fertilizer use is crucial for accelerating agricultural production in the developing world. In order to understand the process of growth in fertilizer consumption, IFPRI research utilizes a conceptual framework that takes into account the overall availability and distribution of fertilizer, farmers' effective demand for it, and the systems that support agricultural research, extension, and credit. During 1989, IFPRI research focused on examining the forces of growth and the policy instruments to accelerate that growth in fertilizer use in Sub-Saharan Africa. In addition, ongoing work in South Asia focused on fertilizer use in India.

Sub-Saharan Africa. One-fifth of the developing world's arable and permanent cropland and one-tenth of its population are in Sub-Saharan Africa. But Sub-Saharan Africa currently accounts for a small and declining share in the developing world's fertilizer use, falling from 4 percent in the early 1960s to 2.25 percent today. And there has been a disturbing deceleration in the growth rate of fertilizer use during this period (see Figure 6). According to FAO, by 2010 fertilizer consumption in the region must increase almost six times its 1.1-million-ton level in 1987 to raise agricultural production by 2.9 percent per year.

In collaboration with the International Fertilizer Development Center, IFPRI is examining the constraints to growth in fertilizer use in Sub-Saharan Africa. Work has been initiated in Rwanda and Zaire. Variations in growth of fertilizer consumption within African countries suggest that before there can be improvements, there needs to be an increase in supply and the institutions to support its spread, a focus on food crops, and government commitment to agricultural development.

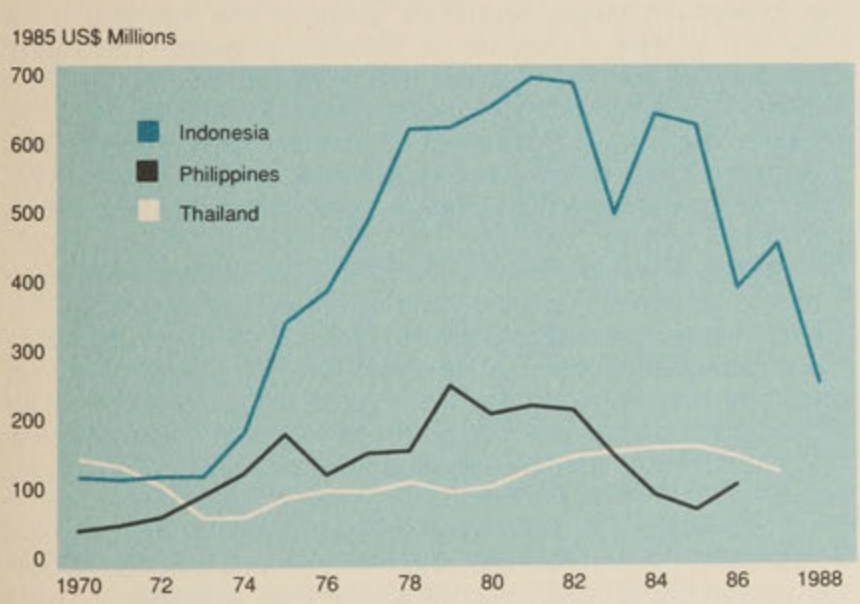
India. During 1989 IFPRI initiated research on policy issues in future growth of fertilizer use in collaboration with Indian Agricultural Research Institute, Indian Agricultural Statistics Research Institute, Gujarat Institute of Area Planning, and ICRISAT. Four studies are under way. The first aims at an in-depth understanding of the fertilizer response function environment for main crops in different regions. The second focuses on farmers' behavior as fertilizer buyers and also on the micro level constraints in adequate and timely availability of this input. The third aims at analyzing the experience of Gujarat state in raising fertilizer use under unirrigated conditions. The fourth study addresses issues pertaining to soil fertility management and fertilizer use in the semiarid tropical regions of India by analyzing the data collected from a panel of households for 5 to 10 years. Together these studies expect to contribute to the formulation of sustainable

policies for both rapid and economically efficient growth in fertilizer use.

IRRIGATION

Irrigation has been a critical factor in agricultural development in India, Indonesia, the Philippines, Thailand, and Sri Lanka. IFPRI is conducting a series of studies on irrigation policy in these countries in order to develop a comprehensive data base on irrigation development, document the changes in irrigation investment priorities, and identify some of the causes of these changes. Past IFPRI research described and analyzed changes in irrigation investment policies. Current research examines the relationship of trends in government irrigation investment to trends in benefits and costs of irrigation and other factors such as the increases in national debt and net imports of cereals. During 1989 preliminary results were found for the determinants of public irrigation investment in the Philippines, Thailand, and Indonesia (see Figure 7).

Figure 7
Annual investment in irrigation in Indonesia, the Philippines, and Thailand



Sources: Mark Rosegrant and Mark Svendsen.

Philippines. Examination of investment cost and return data on Philippine National Irrigation Administration (NIA) systems for the period 1950 to 1984 indicate that Philippine government investment in new irrigation systems was related to the ratio of benefits to costs and to the net imports of rice. The study also indicates that in 1973 there was a change in investment behavior characterized by larger projects, longer construction periods, higher capital costs per hectare, and lower average profitability of investment. These changes coincide with a shift from internal to external sources of financing.

This study confirms that profitability calculated using international prices better explains investments than analogous measures using domestic prices. This is consistent with the international lenders' practice of using world prices in project analysis. Decisionmakers appear to manifest their concern over domestic prices through rice import levels, a powerful explanatory variable in the estimated models. Rice imports are often increased by the government, particularly in election years, to prevent undesirable pressure on domestic prices. Because of this government intervention in domestic prices, they do not independently affect irrigation investment.

Thailand. The government of Thailand has broadened its policy objectives in the rice sector from an overriding concern with generating revenues and foreign exchange to a more balanced approach that also includes stabilizing rice prices for consumers and farmers and sustained growth in farm income. The irrigation investment program is one of the policy instruments to meet these objectives. As in other countries, irrigation investment in Thailand competes with a range of other agricultural and nonagricultural investments for government funding.

Results for the study period 1960-87 indicate that investment in new irrigation construction was a function of the profitability or cost-effectiveness of new irrigation systems, the availability of government resources, and the potential for earning foreign exchange. The world price of rice had a positive influence on new investment in irrigation projects. The capital cost per hectare for irrigation had a negative effect on new irrigation investment. In addition, the level of real GNP positively affected new irrigation investment. Years of high rice exports had a negative effect on irrigation investment in subsequent years, reflecting government concern over downward pressure on world prices.

Indonesia. The Indonesian government has attempted to meet a number of sometimes conflicting objectives through its agricultural investment and pricing policies. Among the major objectives have been maintenance of relatively low and stable consumer prices for rice and other staples, maintenance of incentives for rapid growth in domestic food production, growth in farm income, and reductions in the level of imports of rice and of the foreign exchange costs of rice imports.

The analysis of Indonesian data for 1969-87 indicates that investment in new irrigation construction was a function of both the profitability or cost-effectiveness of new irrigation systems and the availability of government resources and foreign exchange. World rice prices and rice revenues positively influenced new irrigation investment in subsequent years. Capital costs per hectare had a negative effect on investment in irrigation in subsequent years. The results indicate that the price of oil, which generates a large share of government revenue, and real GNP were positively associated with irrigation investment.

ACCELERATING GROWTH WITH EQUITY

AFRICAN COMMODITY PRIORITIES AND REGIONAL MARKET OUTLETS

IFPRI's research on Sub-Saharan Africa focuses on the need to identify a set of commodity priorities in order to sustain cost-reducing technological change. Given the very high levels of transaction costs associated with agricultural marketing in the region, especially in the case of foodgrains from the relatively remote semiarid areas, consideration of commodity priorities cannot be limited to supply side issues. Farm incomes from different activities in Africa are frequently driven by local supply and demand conditions. Therefore, realization of the income potential offered by new crop technologies is often dependent on improvement in long distance outlets for the extra produce.

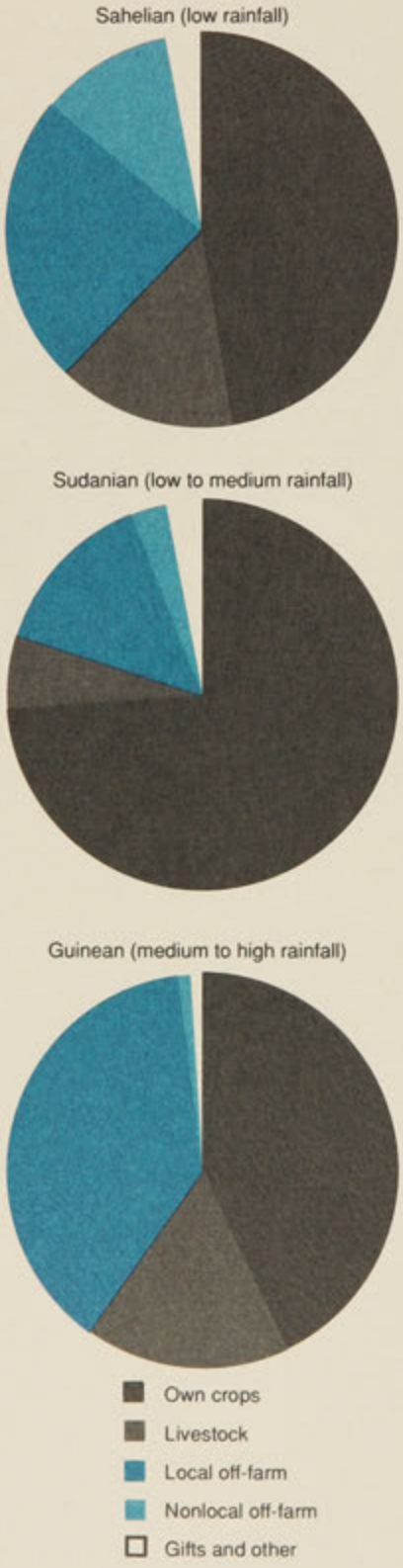
Work continued during 1989 on structural changes in demand for sorghum, a commodity for which there is considerable potential for decreasing the unit costs of production in the semiarid areas. IFPRI's collaborative project with ICRISAT in Southern Africa to identify sorghum and millet production, marketing, and utilization patterns continued. Several in-depth studies of marketing and utilization issues for coarse grains were initiated in Botswana, Zambia, and Tanzania.

In West Africa, research on market outlets for increased sorghum and millet production examined the likely demand prospects for a growth-oriented supply strategy in agriculture in the semiarid and savanna regions. Initial research indicates that rice consumption is likely to continue to increase in both the sorghum-producing areas and coastal West African markets. In addition, maize is a very good substitute for sorghum and millet in the diets of these areas. Taken together, this suggests that commercial demand outlets for sorghum and millet for food will be highly dependent on keeping their supply prices low and finding ways to improve their processing to better fit urban food preparation needs.

As an outgrowth of this work, IFPRI initiated research on the role of intraregional agricultural trade in this process. This involves assessing the extent to which growth in Sahelian agriculture is dependent upon coastal markets for output of various commodities. It will also highlight the effect of world trade distortions on Sahelian agriculture through their impact on the import patterns of the coastal countries in West Africa.

Agricultural development in the Sahel is constrained by historically low world prices for Sahelian agricultural and livestock products and overvalued exchange rates for the franc-zone countries relative to non-franc-zone trade partners within the region. Research suggests that demand for regional products in the coastal and Sahelian countries are promising, especially for livestock products. However, realization of this potential will depend on cutting transaction costs within the region, increased investment in those commodities for which specific West African areas are likely to have a comparative advantage, and devaluation of the CFA franc vis-à-vis other West African currencies. In this context, new sorghum technology offers an opportunity to overcome the historical constraint that feed production poses in

Figure 8
Income sources by zone, Burkina Faso, 1981-85



Sources: Tom Reardon, Chris Delgado, and Peter Matlon.

promoting mixed farming with dairy and export cattle in the Sahel. However, this will depend upon recapturing regional markets for these outputs and keeping the price of coarse grains low through technological change.

Another aspect of this research addresses the underlying complementarity of resource endowments within West Africa. Preliminary findings suggest that the patterns of commodity specialization among West African countries in agricultural and livestock production and exports are more complementary than similar, and that the potential for profitable intraregional agricultural trade is much higher than reflected by actual trade flows. It also appears that increased cross-border trade in cereals would smooth domestic supply fluctuations and stabilize local food markets in most West African countries and that inward-looking national policies have isolated national agricultural markets and dampened demand.

INCOME STRATEGIES OF PRODUCERS IN SEMIARID WEST AFRICA

During 1989 work also continued in collaboration with ICRISAT on the examination of the role of coarse grains in the income strategies and food security of rural Burkina Faso. Sahelian households are not solely subsistence farmers, and research indicates that they purchase large portions of their food. These purchases are financed by a diversified income base.

Findings suggest that household income is not closely related to the agroclimatic level of the zone. In fact, in the Sahelian zone, the lowest rainfall area, and the Guinean zone, the highest rainfall area, incomes are US$107 and US$140 per adult equivalent, respectively. They are only US$75 in the medium rainfall area of the Sudanian zone. In addition, nonfarming income comprises 52 percent of the income in the Sahelian zone, 57 percent in the Guinean zone, and only 26 percent of the income in the Sudanian zone (see Figure 8). In general, the higher the income the lower the share of cropping in total income at both the zone and household levels. Nonfarming income compensates for production fluctuations and thus ensures food security. In the Sahelian zone, crop income is much more variable than total income. In the poorer Sudanian zone, this is not the case.

The findings also indicate that households with the least diversified incomes and thus with more dependence on farming—the Sudanian zone in general and the poorer households in all zones—are more vulnerable to fluctuations in harvests. They also experience more hunger than the richer, more diversified zones and households.

The type of income diversification differs between the more arid Sahelian zone and the better-watered Guinean zone. The Sahelian incomes have a higher share of migration income and growth linkages to local agriculture are less well developed. The Guinean zone incomes have a higher share of local off-farm income based in agriculture and thus greater growth linkages.

These results raise a number of policy and research questions. What are the consequences of diversification for long-term productivity? Will households invest nonfarm profits in agriculture or in further diversification? What effect does income diversifica-

tion have on the evolution of trade patterns? For example, in poor cropping years, Sahelian households buy maize produced in coastal countries. Will diversification increase this trade? What effect should this have on agricultural research strategies?

AGRICULTURAL PRICE STABILIZATION

Instability in food prices can create severe food insecurity in developing countries. But whether policies to stabilize foodgrain prices are beneficial or wasteful is a pressing economic issue in these countries. During 1989, IFPRI published *Rice Price Fluctuation and an Approach to Price Stabilization in Bangladesh*, Research Report 72, by Raisuddin Ahmed and Andrew Bernard. The report indicates that stabilization is necessary in countries with large, poor populations because poor consumers cannot take advantage of price fluctuations by saving enough when prices are low to cover purchases when prices are high.

The report indicates that annual price instability worsened in Bangladesh between 1960-70 and 1976-84. Supply shocks and random forces such as floods and droughts have become increasingly more severe. In addition, because of the adoption of high-yielding varieties with different harvest times, seasonal peaks and lows in prices related to harvests do not always occur at the same time of the year as before. As foodgrain imports have grown, accurate forecasting of domestic production is essential to avoid over- or under-importing.

The report proposes a framework for price stabilization stipulating target prices within a price band. Using a model to set seasonal ceiling and floor prices based on the average rice price expected to prevail in the coming year, the study concludes that if the framework were in operation, the percentage of fluctuation in annual prices would have varied from 3.4 to 23.1 percent, instead of the actual price fluctuations of 4.2 to 41.3 percent. The report recommends that opening stocks of 1 million metric tons be held and that considerable flexibility to respond to irregular forces be built into the program. Further work on the determination of optimal stocks is in progress.

FOODGRAIN PRODUCTION VARIABILITY

Many developing countries have achieved impressive rates of growth in national foodgrain production in recent years. Much of this growth is attributed to new technologies, especially improved varieties, and the increased use of irrigation and fertilizers. But as agricultural output has grown, so, often, has variability in national yields from year to year. This increased variability is reflected in increased market and price instability, which can pose difficult problems for farmers and poor consumers alike. During 1989, IFPRI published *Variability in Grain Yields: Implications for Agricultural Research and Policy in Developing Countries*, edited by Jock R. Anderson and Peter B. R. Hazell (Baltimore, Md.: The Johns Hopkins University Press), which reviews available evidence on patterns of variability in cereal production and how these patterns have changed in recent years, the biological, climatic, and economic factors underlying yield variability, and the implications for agricultural research and policy.

The book suggests that although variability of production of basic staples is probably increasing in many parts of the world, it is being compensated for in many areas by the moderating influences of better transportation and trading systems and by improved policies and responses. It notes that a fundamental issue facing decisionmakers is the cost-effectiveness of coping with or reducing variability. Reducing variability, through plant breeding and input management, for example, will be worthwhile only if it can be achieved more economically than can ways of coping with it, such as through buffer stocks and international trade. However, it suggests that attempts to draw definitive conclusions about the cost-effectiveness of different approaches in reducing or coping with yield variability will be ineffective until more quantitative information is available about the costs and benefits of each approach. More is known about the costs and benefits of public policy approaches such as crop insurance, effective marketing systems for farm inputs and outputs, containing prices and maintaining food consumption at the national level through buffer stocks, and monitoring natural and economic environments. However, these solutions must be carefully targeted to the households most adversely affected by production variability.

E AGRICULTURAL RESOURCES AND THE ENVIRONMENT

Environmental concerns occupy a prominent place among the policy issues facing the world, and they pose particular challenges for developing countries. In general, environmental stress results from the growing demands made on scarce resources. Although much less than that of the developed countries, the contribution of developing countries to environmental damage or degradation through soil erosion, desertification, and deforestation has been increasing over time. As the sheer numbers of rural poor and their pressing need for increasing income and employment opportunities have grown, so has their use of natural resources. During 1989, IFPRI initiated a major effort to identify environmental components of ongoing research efforts and to plan new research initiatives with an environmental focus. In its approach, IFPRI recognizes that in developing countries, the environment, its degradation, and poverty are inseparable concerns. The rural poor depend directly or indirectly on agriculture and, therefore, on the environment for their income. As more developing countries fall into the extreme poverty associated with rapid population growth, poor nutrition and hygiene, and low levels of education, the dangerous exploitation of fragile resources by increasing populations is exacerbated.

In undertaking research with an environmental emphasis, IFPRI is focusing on defining agroecological zones of varying potential productivity under given agronomic management conditions, population densities, market linkages, and other socioeconomic conditions. This methodology depends on an accurate assessment of the natural resource base—climate, soils, and topography—together with an understanding of the predominant

production systems present in the region. Agroecological characterization to aid in natural resource management and land use planning is of increasing importance in many national and international research institutions. Working in collaboration with institutions that have amassed information on natural resources relevant to agriculture, IFPRI can contribute insights regarding the influence of the economic and policy environments on agricultural decisionmaking. This collaborative research can provide insight into the environmental effects of agriculture and the technological and policy interventions that can encourage sound land use strategies from an agronomic and economic viewpoint.

AGRICULTURE AND THE ENVIRONMENT IN THE PERUVIAN AMAZON

During 1989 research was undertaken in collaboration with Centro Internacional de Agricultura Tropical (CIAT) on the distribution of five important crops—rice, maize, beans, cassava, and plantains—in the Peruvian Amazon, a region of 75 million hectares, 60 percent of the national territory of Peru, and 16 percent of the Amazon Basin. This area produces 54 percent of the country's yellow maize and 33 percent of its rice and is threatened by environmental degradation that is affecting crop yields.

The study defined priority regions for technological and policy intervention based on actual land use patterns and the underlying agricultural resource base. Using new advances in computer-based geographic information systems the project superimposed crop distribution patterns on varying patterns of soil and topography to define areas undergoing environmental degradation. Four geographic areas, responsible for about 55 percent of the cultivated area in the region, were identified as priority areas for immediate intervention (see Figure 9).

In addition, the study identified the need for technological options in the short run to minimize agriculturally induced environmental degradation while devising alternative production systems to enhance the comparative advantage of the Amazon in perennial and other crops.

Figure 9
Areas at risk of environmental degradation in the Peruvian Amazon

Areas of Actual or Potential Agriculturally Induced Environmental Degradation:

- Alto Mayo-Tarapoto-Huallaga Central region
- Pucallpa-Aguaytia region
- Yurimaguas region
- Puerto Maldonado-Iberia-Iñapari region

Source: William Loker.
Note: Shaded portion is the study area.

SUSTAINABLE FARMING SYSTEMS IN WEST ASIA/NORTH AFRICA

In collaboration with the International Center for Agricultural Research in the Dry Areas (ICARDA) during 1989, IFPRI undertook research on raising agricultural production while improving the deteriorating agricultural resource base in West Asia/North Africa. This resource base is suffering from widespread and increasing salinity and waterlogging in irrigated areas, increasing competition for water, and serious erosion and desertification of rainfed land through uncontrolled mechanization and extension of cultivation to marginal areas.

The initial research points to the need for a closer agroecological characterization of the region in order to identify areas suited to intensification, especially through replacement of fallow land by farming systems including food and feed legumes; research in a systems context to determine which cropping patterns contribute most to income growth and to sustainability in the

major ecological zones; and more effective use of farm mechanization, among others.

SALINIZATION AND WATERLOGGING IN INDIA

A pilot study in collaboration with the Central Soil Salinity Research Institute in India on the effect on farmland of salinization and waterlogging in the Sharda Sabayak Irrigation Project in Uttar Pradesh revealed that in severely affected areas land use intensity drops from 166 percent on normal farms to only 110 percent on problem-affected farms, thus negating the intensification benefits of irrigation. Also, 29 percent of the farm area is damaged to the extent that it can no longer be cultivated. The study also shows that the effects on productivity are severe. Yield of paddy decreases by more than 50 percent on salt-affected soils, and waterlogging reduces wheat yields by 78 percent. These declines translate to increases in the unit cost of production of 60 percent and 88 percent for rice and wheat, respectively.

AGRICULTURAL GROWTH LINKAGES PROGRAM

The Agricultural Growth Linkages Program conducts research on how technological change in agriculture affects national economic growth and the welfare of the poor. This research documents the extent to which increased agricultural productivity and higher incomes associated with the adoption of technological change contribute to increased demand for agricultural products and other goods and services. Understanding the nature and effect of government policies on agriculture is an important part of work in this program.

In 1989 the research effort included the completion of research in rural Zambia and Egypt, the preliminary analysis of data in Zimbabwe, and data collection in Pakistan. Research was published on the resource transfers within the national economy of Argentina.

GROWTH AND EQUITY IN RURAL AREAS

Gaining a better understanding of the short- and long-term effects of technological change on rural poverty in order to assist in the design of appropriate projects, policies, and institutional changes necessary to mitigate this poverty is key to the work of the program.

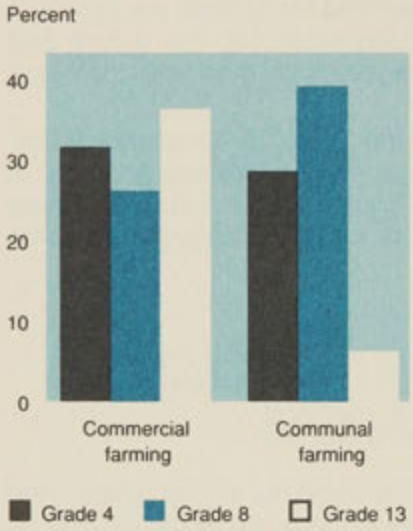
AGRICULTURAL GROWTH LINKAGES IN ZAMBIA

During 1989, research on agricultural growth linkages in rural Zambia was completed. The Zambia research revealed important household differences in the adoption of new agricultural technology, income earned from farm and nonfarm activities, expenditures on goods and services, health and nutritional characteristics related to the amount of land available for cultivation, the agroecological conditions, and the household's access to rural services (see *IFPRI Report 1988*). Discussions of these findings with Zambian policymakers and academics resulted in the identification of the areas of future research that will have the greatest impact on smallholder agriculture. (Also see the Outreach section.) These include the diffusion of agricultural technology and its adoption, agricultural extension, and access to rural service infrastructure.

SMALLHOLDER FARMING IN ZIMBABWE

Zimbabwe is considered to have one of the best agricultural performance records in Sub-Saharan Africa. It has a history of progressive agricultural policies that have promoted the agricultural sector. However, these policies historically focused on commercial rather than smallholder agriculture. In an attempt to boost overall agricultural production and economic growth in this sector, the government has shifted attention to smallholder agriculture. IFPRI is conducting research on the effect of access to rural infrastructure services on agricultural development by comparing commercial and communal farming areas. During 1989 demographic and economic data collected in 10 villages in Manicaland province of Zimbabwe were analyzed.

Figure 10
Percent of household members with different levels of education, Zimbabwe



Source: Sudhir Wanmali.

Table 1
Credit available to farming households in Zimbabwe, 1987/88

Sources of Credit	Average Value of Access to Credit of Farming Regions, per Household	
	Commercial	Communal
	(Zimbabwe dollars)	
Total	51,911.80	6.25
Banks	47,127.50	0.00
Cooperatives	1,132.08	5.56
Others	3,407.41	0.66

Source: Sudhir Wanmali.

In the study area commercial farm size averaged about 200 hectares and smallholder, or communal, farms averaged about 5 hectares. The analysis indicates that commercial farming households are smaller in size, have higher levels of education, have a higher percentage of heads of households engaged only in agriculture, have greater access to credit, and have higher value of stocks than communal farming households. Specifically, family size in commercial households was four, whereas it was seven in communal households. Although 98 percent of the family heads of commercial households were involved only in agriculture, 38 percent of the communal heads of household combined agriculture with other work. Comparing education, the data indicate that 36 percent of the commercial household members attended 13 years of school, whereas in the communal households, only 6 percent had achieved this level (see Figure 10).

Perhaps one of the most striking differences noted in the analysis was access to credit. Commercial farming households were the sole recipients of loans from commercial banks in the study region. Cooperatives, which are meant to provide credit primarily to the communal farmers, provided credit valued at an average of 200 times more to commercial than communal farmers. Even those in the informal credit sector such as store owners provided credit valued at 5,000 times greater to commercial than communal households (see Table 1).

These demographic and economic differences influence the demand patterns for both production and consumption of goods and services in the study region. Policies to promote agricultural and overall development within the smallholder sector will necessarily have to focus on making these services more accessible to it.

IMPROVING THE LOCAL ECONOMY

In many developing countries, remittances—money and goods earned by laborers working abroad—provide an important stimulus to the rural economy. IFPRI continues its research on the effect of Egyptian worker remittances on the local economy. By comparing the expenditure behavior of a set of migrant and nonmigrant households in Minya Governorate, this study seeks to pinpoint how worker remittances affect rural consumption and investment. The research has yielded three important policy conclusions. First, and most importantly, the study shows that migrant households have a higher propensity to invest than do nonmigrant households. Controlling for level of expenditure, marginal budget shares for migrant households are consistently higher than those of nonmigrant households. Most of this investment goes into the purchase of land. Second, contrary to other studies, this analysis shows that migrant households do not "waste" their remittance earnings on consumption (food, clothing, education, medical, and marriage). At the mean level of expenditure, migrant households devote only 12 percent of their increments to expenditure to consumption. Third, this analysis underscores the large amount of remittance earnings that goes into housing. Approximately 54 percent of all remittance expenditures on nonrecurring expenses went into the construction or repair of houses.

From the standpoint of Egyptian agriculture, the challenge now facing policymakers is how to encourage migrant house-

holds to invest more of their remittance earnings into new agricultural technology. Such investments in new technology are needed to stimulate yield productivity growth in Egyptian agriculture.

EDUCATION AND HUMAN CAPITAL IN RURAL DEVELOPMENT

Increases in educational attainment in rural areas affect labor allocation in rural activities, productivity of labor in agriculture and rural manufacturing and services, and the linkages between agriculture and rural, nonagricultural activities and between rural and urban areas. IFPRI's research on human capital accumulation in rural areas continued during 1989 with the completion of data collection in Pakistan. The data set links investment decisions in education with the schooling process and with subsequent performance in the labor market, on the farm, and in the household.

One of the areas of inquiry is the extent to which the markedly higher levels of cognitive skills observed among males than among females is due to gender differences in demand for schooling, availability of schooling, quality of schooling, and out-of-school investments in human capital (see Figure 11).

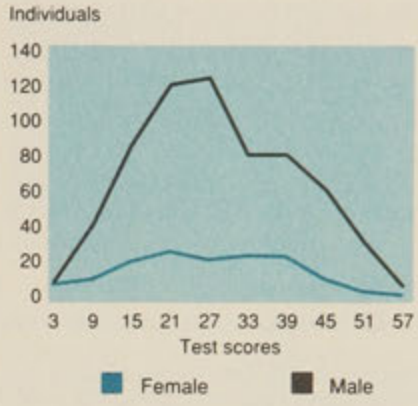
The results indicate that workers with more years of schooling have greater cognitive skills. Controlling for years of schooling, high ability workers have greater cognitive skills than low-ability workers, presumably because, as students, they were more efficient learners. The results also indicate that the father's education has a positive and significant influence on cognitive skill endowments. This may reflect the ability of educated fathers to play, at virtually no cost, a tutoring role in the home.

If boys attend higher-quality school than girls, then it would be expected that for a given number of years of schooling and level of ability, boys learn more than girls. This is not the case, however. The implication is that there is no gender gap in the quality of schooling. If subsequent analysis supports this finding, then to narrow the large gender gap in human capital in rural Pakistan the policy focus should be on differences in the quantity of schooling.

Although the level of education of fathers has a substantial effect on the acquisition of cognitive skills by sons, it has no apparent influence on the cognitive skill acquisition process of daughters, according to the results. This difference may reflect the more limited contact fathers have with their daughters than with their sons. The lack of influence of educated fathers on the human capital accumulation process of daughters is not compensated for by the influence on daughters of educated mothers. The level of education of mothers does not influence the cognitive skill acquisition process of either sons or daughters. This is not necessarily because mothers are less effective at transferring their skills to the next generation. A more likely explanation is that because there are so few mothers with any education, their influence is not statistically significant.

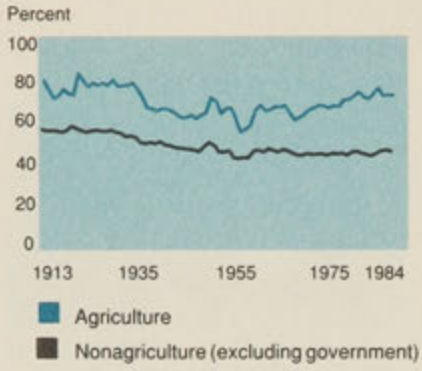
The results indicate that educating one generation appears to improve the efficiency of the educational process of the next generation. Furthermore, it appears that the marked gender

Figure 11
Distribution of cognitive skills test scores in rural Pakistan, 1989



Source: Richard Sabot.

Figure 12
Traded share of sectoral output, Argentina, 1913-84



Source: Yair Mundlak, Domingo Cavallo, and Roberto Domenech, *Agriculture and Economic Growth in Argentina, 1913-84*, Research Report 76 (Washington, D.C.: IFPRI, 1989).

difference in educational opportunities of the current generation of adults in rural Pakistan is now placing daughters at a learning disadvantage in school relative to sons and that this learning disadvantage contributes to the persistent gender gap in human capital. These results suggest that a policy emphasis on increasing the quantity of educational opportunities for girls will have both a short-run and a reinforcing longer-run, or intergenerational, tendency to reduce the gender gap.

RESOURCE TRANSFERS IN THE NATIONAL ECONOMY

Growth in an economy is achieved by increasing per capita resources (capital) and by using resources more efficiently. In an open economy, increasing capital depends on the competitive position of the country, which in turn depends on its macro, trade, and tax policies. The evaluation of policies aimed at the development of agriculture cannot be adequately pursued without taking into account the interdependence of agriculture and the rest of the economy. During 1989 IFPRI research continued on the historical and quantitative aspects of resource transfers in national economies.

In *Agriculture and Economic Growth in Argentina, 1913-84*, Research Report 76, Yair Mundlak, Domingo Cavallo, and Roberto Domenech relate Argentina's poor economic performance to inward-looking economic policies directed toward isolating the country from the world economy. They note that as a result, Argentina did not fully exploit its comparative advantage in agriculture. (This report builds on the earlier work by Cavallo and Mundlak, *Agriculture and Economic Growth in an Open Economy: The Case of Argentina*, Research Report 36.)

The report disaggregates the economy into agriculture, nonagriculture, and government. It notes that agriculture has always been a more trade-oriented sector than nonagriculture and therefore has been more sensitive to antitrade policies and to the appreciation of the domestic currency (see Figure 12). To evaluate the damage caused by these policies, the economy is simulated under three alternative policies that would favor trade and maintain a more stable economy. The results show that during the 1930-84 period Argentina could have had a growth path similar to that of Australia, producing on average increases in income, consumption, and investment of 63, 70, and 112 percent respectively.

FOOD CONSUMPTION AND NUTRITION POLICY PROGRAM

Research in the Food Consumption and Nutrition Policy Program examines how public policies affect the real incomes, food consumption, nutrition, and health of low-income households and individuals within these households. Research focuses on conceptual and empirical studies that ultimately contribute to policy formation and implementation. The research places particular emphasis on understanding the processes that occur within the household. To accomplish this, data are collected through household surveys conducted by IFPRI staff in collaboration with local institutions.

During 1989 the Consumption and Nutrition Policy Program continued ongoing and published completed research in the areas of food price and subsidy policies, commercialization of agriculture, famine, seasonality, and technological change. It initiated research on a new area that examines how agriculture, health, and nutrition are linked. Research in this area builds on prior work that has noted the importance of incorporating health and nutrition issues into agricultural policy planning and seeks to identify how this can be accomplished.

FOOD SUBSIDIES IN DEVELOPING COUNTRIES

IFPRI undertakes research on food subsidies to help governments assess how current and alternative subsidy policies affect human welfare, fiscal costs, and food production. As part of this work, in 1989 the Consumption and Nutrition Program published a comprehensive analysis of the Egyptian rice market, which has a long-standing record of government intervention. In *The Egyptian Rice Market: A Model Analysis of the Effects of Government Interventions and Subsidies*, Working Paper 5 in IFPRI's series on food subsidies, Ahmed M. Elminiawy examines rice policy in Egypt to determine the extent to which these interventions have constrained rice production.

The Egyptian government's policies related to rice production include procuring rice, providing subsidies for inputs such as irrigation and fertilizer, controlling land use and water, distributing rice at subsidized prices, managing foreign trade, and fixing prices on quota rice. Using partial equilibrium models to simulate policy changes, the study finds that, without the distribution of subsidized rice in the rice-producing areas, rice production would have been 4 percent higher; and that, with the elimination of all policy restrictions, rice production would have increased by 15 percent. Even under current systems of interventions, a price regime more closely oriented to the higher international rice price would stimulate adoption of yield-increasing technology and thus rice production.

The study did not examine the effects of changing government rice policy on consumption. Presumably, to the extent that rice producers' incomes increased, household food consumption of these rice-producing households would benefit. However, the net consumers of rice would lose as a result of the decrease in subsidized rice consumption.

EFFECTS OF COMMERCIALIZATION ON SMALLHOLDER AGRICULTURE

Integration of traditional smallholder agriculture into the exchange economy is part of a successful development strategy. Specialization and commercialization are parts of that process. Some hypothesize that benefits of increased commercialization may be less than expected or even negative in early phases of the process or when rapid changes in traditional agriculture occur. The rural poor and malnourished may not capture a significant share of the economic gains from increased commercialization.

The Food Consumption and Nutrition Policy Program undertakes research on the process of commercialization to identify key factors that lead to beneficial or potential detrimental effects on nutrition. This collaborative work is carried out in countries and related to programs where commercialization is occurring in smallholder agriculture. During 1989 research was published based on studies in The Gambia, Guatemala, and Kenya. The studies suggest that efforts to improve nutrition cannot be approached from the vantage point of food supply alone. The high prevalence of malnutrition in the study areas is a result of the interaction of lack of food and overall poor health. Resolution of the long-term problem requires effective rural health services and improvement in sanitation within communities (see section on Agriculture, Health, and Nutrition below).

RICE IN THE GAMBIA

Two studies were published on the introduction of rice irrigation technologies in The Gambia. In *Irrigation Technology and Commercialization of Rice in The Gambia: Effects on Income and Nutrition*, Research Report 75, Joachim von Braun, Detlev Puetz, and Patrick Webb examine the results of a project to develop new rice fields with two types of improved technology—full water control through pump irrigation and drainage, and partial water control through tidal irrigation or upgraded rainfed cultivation and drainage. The fully water-controlled technology produced the only dry-season crop.

Wet-season yields per crop in the fully water-controlled areas were 6.6 tons per hectare in 1984 and 5.2 tons in 1985. For the same years, the partially water-controlled areas had rice yields of 2.2 and 2.8 tons respectively. Traditional rainfed rice, predominantly a women's crop grown in swamps, had yields of 1.3 tons.

Most farmers in the project also grew upland crops—mainly groundnuts and millet. The new rice projects pulled labor away from the upland crops, resulting in a loss of 531 calories in these crops for every 1,000 calories gained in rice production. The study found that an income increase of 10 percent leads to a 4.8 percent increase in calorie consumption. A 10 percent increase in calorie consumption per capita was associated with an 2.4 percent improvement in nutrition, reflected in increased weight-for-age of children in the study area. This increase was even higher in households with greater nutritional deficiencies.

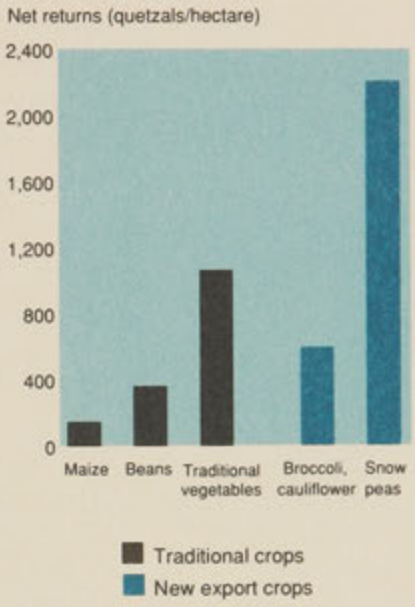
The study found that dry season irrigated rice can make an important contribution to household food security. In addition to rice development, it recommends a more broad-based policy emphasizing improved infrastructure, input delivery systems, and—in this environment, where seasonal labor is manually constraining—labor-saving technology.

In the second publication, *Intrahousehold Decisionmaking and Resource Control: The Effects of Rice Commercialization in West Africa*, Working Paper 3 in the commercialization of agriculture and nutrition series, Patrick Webb takes a systematic anthropological approach to focus on the impact of the introduction of the new rice technologies on intrahousehold decisionmaking, resource control, and labor activities in the same study area described above.

The paper indicates that families initially have benefited greatly from the increases in rice yields. These benefits were accompanied by substantial changes in the organization of production and in the sphere of intrahousehold decisionmaking. Control over rice production and use was transferred from women to men. Men work on and control the bulk of rice grown with new production technology. In addition, the expanded use of rice as a crop for household consumption (coupled with the higher labor demands) increased work burdens for all family members, relatively more for women than men. This is partly compensated for by in-kind payments of rice to women. However, women's decisionmaking authority over rice eroded.

The results indicate that targeting a women's crop, in this case rice, with new technology will not necessarily lead to benefits for women. As seen in this study, divisions of labor by sex and crop are less rigid than often supposed and changes in one part of the household farm system will have repercussions in the rest of that system.

Figure 13
Net returns of traditional crops and new export vegetables to cooperative members, Guatemala, 1984/85



Source: Joachim von Braun, David Hotchkiss, and Maarten Immink, *Nontraditional Export Crops in Guatemala: Effects on Production, Income, and Nutrition*, Research Report 73 (Washington, D.C.: IFPRI, 1989).

EXPORT VEGETABLES IN GUATEMALA

The production for export of nontraditional vegetables in the smallholder sector is a promising way to increase foreign exchange revenues and provide a substitute for traditional export crops, which face deteriorating prices in the world market. In addition, demand for nontraditional export vegetables is growing in the industrialized markets and their production is labor intensive.

In *Nontraditional Export Crops in Guatemala: Effects on Production, Income, and Nutrition*, Research Report 73, Joachim von Braun, David Hotchkiss, and Maarten Immink examine the introduction of labor-intensive vegetable production into the traditional small-farm sector of Guatemala's western highlands.

The analysis shows that nontraditional export crops are substantially more profitable to farmers in the participating cooperative than traditional crops. While per-hectare costs of snow peas were 13 times higher than those of maize, the peas provided a net return 15 times higher than maize (see Figure 13). In addition, the export-crop-production scheme led to increased income in the participants' households. This increase between surveys conducted in 1983 and 1985 was most pronounced in the group of new adopters, in which expenditures—used as an income proxy—increased by 33 percent. The income gains were

highest among the adopters on the smallest farms, and among landless households, who found increased employment. Thus the new export crops had the favorable effect of moving the poorest upward on the income scale.

Commercialization was associated with increased employment and income growth. The study also found that export crop-producing households spent less of their additional income on food than traditional-crop households at similar income levels. To a lesser extent, this was also true for calorie consumption. Thus, food expenditures and consumption increased relatively less than expected. However, improvement in the nutritional status of children, most significantly in decreased wasting, was associated with increased income and food consumption in export-crop-producing households. The nutritional benefits of economic growth, as shown in this study, are substantial but can be further enhanced by appropriate health- and nutrition-oriented social infrastructure. The effects of health programs conducted by the export-crop cooperative in participating communities support this conclusion.

SUGAR IN KENYA

In *The Effects of Sugarcane Production on Food Security, Health, and Nutrition in Kenya: A Longitudinal Analysis*, Research Report 78, Eileen T. Kennedy traces a group of farmers before, during, and after a switch from maize to sugarcane production in South Nyanza. The study finds that sugarcane production substantially increased incomes and slightly increased calorie intake, but had little effect on the prevalence of illness in the area.

The report found that farmers (who at the time of switching to sugar had salaries of KSh 1,926 compared to their nonsugar counterparts' salaries of KSh 1,924) were able to increase their annual incomes by more than 1,000 shillings after the first year. This project was also found to generate increased income opportunities for the landless as well. These increased incomes resulted in increased household caloric intake; however, this incremental consumption was not found to reduce the incidence of malnutrition. The study found similar patterns of illness across income groups, suggesting once again the need for improvements in sanitation and health care.

POLICIES FOR FAMINE PREVENTION

Even in resource-poor countries, famines are the result of national and international policy failures—that is, failure to give priority to the conceptualization, implementation, and management of famine prevention. IFPRI's ongoing research for improved famine prevention policy aims to help correct such failures. During the 1980s, severe famines were confined to Africa. Sudan and Ethiopia were the two major problem cases. In 1989 famine conditions began emerging again in large parts of both countries. Famine deaths in Ethiopia between 1983 and 1985 have been estimated at more than 1 million, those in

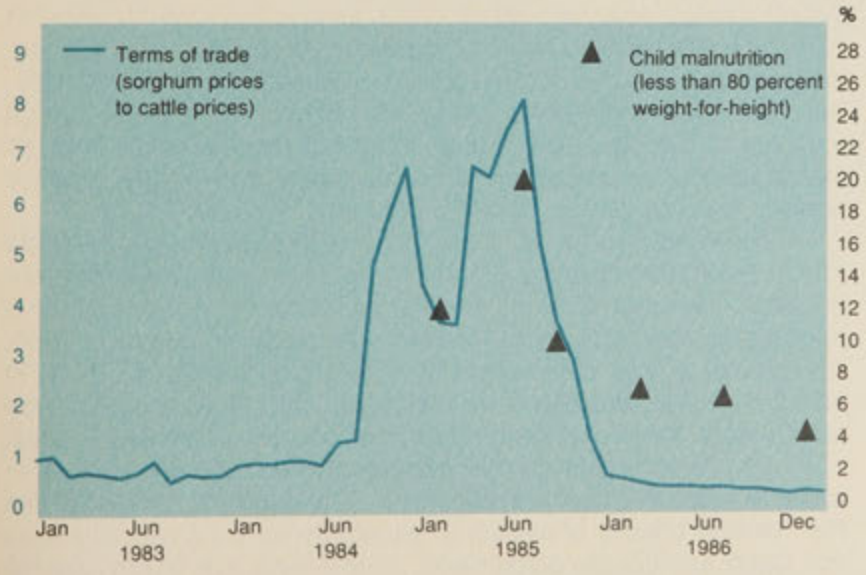
western Sudan at about 200,000 in 1984/85, and those in the war-stricken southern provinces at 200,000 in the second half of the 1980s.

In both these countries, it is tempting to point to continuing military conflicts as the chief cause of famine. It is true that the resource drain and economic disruption resulting from war are important factors. However, drought and other unfavorable weather conditions remain a chief trigger of famine crisis when public preparedness is lacking. Modeling results by IFPRI indicate that a 10 percent decline in long-term average rainfall results in an 8.4 percent drop in total cereal production in Ethiopia and a 5.0 percent drop in Sudan. Responses are larger for individual crops concentrated in drought-prone regions. For sorghum, for example, the figures are 16 percent in Ethiopia and 7 percent in Sudan.

Food production in Ethiopia shows a disturbing trend, and production fluctuates excessively in both Ethiopia and Sudan. Production fluctuations have a direct effect on food availability due to the countries' infrastructure constraints, which prevent the movement of large amounts of food in a crisis. The most severe famine years have generally been preceded by two or three years of low rainfall and production.

In addition to the direct effect on food availability, production crises also have an indirect effect on prices, rural wages, and employment in both farm and nonfarm rural economies. IFPRI's analysis in Sudan shows that a 10 percent decline in cereal production led to an approximately 20 percent increase in real cereal prices. In 1984/85, real food prices in Sudan tripled, and in Ethiopia they more than doubled in 1983/84. A critical factor in such price movements was the deterioration in domestic cereal/livestock price ratios. A close relationship between disruption of cereal/livestock terms of trade and child malnutrition is found in Sudan (see Figure 14).

Figure 14
Seasonal cereal/livestock terms of trade and child nutrition in Kordofan, Sudan, 1983-86



Sources: Tesfaye Teklu and Joachim von Braun.

Figure 15
Preferred form of famine relief by beneficiaries of cash transfer schemes, Arsi Province and Gamo Gofa Province, Ethiopia

Sources: Patrick Webb and Joachim von Braun.

Food aid played a crucial role in both countries. In Ethiopia it reached 1.2 million tons in 1985 and 1.3 million tons in 1988, and in Sudan it reached 0.7 million tons in 1984/85. Red (feed) sorghum was the principal relief food distributed in Sudan.

Food-for-work operations in both countries largely came to a standstill during the crisis, mainly because of logistical problems and the more immediate demands of relief intervention. Both countries are a long way from effective utilization of public works during periods of decline in agricultural production and employment, a key instrument for famine prevention in India.

Cash transfer schemes to households in famine-stricken areas in Ethiopia had mixed results. IFPRI surveys show that at one site beneficiaries ran into interregional trade restrictions imposed by the state that curtailed long-distance food acquisition. This generated local inflation. At another site, access to markets outside the drought zone was freer. As a result, most respondents at the market-inaccessible site would have preferred to receive food aid rather than cash. The opposite held true for respondents at the site where market access was easier (see Figure 15).

The research suggests that improvements in agricultural technology can play a key role for famine prevention, particularly by increasing production in high potential areas. In Sudan, research found that households with access to improved technology coped better during drought.

SEASONAL FLUCTUATIONS IN FOOD CONSUMPTION

In many developing countries, hunger is a seasonal phenomenon coinciding with the agricultural cycle and fluctuations in income, prices, food supply, and food demand. As a result of many factors, such as general economic development, increased population pressure, and social change, many of the traditional methods of buffering seasonal fluctuations are no longer working effectively. In 1989 the Consumption and Nutrition Program completed a major research effort in this area with the publication of *Seasonal Variability in Third World Agriculture: The Consequences for Food Security*, edited by David E. Sahn (Baltimore, Md.: The Johns Hopkins University Press). The book brings together authorities from a wide range of disciplines to analyze the problems associated with seasonality and suggest policy options that could help promote solutions.

The ways in which the poor deal with seasonal fluctuations are diverse. During the preharvest season when resources are depleted, the poor may sell off their assets to buy food. Seasonal migration, another way of dealing with getting access to food, may result in the dissolution of the family structure. Thus, in addition to the depletion of nutritional status associated with seasonality, there may be long-term economic and social results.

The book indicates that seasonal variability does not necessarily require seasonal solutions. The authors conclude that the harmful effects of seasonal variability on food security have not been sufficiently addressed. In the long run improving the performance of commodity, capital, and labor markets is re-

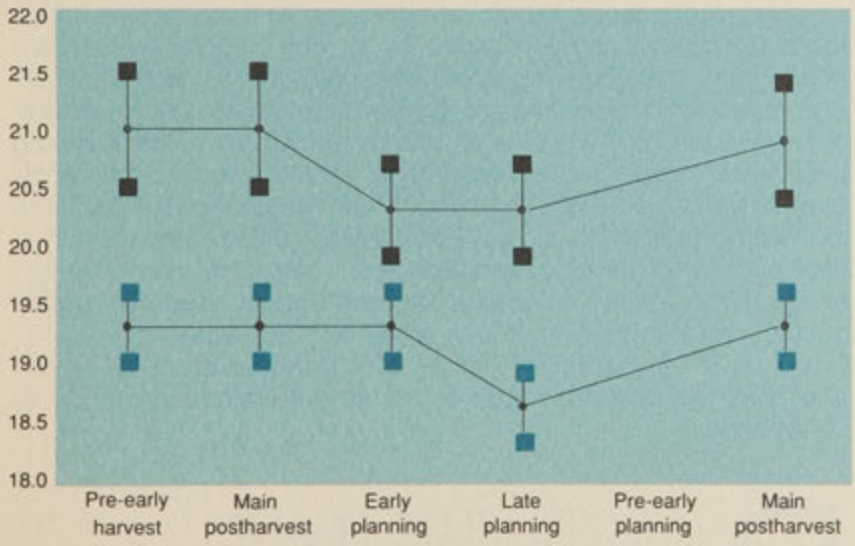
quired. But it is also necessary to examine the adverse effects and the need for shorter-term guarantee schemes, food subsidies, and price stabilization programs.

In related work in Pakistan, IFPRI has been exploring the means by which households respond to short-term shocks in income. With 10-15 percent of total incomes coming from pensions and remittances and another 40 percent from nonfarm activities, these rural households are shown to be integrated into the larger economy. Nevertheless, droughts and floods have greatly affected earnings of many of these households. Preliminary evidence indicates that household expenditures are cushioned from such fluctuations by savings and readily available consumption credit.

The source and utilization of such credit is also being examined. Agricultural census data from 1972 and 1985 indicates a pronounced growth in formal credit. This credit has not been targeted to smallholders, contrary to an objective of the agricultural bank. Smallholders and tenants do, however, obtain credit from their landlords or through family networks. The costs of such credit as well as the constraints to access are not well understood.

Follow-up work on the question of the effects of seasonal food and nutrition insecurity is continuing. In 1989 five case studies were completed in areas in India, Ethiopia, Kenya, Zambia, and Niger, where seasonal weight loss varies. These studies indicate that households with the overall lowest nutritional status are also likely to face the greatest seasonal stress. These households are also those with a relatively poorer agricultural performance (see Figure 16).

Figure 16
Mean body mass index for males 18 years and older, Niger, 1984



■ Producers with above median production sufficiency of foodgrains.
■ Producers with below median production sufficiency of foodgrains.

Source: Shubh Kumar.
Note: For healthy populations, a body mass index of 20 is generally considered to be an indicator of undernutrition in adults.

Households primarily dependent on agricultural production have a different pattern of seasonal food and nutritional insecurity than those dependent on agricultural labor. The first type of households faced greatest insecurity during periods of high workload and employment in agriculture, whereas the labor households faced the greatest insecurity during periods of low employment. Thus seasonal patterns for households at risk in labor-surplus Asian countries are expected to differ from those in Sub-Saharan Africa. In Kenya, where population densities are relatively higher and landlessness is beginning to emerge, both types of households were found. The agricultural productivity implications of the findings appear to be most obvious for the Sub-Saharan countries where the majority of the rural population is engaged in cultivation.

THE NUTRITIONAL EFFECTS OF TECHNOLOGICAL CHANGE

The Consumption and Nutrition Program undertakes research in rural areas on the effects of technological change in agriculture on food and nutrition levels within the household. During 1989, research explored the mechanisms that influence household food and nutritional security associated with technological change. It focused on identifying those intermediate factors that affect nutrition and food security. These include land tenure, employment, labor input and work loads, access to improved technological inputs, extent of off-farm employment, agricultural and dietary diversity, women's work loads and economic decisionmaking, water supply and sanitation, and access to health services, among others.

In most cases, findings suggest that when the nutritional situation did not improve in areas where agricultural technology had improved, there was a deterioration in these intermediate factors. For example, in areas in Zambia where households substantially adopted improved agricultural technologies, there was little improvement in nutrition and health status. Investigation revealed that work loads increased by 50 percent during peak work periods, whereas calorie consumption increased by only 30 percent in the study households. In addition it was found that women's work loads were continuing to increase while their economic roles as decisionmakers were declining. These factors negated the positive effects of improved quality and diversity of calories and improvements in sanitation resulting from higher incomes. This suggests that for net improvements to occur, alleviating the negative outcomes of intermediate factors must be considered.

POVERTY, AGRICULTURE, HEALTH, AND NUTRITION

Poverty and food insecurity are the major causes of malnutrition in the developing world. In the long run the alleviation of poverty is the best solution to the nutrition problem. In the

shorter term, however, governments and international institutions have pursued a variety of strategies aimed at alleviating malnutrition. Increasingly policymakers have pursued broad-based development strategies as a means of achieving multiple goals, including food security and nutrition objectives. For example, many agricultural policies such as technological change and commercialization assume that by increasing household income, particularly of the rural poor, household food consumption and the health and nutritional status of individual household members will improve.

As noted above, studies on the commercialization of agriculture in The Gambia, Guatemala, and Kenya examined the linkages among cash crop production, household income, food consumption, and health and nutritional status. Results indicate that income-generating schemes such as commercialization make a major contribution to alleviating the hunger problem. However, increased household income alone is insufficient to solve the malnutrition problem in women and preschoolers. Agricultural policies and programs must be combined with health and nutrition activities in order to bring about a significant reduction in malnutrition in the short term.

IFPRI is building on this prior work as part of a new research focus on the linkages among agriculture, health, and nutrition. The issue of incorporating nutritional concerns into agricultural planning is hardly new. However, advice to policymakers often does not go beyond broad generalities. Research in the first phase of this project was initiated to identify ways to incorporate food security and nutrition activities in a range of agricultural policies and programs.

Related work currently under way in Pakistan is examining the effect of fluctuations in the levels and sources of income on how households seek health care. Research indicates that the majority of the poorest households use private doctors to care for childhood illness, in part because public health care is perceived as inferior. Poor households decrease their use of health services in response to increases in the price of health care and are thus likely to be adversely affected by many of the health care cost recovery measures being implemented. Results from Pakistan also show gender discrimination in the household's use of health care. Girls are less likely than boys to receive health care. However this gender discrimination in the household's health-seeking behavior declines with rising income.

INTERNATIONAL TRADE AND FOOD SECURITY PROGRAM

A developing country's trade policies and the international setting in which they are implemented affect its short-term food availability as well as the structure of incentives for food production in the long run. Because developing countries typically have open economies dominated by agriculture, trade policies affect both the agricultural and nonagricultural sectors. Researchers in the International Trade and Food Security Program examine the domestic and international issues associated with agricultural growth and food security.

During 1989 analyses in the International Trade and Food Security Program focused on short-term management needs; the long-run effects of trade and exchange rate policies on production incentives and growth in agriculture; analyses of international policy issues, with an emphasis on protectionism in light of the multilateral agricultural trade negotiations; and international food aid.

NATIONAL FOOD SUPPLY MANAGEMENT

National food security to ensure consumption stability requires appropriate government policies for managing food supplies. Consumption requirements must be balanced with a government's budget, trade objectives, and balance of payments, all of which are linked to its import policies. During 1989, IFPRI completed research on food supply management in Pakistan.

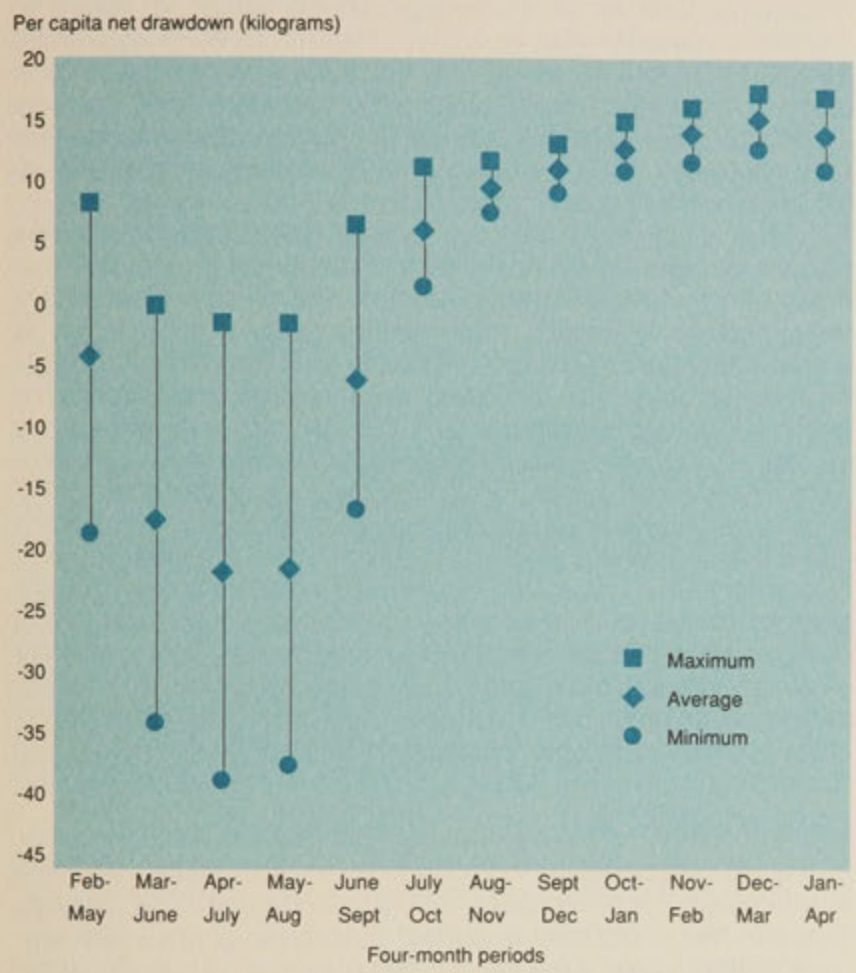
In *The Demand for Public Storage of Wheat in Pakistan*, Research Report 77, Thomas C. Pinckney examines public stockholding in a system in which the government controls wheat procurement and release. The report finds that holding interannual stocks is the least efficient policy, costing more than it saves, unless the world price of wheat were to fall to below US$80 per metric ton. However, a policy that permits price responses to fluctuations in crop size and world price can be beneficial. The model shows that holding harvest prices within 1.4 percent of the target costs about US$11 million more per year than holding harvest prices within 8.4 percent of the target.

When the need to import is evident, the amount of import buffer stocks that should be held depends on the length of time required for imports to arrive and the anticipated drawdown of government stocks during the period. The study presents a detailed historical pattern of the minimum, maximum, and average drawdown from these stocks for each four-month period from 1976/77 to 1986/87 and recommends that the government should not export unless it holds more than 3.1 million tons in early August, which would ensure meeting import buffer requirements later in the year (see Figure 17).

TRADE AND EXCHANGE RATE POLICIES

Trade and exchange rate policies can have a substantial effect on relative prices and production incentives in agriculture.

Figure 17
Per capita drawdown minus procurement of wheat stocks, Pakistan, 1976/77-1986/87



Source: Thomas C. Pinckney, *The Demand for Public Storage of Wheat in Pakistan*, Research Report 77 (Washington, D.C.: IFPRI, 1989).

And the implicit taxation of agriculture through overvalued exchange rates can sometimes dominate, through their effect on production incentives, certain commodity policies. In addition there is often a substantial direct taxation of export crops. Research on trade and exchange rate policies is closely linked to work undertaken in the Agricultural Growth Linkages Program on national resource transfers. During 1989 research on the effect of these policies on production incentives, growth, and employment in agriculture was completed in a comparative study of five countries in Latin America and on developing countries in this and other regions.

DEVELOPING COUNTRIES

During 1989 work was completed on a study of the trade and macroeconomic policies in eight developing countries and a survey of related work in Africa, Asia, and Latin America.

The study finds that the combined effects of trade, macroeconomic, and sector-specific pricing policies have resulted in strong incentive biases against production of tradable goods and

in favor of nontradables; exports relative to import-competing goods in the tradable-goods sector; agricultural products relative to manufactured goods in the export sector; and export crops relative to food crops in the agricultural sector. In failing to provide a more neutral incentive structure to encourage more efficient allocation of resources, the trade and macroeconomic policies adopted in many developing countries have not only contributed to a relatively inferior agricultural performance, but they have also generated unfavorable economywide effects inhibiting overall economic growth.

The study finds that the indirect effect of economywide policies on agricultural incentives is three times greater than the direct effect of sector-specific policies. The greatest disincentive to agriculture is implicit (non-revenue-generating) taxation of tradable agricultural products resulting from the overvaluation of the real exchange rate. The study suggests that, in addition to the analysis of sector-specific pricing policies, governments should monitor and examine closely the effects of trade and macroeconomic policies on the real exchange rate. Officials at the ministries of agriculture could play a broader role in promoting agriculture's interests, placing themselves on the side of policy reform to reduce industrial protection, strengthen the financial system, foster fiscal discipline, and manage the nominal exchange rate rationally. A major challenge for developing-country governments is to develop the institutional arrangements necessary to ensure that agricultural policymakers are not left out in the formulation of trade and macroeconomic policies.

LATIN AMERICA

As part of collaborative work with several economists from Latin America and the World Bank, IFPRI's Trade and Food Security Program has completed a comparative study of price interventions in agricultural markets in Latin America. The study, available in Spanish, examines economic policies in Argentina, Brazil, Chile, Colombia, and the Dominican Republic to provide systematic estimates of the degree of price interventions affecting agriculture during 1960-84; measure the effect of the exchange rate misalignment under alternative policy scenarios and estimate this effect on agricultural incentives; compute estimates of these price interventions on agricultural output, income transfers, the government budget, foreign exchange, and household income in urban and rural areas; and present an analysis of the economic and political determinants of these price interventions affecting agriculture.

On average for the five countries, transfers to agriculture from public investment during 1960-83 were the equivalent of 7 percent of agricultural GDP. (These were particularly high in Brazil and the Dominican Republic.) The effect of price interventions on output prices at the official exchange rate less government input subsidies and public investment resulted in a net overall average annual transfer to agriculture of approximately 4 percent of agricultural GDP. (For Argentina the values were negative throughout; for Colombia they were negative only in 1970-79.) However, when the effect of the exchange rate misalignment and the direct effect of industrial protection are included in the measures of transfers, the net effect of price

interventions on farm income resulted in a net transfer out of agriculture of approximately 27 percent of agricultural GDP (see Table 2).

Thus, for each of the 25 years of the study, net agricultural income was one-fourth to one-third less than it would have been with a trade regime neutral to agriculture. This implicit taxation reduced farm investment and rural employment, and had a significant effect on aggregate farm output. The main element of future policy reforms to reduce these disincentives to agriculture requires removing the real exchange rate misalignment and reducing industrial protection.

Table 2
The effect of price interventions on income transfers, Latin America, 1960-83

Country	Period	Price-Related Transfers		Nonprice Transfers[c]	Net Transfers[d]	
		Direct[a]	Total[b]		Direct	Total
		(percent of agricultural GDP)				
Argentina	60-83	-24.0	-53.0	0.0	-16.0	-42.0
Brazil	70-83	27.0	13.0	12.0	36.5	22.5
Chile	60-82	-0.0	-61.0	4.0	5.5	-42.0
Colombia	60-83	-9.0	-46.0	4.0	-1.0	-38.5
Dominican Republic	70-84	-23.0	-54.0	12.0	3.5	-36.0
Total	60-83	-6.0	-40.0	7.0	4.0	-27.5

[a]Agricultural price interventions on output and input at actual production levels at the official exchange rate.
[b]Net effect of direct and economywide price interventions adjusted for exchange rate misalignment and industrial protection.
[c]Public investment in irrigation, research, and extension.
[d]Net effect of price and nonprice transfers. Price transfer values are averages of two alternative assumptions about the commodities covered in these calculations.
Sources: Alberto Valdés, Maurice Schiff, and Anne Krueger.

AGRICULTURAL PROTECTIONISM AND MULTILATERAL TRADE NEGOTIATIONS

The agricultural policies pursued by developed countries have a strong influence on international markets for agricultural products. Their effect on developing countries can be great. Understanding how policy decisions are made in the industrialized countries, particularly those decisions related to Europe's Common Agricultural Policy, have far-reaching consequences outside the EC. In *Pressures on Europe's Common Agricultural Policy*, Michel Petit traces three changes in economic policy in the European Community and the United States through a complex array of influences and interactions.

In the model of policy determination developed in this study, the relationship between economic and political phenomena de-

termines agricultural policies. A consensus on what is politically feasible, tempered by economic constraints, emerges among the policy actors involved. Then organized interest groups exert pressures while other actors are defending opposing interests. Alliances are formed and compromises are reached, resulting in a policy decision.

The model is tested against three case studies, which include a description of the political activities behind the 1985 price package of the EC, analysis of interactions at the national level that led to the reform of the EC cereal policy in 1986, and discussion of political pressures brought to bear in France and the United States regarding French wine and spirit exports to the United States.

Agricultural policy reform is perhaps the most difficult issue in the current General Agreements on Tariffs and Trade (GATT) Uruguay Round of trade negotiations. IFPRI has contributed to the policy debate by analyzing the economic consequences for developing countries of agricultural reform in industrial countries and evaluating alternative approaches to reform with explicit attention to developing-country interests.

Work during 1989 included an analysis of the effects of long-term policies on the international markets for coarse grains, soybeans, beef, wheat, rice, and sugar under various scenarios of trade liberalization in the developed and developing countries. Most of IFPRI's previous work has focussed primarily on the policies of OECD countries because of their dominance in global markets. This analysis examines liberalization of developing-country trade policies as well and incorporates scenarios in which the current misalignment of trade and exchange rate policies are corrected. It projects income and agricultural productivity growth patterns with and without liberalization to the year 2000 for both groups.

The study finds that a 50 percent reduction in the nominal rate of protection in industrialized countries would result in real world price increases of 1 percent for beef, 7.6 percent for sugar, 2.0 percent for wheat, and 1.0 percent for rice. Real prices of coarse grains and soybeans, however, would decline by 3.0 percent and 4.0 percent, respectively.

Complete liberalization of trade policies in the developed countries would lead to an increase in exports of beef, rice, and sugar in developing countries and a decrease in net exports of coarse grains and soybeans (see Table 3).

Liberalization of trade policies in developing countries would increase exports of coarse grains, rice, and sugar. Net exports of wheat would be unaffected, but net exports of beef would decrease by 1.8 million tons and of soybeans by 4 million tons.

Although studies have found large differences in predicted price changes of commodities with liberalization in developed countries, there appears to be less controversy about trade flows, particularly those for cereals. There appears to be no evidence that trade liberalization will increase the aggregate cereal import bill of developing countries above the projected trend without liberalization if the developing countries also liberalize.

Table 3
Absolute change from base-line run in developing-country net exports under various liberalization scenarios

Liberalizing Group	Wheat	Coarse Grains	Rice	Beef	Sugar	Soybeans
			(million metric tons)			
Developed countries	8.8	-11.6	4.0	0.8	5.1	-0.9
Developing countries	0.0	16.1	2.5	-1.8	2.5	-4.0
All	8.9	1.7	6.4	-0.7	7.8	-5.3

Source: Joachim Zietz and Alberto Valdés.

D FOOD AID

During 1989 research continued on food deficits in developing countries for the period 1961 to 1984. The analysis indicates that during this period, per capita food production growth rates were negative in 65 out of 104 countries examined, because their rapid population growth rates exceeded their food production growth rates. The demand-supply gap is widened further by the growth in their per capita incomes.

As a result, unless these gaps are closed by commercial imports, food aid, or a combination of both, domestic food prices could rise. This would induce a reduction in food consumption, particularly within the poorest households.

Simulation estimates using a simple model show that when per capita food production declines annually by 1.0 to 3.0 percent, the rates of growth of prices range from 2.0 to 8.5 percent if there are no imports. Price-induced increases in food production growth rates range up to 1.13 percent, filling up to one-third of the food deficit. However, price-induced decreases in the overall rate of per capita food consumption that occur at the same time fill the balance. They range from 0.5 to 3.0 percent, and for the poor from 1.2 to 6.4 percent.

OUTREACH

IFPRI's outreach activities—collaborative projects, policy seminars and meetings, and publications—continued to increase in number in 1989 as the Institute's dialogue with policymakers and researchers, its main audience, grew. These formal links are supplemented by more informal contacts, and the increase in all of these activities gave IFPRI's research a larger voice in the policymaking arena. The collaborative activities involved more than 80 institutions in about 35 developing countries. These extensive consultations and joint activities have a direct effect on policy as policy options that are identified result in the implementation of new policies. IFPRI's collaborative research has led to shifts in policies concerning prices, trade, food subsidies, and allocation of research and investment resources, among others. The different aspects of the outreach process are detailed below.

PUBLICATIONS

Major studies 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.) The studies are based on data analyses and research to advance methodology. These are distributed to libraries and researchers around the world, and, along with abstracts that summarize the major policy conclusions, to policymakers in developing and developed countries. In 1989 analyses were also reported in three working paper series: cassava research, food subsidies, and commercialization of agriculture and nutrition; a "gray" report series that makes available conference proceedings and overviews of policy issues; a policy briefs series that summarizes research findings not yet available to the general public; reprints of journal articles by IFPRI staff; food policy statements; a quarterly newsletter; and two 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 listing of 1989 titles appears in the Publications and Papers section.

These publications were distributed through the mailing list and special requests to more than 13,000 individuals, libraries, educational institutions, research organizations, and government organizations, about half of which were in the Third World. About 22,000 publications were distributed in addition to those sent out through the mailing list. Entries on the mailing list were coded for areas of interest, increasing the flexibility of this method of outreach. Development issues were communicated to a more general audience as well, through press briefings and press releases. These events and various conferences IFPRI held were covered by newspapers and magazines around the world.

IFPRI also made known its research by displaying its publications at conferences and book fairs in Tokyo, Frankfurt, and cities in the United States.

COLLABORATION WITH CENTERS IN THE CGIAR

As the policy research center of the CGIAR, IFPRI carries out research that facilitates the use of and enhances the returns on the technological improvements produced at the other centers. Collaboration with other centers is the key to creating a policy environment conducive to accelerating technological change in agriculture. Work undertaken with other centers has ranged from data sharing and project analysis to formulating intercenter research strategies and outposting staff for extended periods of time. In 1989 five senior staff were outposted to international agricultural research centers, three of which were in the CGIAR. By supplying a social science perspective, IFPRI also helps broaden the network of research institutions that collaborate with the CGIAR centers.

During 1989 the following activities were undertaken in collaboration with other centers. More detailed descriptions of some of these projects are given in the sections dealing with IFPRI's five research programs.

- An outposted IFPRI research fellow at the International Rice Research Institute (IRRI) is investigating issues related to agricultural diversification in the Philippines and Indonesia, and analyzing corn/livestock policy in the Philippines.

- IFPRI collaborated during 1989 with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Burkina Faso and Niger on a study assessing the role of millet and sorghum in farmer-income and food-security strategies. IFPRI has posted a research fellow at ICRISAT/Niger. An IFPRI research fellow seconded to ICRISAT in Zimbabwe is looking at the constraints to increased marketing and use of sorghum and millet in the Southern African Development Coordination Conference (SADCC) region.

- IFPRI and ICRISAT are collaborating on a study on soil fertility management in the semiarid tropics in India. This is a part of IFPRI's research with national institutions on future growth of fertilizer use in India.

- Three remaining working papers and a summary of workshop proceedings were published this year as part of a completed study with the Centro Internacional de Agricultura Tropical (CIAT) and the International Institute of Tropical Agriculture (IITA) on the supply and demand prospects for cassava, with particular reference to its food and feed uses in the Third World.

- 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.

- With CIAT the Institute is examining the relationship between agriculture and the environment in the Peruvian Amazon. Appropriate agricultural development options are being analyzed given local agroecological and socioeconomic constraints that affect the design and adoption of agricultural innovations aimed at increasing agricultural productivity.

IFPRI and the International Livestock Center for Africa (ILCA) are working together to examine famine in the context not only of successions of bad crop years, but of the performance of rural markets and different household food security strategies. Contemporary famine theory, policy, and practice is being reviewed and field data on production-income-consumption-nutrition linkages associated with drought and food shortages will be collected. An IFPRI postdoctoral fellow was outposted to ILCA for this project. A new project on seasonality in food security involves ILCA in examining agriculture-livestock linkages in household food security and productivity growth.

IFPRI and ICARDA are developing a project to evaluate the role of food legumes in farming systems and the economies of countries in the Middle East and North Africa.

With ICARDA's involvement, IFPRI is also examining the supply and demand prospects for barley in the Middle East and North Africa in relation to the development of small livestock and the enhancement of trade and food security in the region.

With the Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), IFPRI has prepared a report analyzing the rapid growth in productivity of wheat in the People's Republic of China.

In conjunction with the Centro Internacional de la Papa (CIP), IFPRI is undertaking a study of the production, technology, marketing, and utilization in the People's Republic of China of sweet and white potatoes.

IFPRI also has a collaborative project with other international agricultural research centers, including the International Fertilizer Development Center (IFDC) and the International Irrigation Management Institute (IIMI). With IFDC, IFPRI is undertaking a study of policies conducive to accelerating fertilizer use in Sub-Saharan Africa. An IFPRI research fellow has been posted at IFDC/Togo. The studies with IIMI involve the development of a framework and methodology for assessing the performance of irrigation systems and applying the methodology to build a database on irrigation system performance.

COLLABORATION WITH INSTITUTIONS IN DEVELOPING COUNTRIES

Collaboration with developing-country institutions is crucial for attuning research with the need for appropriate policies and for shaping those policies by ensuring that there is a national base for the eventual dissemination of research results. Both policy and research can evolve in response to each other during the course of a collaborative project, further enhancing the results of the applied research. Collaboration with government agencies and other research organizations in developing countries has been conducted in the field and at headquarters through data collection and analysis, the holding of workshops and seminars, outposting of IFPRI staff, work with visiting researchers, and informal interaction. These activities facilitate the formulation

of research projects most suited to local needs and improve the capacity of developing countries to undertake policy analysis. IFPRI helps build this capacity by providing analytical frameworks and techniques that are adapted by the national systems to the analysis of such questions as how technological change in agriculture affects production, consumption, and nutrition in their countries. And in view of the ways national and international policies impinge upon the agricultural sectors of developing countries, particularly those undergoing structural change, the building of research capacities in macroeconomic policy analysis becomes important as well.

Collaborative research covers a wide range of issues related to food policy. In 1989 IFPRI collaborated with the following institutions in developing countries.

AFRICA

Burkina Faso

- Centre d'Etudes, de Documentation, de Recherche Economique et Sociale (CEDRES), University of Ouagadougou, 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.

Ethiopia

- Ethiopian Nutrition Institute, Addis Ababa, on the consequences for productivity and the implications for adoption of agricultural technology of seasonal food insecurity.
- Office of the National Committee for Central Planning, Addis Ababa, on a study examining famine in the context of successions of bad crop years and the performance of rural markets and different household food security strategies.

The Gambia

- Programming, Planning, and Monitoring Unit for the Agricultural Sector, Banjul, on studies of irrigation and rice production policy and the implications for economic and nutrition-related programs and policy of increased commercialization of agriculture in The Gambia; a report was published this year.

Kenya

- Kenyatta University, Nairobi, on a study of the effects on nutrition of agricultural policies and programs in Kenya.
- Ministry of Planning and National Development, Nairobi, on a study to assess the income and nutritional effects of structural adjustment; the study has used IFPRI methodology to look at social dimensions of adjustment.

Lesotho

- Ministry of Agriculture, Department of Agricultural Research and Department of Marketing, Maseru, on a study of the contribution of sorghum dehulling to coarse grain markets.

Niger

- Institut Nationale de Recherches Agronomiques du Niger (INRAN), Niamey, on household income diversification and agricultural supply and consumption strategies in Niger.

Nigeria

- University of Ibadan, Ibadan, on an analysis, which was published this year, of the past trends and prospects for future use of cassava as food.

Rwanda

Ministry of Agriculture, Kigali, and National Agricultural Research Center (ISAR), Butare, on research on policy issues for long-term growth in fertilizer use.

Senegal

Institut Sénégalais de Recherches Agricoles (ISRA), Dakar, on household income diversification and agricultural supply and consumption strategies, and on fertilizer issues, in Senegal. An IFPRI research fellow is posted here.

Sierra Leone

Rice Research Institute, Rokupr, and University of Sierra Leone, Njala, on a comparison of rice research in Sierra Leone and Sri Lanka to determine the transferability between Asia and Africa of lessons learned in agricultural research, and especially about relations between farmers and researchers.

Southern African Development Coordination Conference (SADCC)

Southern African Center for Cooperation in Agricultural Research (SACCAR), Gaborone, Botswana, on how crop, livestock, and agroindustrial production and marketing policies in the SADCC region can be attuned with the production opportunities for sorghum and millet—particularly those of smallholders in the lower rainfall areas.

Sudan

Ministry of Finance and Economic Planning, Khartoum, on a study examining famine in the context of successions of bad crop years and the performance of rural markets and different household food security strategies.

Tanzania

Sokoine University of Agriculture, Morogoro, on a preliminary study of the marketing opportunities for and constraints on the use of millet and sorghum.

Zaire

University of Kinshasa, Kinshasa, on an analysis, which was published this year, of the past trends and prospects for future use of cassava as food.

Zambia

Ministry of Agriculture, Lusaka, on a study of growth and equity in Zambian agriculture in the context of technological change, the impact of rural infrastructure on agricultural development, and the factors affecting the diffusion of new agricultural technology.

National Commission for Development Planning, Lusaka, on a study of growth and equity in Zambian agriculture in the context of technological change, the impact of rural infrastructure on agricultural development, and the factors affecting the diffusion of new agricultural technology; and a study of the options for promoting traditional crops in the Zambian economy.

National Council for Scientific Research, Lusaka, on a study of the options for promoting traditional crops in the Zambian economy.

National Food and Nutrition Commission, Lusaka, on a study of growth and equity in Zambian agriculture in the context of technological change, the impact of rural infrastructure on agricultural development, and the factors affecting the diffusion of new agricultural technology.

University of Zambia, Rural Development Studies Bureau, on a study of growth and equity in Zambian agriculture in the context of technological change,

the impact of rural infrastructure on agricultural development, and the factors affecting the diffusion of new agricultural technology; and a study of the options for promoting traditional crops in the Zambian economy.

Zambia National Commercial Bank, Lusaka, on a study of growth and equity in Zambian agriculture in the context of technological change, the impact of rural infrastructure on agricultural development, and the factors affecting the diffusion of new agricultural technology.

Zimbabwe

Ministry of Lands, Agriculture and Rural Resettlement, Harare, on a survey to determine the comparative advantage of millet and sorghum in Zimbabwe.

Ministry of Local Government, Rural and Urban Development, Department of Physical Planning, Harare, on an analysis of the impact of rural service infrastructure on agricultural and rural development in the Gazaland District, and on the issue of converting the potential for fertilizer use into effective farmer demand.

University of Zimbabwe, Harare, on an analysis of the impact of rural service infrastructure on agricultural and rural development in the Gazaland District, and on a survey of coarse grain market behavior in smallholder farming areas.

ASIA

Bangladesh

Bangladesh Institute of Development Studies (BIDS), Dhaka, on research on the developmental effects of rural infrastructure and on food distribution and agricultural price policies.

Government of Bangladesh, on a United Nations Development Programme/Government of Bangladesh evaluation of the agricultural research system in Bangladesh.

People's Republic of China

Chinese Academy of Agricultural Sciences (CAAS), Agricultural Economics Institute, Beijing, on collecting data on technical change in and constraints on the productivity of rice yields in poor-rice-growing areas in South China, and analysis of township-level data in Hunan Province.

Chinese Academy of Sciences (CAS), Institute of Geography, Beijing, on research on water management policy in Shandong Province, a project summarizing available statistical information on China's poorest counties, and a study of rural services and the modernization of small towns in Shandong Province.

Chinese Academy of Social Sciences (CASS), Rural Development Institute, Beijing, on farm household surveys on technological change and market access in Jiangsu and Hubei provinces.

South China Agricultural College, Guangzhou, on analysis of fertilizer-related data from household surveys in Jiangsu and Hubei provinces.

India

A.N. Sinha Institute of Social Studies, Patna, on a study of the contributions of nontraditional investments to increased, irrigated agricultural production.

Central Soil Salinity Research Institute, Karnal, on a study of the effect on farmland of salinization and waterlogging in the state of Uttar Pradesh.

Gujarat Institute of Area Planning, Ahmedabad, on a study of the experience of the state of Gujarat in increasing fer-

tilizer use under unirrigated conditions.

- Indian Agricultural Research Institute, New Delhi, on analysis of farmers as buyers of fertilizer and microlevel constraints in availability.

- Indian Agricultural Statistics Research Institute, New Delhi, on a study of the fertilizer response function environment in India.

- Indian Council of Agricultural Research, New Delhi, on a U.S. Agency for International Development (USAID)/Government of India (GOI) review of the impact of USAID/GOI support to the state agricultural universities in India.

- Indian Institute of Management, Ahmedabad, on a study of the contributions of nontraditional investments to increased irrigated agricultural production.

- Institute of Economic Growth, New Delhi, on a study of effective protection and subsidies in agriculture and the contributions of nontraditional investments to increased irrigated agricultural production.

- Institute of Rural Health Studies, Hyderabad, on a longitudinal study of household responses to drought in an area where improvements in agricultural technologies have taken place, with an emphasis on investigating how households can sustain the production and nutritional levels of predrought years.

- National Institute of Nutrition, Hyderabad, on a study of adaptations and other responses to dietary energy stress.

- Rajendra Agricultural University, Pusa (Samastipur), on analysis of the transfer of technology from regional research institutions to the farm in India.

- Reserve Bank of India, Bombay, on a high-level committee on rural credit.

- Tamil Nadu Agricultural University, Coimbatore, on research on the impact of rural service infrastructure on agricultural and rural development in North Arcot district in the state of Tamil Nadu, a study of the contributions of nontraditional investments to increased, irrigated agricultural production, and analysis of the transfer of technology from regional research institutions to the farm in India.

- University of Madras, Madras, on research on the impact of rural service infrastructure on agricultural and rural development in North Arcot district in the state of Tamil Nadu.

Indonesia

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

- Center for Agro Economic Research, Bogor, and Ministry of Agriculture, Jakarta, on an investigation of food demand and supply prospects for Indonesia in relation to agricultural policies and strategies such as irrigation development and crop pricing; crop supply and demand models developed in this work are being used by the Ministry of Agriculture to assess policy options for food crops.

Pakistan

- Applied Economic Research Centre, Karachi, Centre for Applied Economic Studies, Peshawar, and Pakistan Institute of Development Economics, Islamabad, on research to formulate and assess policies related to food security and human nutrition, including the issue of education, at the household level in urban and rural areas in Pakistan.

Philippines

Philippine Institute for Development Studies, Manila, on a study of comparative saving behavior among rural and urban households in the context of agriculture-based development.

Department of Agriculture, Manila, on a study of the potential gains, constraints, and policy options in the development of the corn/feed/livestock sector.

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

Sri Lanka

Ministry of Agriculture, Food and Cooperatives, Agrarian Research and Training Institute, Colombo, on an analysis of the comparative advantages in food crop production in Sri Lanka.

University of Peradeniya, Peradeniya, on a comparison of rice research in Sierra Leone and Sri Lanka to determine the transferability between Asia and Africa of lessons learned in agricultural research, and especially about relations between farmers and researchers.

Thailand

Kasetsart University, Bangkok, on an analysis, published this year, 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 irrigation investment policies, including the trends and determinants of public investment in irrigation systems and the implications for future irrigation development.

LATIN AMERICA

Argentina

Fundación Mediterránea, Córdoba, on a study published this year 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), Brasilia, on studies of the forces influencing the adoption and diffusion of modern agricultural practices in Brazil; the nutritional consequences of changes in agricultural technology; the distribution of benefits generated by agricultural research; and the connection between quality and quantity of human capital and the generation of new agricultural knowledge and technology.

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

Instituto de Economia Agricola, São Paulo, on an analysis of the forces influencing the adoption and diffusion of modern agricultural technology in Brazil.

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.

Costa Rica

Confederation of Central American Universities (CSUCA), San José, on a food security and nutrition project in Central America.

Ministry of Health, San José, and Ministry of Agriculture and Livestock, San José, on a food security project, with training of national counterparts in data management, statistical analysis, and interpretation and dissemination of results.

Tropical Agriculture Center for Research and Training (CATIE), Turrialba, on a food security and nutrition project in Central America.

El Salvador

Demographic Association of El Salvador, San Salvador, Ministry of Public Health, San Salvador, and Ministry of Agriculture and Livestock, San Salvador, on a food security project, with training of national counterparts in data management, statistical analysis, and interpretation and dissemination of results.

Guatemala

Cooperative Cuatro Pinos, Santiago, Sacatepequez; Guatemalan-German Cooperation for Food for Work (COHAAT), Guatemala City; Ministry of Agriculture, Livestock, and Food, Guatemala City; and Ministry of Urban and Rural Development, Guatemala City, on a food security project, with training of national counterparts in data management, statistical analysis, and interpretation and dissemination of results.

Institute of Nutrition of Central America and Panama (INCAP), Guatemala City, on a food security and nutrition project in Central America and a workshop on commercialization of agriculture and household food security.

Regional Food Security Program of Central America (PRSA), Guatemala City, on a food security and nutrition project in Central America.

Honduras

Honduran-German Cooperation for Food for Work (COHAAT), Tegucigalpa, and Ministry of Public Health, Tegucigalpa, on a food security project, with training of national counterparts in data management, statistical analysis, and interpretation and dissemination of results.

Nicaragua

President's Office, Regional Technical Secretariat, Estelí, on a food security project, with training of national counterparts in data management, statistical analysis, and interpretation and dissemination of results.

Peru

Centro de Investigación y Promoción Amazónico, Instituto Andino de Estudios en Población y Desarrollo, and Ministry of Agriculture, Grupo de Análisis de Política Agraria, Lima, on a study of the links between agriculture and the environment in the Peruvian Amazon.

NORTH AFRICA/ MIDDLE EAST

Jordan

Ministry of Agriculture, Amman, on an analysis of the supply and demand prospects for barley in North Africa and the Middle East.

Syria

Ministry of Agriculture and Agrarian Reform, Damascus, on an analysis of the supply and demand prospects for barley in North Africa and the Middle East.

Tunisia

Ministry of Agriculture, Tunis, on an analysis of the supply and demand prospects for barley in North Africa and the Middle East.

COLLABORATION WITH INSTITUTIONS IN DEVELOPED COUNTRIES AND MULTILATERAL AGENCIES

Several projects listed above include collaboration with developed-country institutions and international agencies other than the CGIAR. In 1989 IFPRI's three-way links with these institutions and those in developing countries increased, and the links between Europe, IFPRI, and the Third World were put on a more formal level with the opening of a European liaison office in The Hague. The office organizes and coordinates a cooperative program involving scientists from developing countries, European scientists, and IFPRI researchers on food and agricultural policy issues of mutual concern. An advisory committee of leading Third World and European analysts oversees the work of the office. A symposium held in Japan on the relevance of the Japanese development experience for the Third World (see Policy Seminars section) strengthened IFPRI's institutional and intellectual links with Japanese organizations. Such collaborative activities increase the scope for new links between developed- and developing-country institutions. The list below encompasses collaborations in 1989.

- Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), Paris, France
- Cornell University, Ithaca, U.S.A.
- East-West Center, Environmental and Policy Institute, Honolulu, U.S.A.
- German Agency for Technical Cooperation (GTZ), Eschborn, Federal Republic of Germany
- Indiana University, Bloomington, U.S.A.
- International Development Center of Japan, Tokyo, Japan
- London School of Hygiene and Tropical Medicine, University of London, London, United Kingdom
- New York University, New York, U.S.A.
- Ohio State University, Columbus, U.S.A.
- Otaru University of Commerce, Otaru, Japan
- Oxford University, Oxford, United Kingdom
- Rice University, Houston, U.S.A.
- Rutgers University, New Brunswick, U.S.A.
- Stanford University, Food Research Institute, Stanford, U.S.A.
- United Nations Children's Fund (UNICEF)
- United Nations Development Programme (UNDP)
- United Nations Fertilizer Advisory, Development and Information Network for Asia and the Pacific (FADINAP), Bangkok, Thailand
- United States Agency for International Development (USAID)
- University College, University of London, London, United Kingdom
- University of California, Berkeley, U.S.A.

- University of Hohenheim, Hohenheim, Federal Republic of Germany
- University of Kiel, Kiel, Federal Republic of Germany
- University of Laval, Quebec, Canada
- University of Pennsylvania, Philadelphia, U.S.A.
- University of Wageningen, Wageningen, the Netherlands
- University of Warwick, Warwick, United Kingdom
- Williams College, Williamstown, U.S.A.
- World Bank

POLICY SEMINARS

IFPRI's medium-term plan for 1988-92 placed high priority on broadening and strengthening IFPRI's links with the research and policymaking communities in developing countries through its collaborative research program. As that program has grown, the need to disseminate the results of IFPRI research at both the micro and macro levels and apply those results to policy issues has grown accordingly. In this context the medium-term plan also placed high priority on expanding the number of policy seminars that IFPRI sponsors, generally in cooperation with collaborating institutions, in order to disseminate research results to decisionmakers and analysts involved in the policy process. Because the food and agricultural problems of low-income countries often have both a national and an international dimension, due to the trade, macroeconomic, and development assistance policies of the developed countries, IFPRI's policy seminars focus on not only micro level issues confronting farms and households but also the macroeconomic framework within which the agricultural sector in developing countries must operate. The seminars are therefore structured to encourage an exchange of views and experiences between policymakers and analysts at both the national and international levels. In 1989 the Institute's program of seminars reflected the full range of IFPRI's research agenda, and included seminars on the strategic role of agriculture in the process of economic development, the impact of trade and macroeconomic policies on agriculture in the context of structural adjustment, the income and employment effects of technological change in agriculture, the effects of agricultural commercialization on household food security, and the implications of seasonality in agriculture for nutrition and productivity. In addition, in 1989 an Advisory Committee was formed. A principal focus of the work of this committee is to develop a program of seminars with topics of mutual interest to European, Third World, and IFPRI researchers. In the year under review the committee considerably strengthened IFPRI's capacity to plan collaborative seminars that would reach much larger audiences in both developed and developing countries. IFPRI undertook this initiative, which included the opening of a European office in The Hague, with generous initial support from the government of the Netherlands. (See the Personnel section for a list of the committee members.)

JAPAN AND THIRD WORLD AGRICULTURAL DEVELOPMENT

On April 19, 1989, IFPRI organized a symposium in conjunction with its Board of Trustees meeting in Tokyo that looked at the relevance of Japan's experience with agricultural development to contemporary developing countries. The seminar was cosponsored by the International Development Center of Japan. It was attended by senior Japanese officials and development specialists as well as members of the IFPRI Board and research staff. The symposium was inaugurated by the director for multilateral cooperation of Japan's Ministry of Foreign Affairs who set the theme for the symposium in a statement that emphasized the cardinal importance of agriculture in the overall process of economic development. At a time when the international donor community is reprioritizing the goals of development assistance for the 1990s, symposium participants considered the need to reinterpret the appropriate role of agricultural development in promoting balanced economic growth in developing countries. Discussions centered on Japan's growing commitment of material resources to Third World development as well as its intellectual contribution, which grows out of the strategic role agriculture played in Japan's development.

Japanese agriculture contributed to economic growth through increased factor productivity generated by technological change that produced large additions to national income. This income growth created a structure of demand that encouraged the production of labor-intensive, nonagricultural goods and services, thereby stimulating large multiplier effects throughout other sectors of the economy. Japan's experience with an agriculture-led growth strategy has important implications for that country's comparative advantage in extending development assistance to today's developing countries. First, Japan can provide the strategic knowledge necessary to develop the policy framework for implementing such a strategy. Second, it can contribute to the development of institutions within which human capital can be organized into effective research, credit, and distribution systems. Finally, it can provide traditional capital resources, especially in response to the need for human capital formation and the development of physical infrastructure. How Japan, as a major provider of foreign assistance, responds to the resource needs of contemporary developing countries may well be critical not only to the course of foreign assistance in general, but to the efficiency of development processes. By focusing assistance on an agriculture-led development strategy, there is a tremendous opportunity to accelerate progress toward the global objectives of poverty abatement and growth in developing countries.

STRUCTURAL ADJUSTMENT AND AGRICULTURAL GROWTH IN LATIN AMERICA

In an effort to disseminate the results of a series of IFPRI studies on Latin America concerning the relationship between trade regimes, macroeconomic policies, and the structural reforms now under way in many Latin American countries, IFPRI, together with the United Nations Economic Commission for Latin America (CEPAL), sponsored a regional seminar on May 23-25, 1989, in Santiago, Chile. The purpose of the seminar was to examine the issue of the effects

of trade and exchange rate policies on production incentives, employment, and growth in agriculture. The rationale for the meeting was a growing body of evidence that such policies often have a negative impact on relative prices and hence on incentives in agriculture and the larger economy, as well as on employment and, perhaps, on income distribution and consumption. The implicit taxation of the agricultural sector and resulting production disincentives may well predominate over specific commodity or agricultural policies. The seminar addressed these and related issues in the context of research by IFPRI and others on Colombia, Argentina, Chile, Brazil, Bolivia, and Latin America generally. Particular attention was given to the interaction between structural adjustment and the agricultural sector, as well as to price stabilization programs. Participants included policymakers, advisors, and analysts familiar with the determinants and consequences of trade and exchange rate policies. A seminar proceedings is being prepared.

GROWTH AND EQUITY IN ZAMBIAN AGRICULTURE

The results of a four-year study jointly conducted by IFPRI and its collaborators from the University of Zambia, National Food and Nutrition Commission, and Eastern Province Agricultural Development Project were presented at a policy seminar held in Lusaka on November 22-23, 1989. The research focused on the direct and indirect employment effects of technological change in agriculture in rural Zambia. The meeting was attended by officials from the Cabinet Office, Ministry of Agriculture, Zambia National Commercial Bank, and the National Commission for Development Planning, and by members of collaborating institutions. The discussions centered on important differences among rural households in the adoption of new agricultural technology, in income earned from farm and nonfarm activities, in expenditure on goods and services, and in health and nutritional characteristics based not only on the size of land available for cultivation by rural households, but also on the agroecological environments in which the households were located and their degree of access to rural, service infrastructure. An important conclusion of the seminar was that the crucial policy questions emanating from the research and requiring further investigation involved aspects of agricultural technology adoption and diffusion, agricultural extension, access to rural, service infrastructure, and the way these issues relate to smallholder agriculture in rural Zambia.

COMMERCIALIZATION OF AGRICULTURE AND HOUSEHOLD FOOD SECURITY

The effects of commercialization of agriculture on smallholder agriculture in developing countries continues to draw much attention both in developing countries and the donor community. Critics of the commercialization process and related programs and policies emphasize the competition between cash crops and subsistence crops and possible adverse effects on the food consumption and nutrition of the poor. IFPRI, in collaboration with a number of partners in developing countries during the last four years, has undertaken a series of detailed studies into the effects of increased commercialization of agriculture on food production, consumption, and nutrition. This work, together with that of other colleagues in the field, formed the basis for an international workshop held in Antigua, Guatemala,

March 8-12, 1989. The workshop was cosponsored by the Institute of Nutrition of Central America and Panama. The purpose of the workshop was to reassess the effects of commercialization on food security and to draw implications for policy and program design in order to avoid potential adverse effects and enhance favorable ones. Participants addressed questions such as: What is the appropriate macroeconomic policy environment for agricultural commercialization that benefits the poor? What kinds of rural infrastructure policies are required to stimulate an appropriate commercialization process? How can the complementarity between cash crops and subsistence food crops be enhanced to attain household-level food security? To what extent can the favorable income effects from commercialization be expected to contribute to ending hunger? What additional policies are required to enhance the potential benefits in the nutritional improvement of the poor? In addition to a number of analytical studies, the results of a number of case studies based on collaborative field research in Kenya, Guatemala, Papua New Guinea, India, Indonesia, The Gambia, Malawi, Zambia, and Rwanda were presented. Participants were drawn from research institutions and policymaking agencies in the developing world as well as the donor community.

SEASONALITY IN AGRICULTURE: IMPLICATIONS FOR NUTRITION AND PRODUCTIVITY

On January 27-28, 1989, IFPRI and the National Institute of Nutrition in Rome cosponsored a workshop to examine the results of studies in five countries—India, Ethiopia, Kenya, Zambia, and Niger—on the overlapping patterns of seasonal fluctuations in nutritional status, diet, disease, and economic activities, particularly work requirements in agriculture. The case studies confirmed that in areas with low population density, such as in Zambia and Niger, there is a pattern of a high degree of stress during the main planting season, a time of heavy work requirements. In India, and to some extent in Kenya, landless households face greater stress during the preharvest period, the time when their entitlements are most severely curtailed. And households that had a lower level of nutritional status for the year as a whole were also the ones to face more severe seasonal stress. These findings suggest that where food insecurity influences the agricultural productivity of households, it may also contribute to a growth in income inequality and land distribution. An in-depth study in Ethiopia is expected to clarify these relationships. Participants were drawn from research institutions in Africa, Asia, Latin America, North America, and Europe.

IFPRI, EUROPEAN, AND THIRD WORLD COLLABORATION

IFPRI's advisory committee of Third World and European experts met twice in 1989 at the European office to identify priority topics and participants for seminars, provide feedback on current activities, and establish future needs. Research issues that will be addressed include marketing costs and margins and how food reaches the urban consumer in Africa; technology policy in the context of institutions, infrastructure, and rural investment strategies; sustainable agricultural production and conservation of natural resources in developing countries; and the development of rural industries and the generation of employment for surplus agricultural labor.

PUBLICATIONS AND PAPERS

RESEARCH REPORT AND ABSTRACT SERIES

Research Report 72
Rice Price Fluctuation and an Approach to Price Stabilization in Bangladesh, by Raisuddin Ahmed and Andrew Bernard, February 1989.

Research Report 73
Nontraditional Export Crops in Guatemala: Effects on Production, Income, and Nutrition, by Joachim von Braun, David Hotchkiss, and Maarten Immink, May 1989.

Research Report 74
Food Production in a Land-Surplus, Labor-Scarce Economy: The Zairian Basin, by Tshikala B. Tshibaka, June 1989.

Research Report 75
Irrigation Technology and Commercialization of Rice in the Gambia: Effects on Income and Nutrition, by Joachim von Braun, Detlev Puetz, and Patrick Webb, August 1989.

Research Report 76
Agriculture and Economic Growth in Argentina, 1913-84, by Yair Mundlak, Domingo Cavallo, and Roberto Domenech, November 1989.

Research Report 77
The Demand for Public Storage of Wheat in Pakistan, by Thomas C. Pinckney, December 1989.

Research Report 78
The Effects of Sugarcane Production on Food Security, Health, and Nutrition in Kenya: A Longitudinal Analysis, by Eileen Kennedy, December 1989.

Policy implications of each research report are summarized in the four-page *IFPRI Abstract*, which is published in English, French, and Spanish.

OTHER SERIES

IFPRI/The Johns Hopkins University Press Book Series

Variability in Grain Yields: Implications for Agricultural Research and Policy in Developing Countries, edited by Jock R. Anderson and Peter B.R. Hazell. Baltimore, Md.: The Johns Hopkins University Press for IFPRI, 1989. US$45.

Seasonal Variability in Third World Agriculture: The Consequences for Food Security, edited by David E. Sahn. Baltimore, Md.: The Johns Hopkins University Press for IFPRI, 1989. US$44.50.

"Gray" Report Series

Summary Proceedings of a Workshop on Trends and Prospects of Cassava in the Third World, edited by J.S. Sarma, July 1989.

Pressures on Europe's Common Agricultural Policy, by Michel Petit, October 1989.

Working Papers on Cassava

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Number 5
The Egyptian Rice Market: A Model Analysis of the Effects of Government Interventions and Subsidies, by Ahmed Mahmoud Elminiawy, September 1989.

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Number 3
Intrahousehold Decisionmaking and Resource Control: The Effects of Rice Commercialization in West Africa, by Patrick Webb, February 1989.

IFPRI Policy Briefs

Number 4
Japan and Third World Agricultural Development

Food Policy Statements

Number 10
Agricultural Development: Opportunities for the 1990s, by John W. Mellor, June 1989.

Number 11
Variability in Grain Yields, by Jock R. Anderson and Peter B.R. Hazell, August 1989.

Number 12
Seasonal Variability in Third World Agriculture, by David E. Sahn, November 1989.

IFPRI Reports

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Annual crop and livestock transaction patterns for rural households in western Niger. Prepared by Jane Hopkins and Thomas Reardon for the U.S. Agency for International Development, October.

Changes in poverty in Sri Lanka. Prepared by Neville Edirisinghe for the World Bank, November.

China's wheat technology. Prepared by Bruce Stone for CIMMYT, January.

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Research Assistant, U.S.A.

R. Hoffman
Research Assistant, U.S.A.

L. McNeilly
Research Assistant, U.S.A.

G. Mundela-Tshimanga
Research Assistant, Zaire

C. Rodgers
Research Assistant, U.S.A.

S. Rustagi
Research Assistant, India

A. Slack
Research Assistant, U.S.A.

P. Tatian
Research Assistant, U.S.A. (outposted to International Crops Research Institute for the Semi-Arid Tropics, Niger, and Institut Sénégalais de Recherches Agricoles, Senegal)

J. Witcover
Research Assistant, U.S.A.

J. Wong-Valle
Research Assistant, Nicaragua

L. Centeno
Secretary, Philippines

R. Hassan
Secretary, Philippines

Z. Nekaien
Secretary, Afghanistan

G. Wright
Secretary, France

Agricultural Growth Linkages Program

S. Wanmali
Program Director, India

R. Adams
Research Fellow, U.S.A.

Y. Mundlak
Research Fellow, Israel

A. Ray
Postdoctoral Fellow, India

R. Sabot
Research Fellow, U.S.A.

N. Bliven
Research Analyst, U.S.A.

J. He
Research Assistant, People's Republic of China

A. Beyene
Secretary, Ethiopia

Food Consumption and Nutrition Policy Program

M. Lipton
Program Director, United Kingdom

H. Alderman
Research Fellow, U.S.A.

H. Bouis
Research Fellow, U.S.A.

J. von Braun
Research Fellow, Federal Republic of Germany

E. Desta
Postdoctoral Fellow, Ethiopia

M. Garcia
Research Fellow, Philippines

M. Immink
Research Fellow, Netherlands

E. Kennedy
Research Fellow, U.S.A.

S. Kumar
Research Fellow, India

S. Malik
Research Fellow, Pakistan

T. Teklu
Postdoctoral Fellow, Ethiopia

P. Webb
Postdoctoral Fellow, United Kingdom

D. Puetz
Research Analyst, Federal Republic of Germany

S. Ahmad
Research Assistant, Bangladesh

Y. Amde
Research Assistant, Ethiopia

S. Bhattarai
Research Assistant, Nepal

D. Nag-Chowdhury
Research Assistant, India

E. Payongayong
Research Assistant, Philippines

Y. Yohannes
Research Assistant, Ethiopia

J. Addae-Mintah
Secretary, Ghana

M. Aguas
Secretary, Philippines

L. Aspillera
Secretary, Philippines

G. Dizon
Senior Word Processor, Philippines

International Trade and Food Security Program

A. Valdés
Program Director, Chile

R. Bautista
Research Fellow, Philippines

N. Edirisinghe
Research Fellow, Sri Lanka

H. Ezekiel
Research Fellow, India

B. Kinsey
Research Fellow, U.S.A. (outposted to The University of Zimbabwe, Zimbabwe)

J. Stuyt
Research Assistant, Canada

M. Thomas
Research Assistant, U.S.A.

N. Bonifazi
Secretary, Italy

S. Frost
Secretary, Trinidad and Tobago

Visiting Researchers

About 50 researchers visiting from around the world spent time at IFPRI during 1989. Those listed below spent periods of a month or more at IFPRI.

F. Bellin, *Justus-Liebig-University, Federal Republic of Germany*

G. S. Bhalla, *Jawaharlal Nehru University, India*

A. Fall, *Institut Sénégalais de Recherches Agricoles, Senegal*

L. Haddad, *Warwick University, United Kingdom*

K. Johm, *Programming, Planning, and Monitoring Unit for the Agricultural Sector, The Gambia*

U. Koester, *University of Kiel, Federal Republic of Germany*

M. Lamberte, *Philippine Institute for Development Studies, Philippines*

N. Nampoothiri, *Indian Institute of Management, Ahmedabad, India*

T. Oyejide, *University of Ibadan, Nigeria*

S. Qureshi, *Pakistan Institute of Development Economics, Pakistan*

S. Raheja, *Indian Agricultural Statistics Research Institute, India*

S. Ramagem, *Brazilian Agricultural Research Company (EMBRAPA), Brazil*

C. Siandwazi, *National Food and Nutrition Commission, Zambia*

RESEARCH SUPPORT

L. Halsey
Director of Finance and Administration, U.S.A.

B. Cordero
Administrative Assistant, Philippines

Budget and Contracts

A. Orlin
Administrator, U.S.A.

R. Zamora
Assistant to Administrator, Philippines

K. Byrne
Budget and Contracts Analyst, U.S.A.

Accounting

M. DeVol
Controller, U.S.A.

E. Reyes-Mendoza
Senior Accountant, U.S.A.

J. Tatlonghari
Staff Accountant, U.S.A.

C. Spencer
Accounting Assistant, U.S.A.

P. Manalansan
Accounting Assistant, Philippines

Personnel and Administrative Services

Z. Emam
Head, Afghanistan

J. Cabahug
Personnel Coordinator, Philippines

L. Gaskell
Office Services Coordinator, Philippines

M. Hebert
Travel Coordinator, Philippines

S. Averell
Secretary/Travel Assistant, U.S.A.

C. Benedicto
Receptionist, Philippines

G. Briscoe
Photocopy Operator, U.S.A.

A. Thomas
Office Aide, U.S.A.

Computer Services

N. Walczak
Head, U.S.A.

W. Alvarado
Senior Programmer, Philippines

D. Fuxa
Programmer, U.S.A.

M. Mastroianni
Technical Assistant, U.S.A.

Information Services

B. Rose
Head, U.S.A.

T. Klosky
Librarian, U.S.A.

M. Harben
Editor, U.S.A.

P. Skillman
Editor, U.S.A.

U. Mohan
Information Specialist, India

E. Banda
Publication Specialist, U.S.A.

A. Basilio
Manuscript Word Processor, Philippines

L. McCoy
Typesetter, U.S.A.

B. Rosencrantz, *Information Assistant, U.S.A.*

L. Joseph, *Library Assistant, U.S.A.*

C. Normand, *Clerical Assistant, United Kingdom*

Policy Seminars Program

R. Bordonaro
Head, U.S.A.

L. Goldberg
Conference Coordinator, U.S.A.

I. Modders
Administrative Assistant, European Office, Netherlands

T. Pineda
Secretary, Philippines

International Board for Plant Genetic Resources Liaison Office

D. Witmeyer
Liaison Officer, U.S.A.

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

RESEARCH AREA COORDINATORS

The five research areas, which are described in the introduction, cross-cut the research programs and integrate the results of the research administered by the programs. The research area coordinators are

Development Strategy
Romeo Bautista
Richard Sabot

Poverty Alleviation
Joachim von Braun
Shubh Kumar

Technology Policy
Gunvant Desai
Mark Rosegrant

Africa
Christopher Delgado
Tshikala Tshibaka

Food Aid
Hannan Ezekiel

STANDING COMMITTEES

Six standing committees ensure communication on the research priorities and management of IFPRI. The chairpersons of the committees are

Administrative Review Committee, Joachim von Braun

Appointments Review Committee, Romeo Bautista

Director's Advisory Committee, John Mellor

Outreach Planning Committee, Nurul Islam

Planning Committee on the Environment, Nurul Islam

Publications Review Committee, Gunvant Desai

ADVISORY COMMITTEE

The Advisory Committee includes leading analysts from European and developing countries. Its purpose is to advise IFPRI of ways in which collaboration between European, Third World, and IFPRI researchers can be encouraged, particularly through the medium of research-oriented seminars.

Ojetunji Aboyade
PAI Associates International
Ibadan, Nigeria

Louis Emmerij
Organisation for Economic Cooperation and Development
Paris, France

Just Faaland
The Chr. Michelsen Institute
Fantoft, Norway

Michel Griffon
Centre de Coopération Internationale en Recherche Agronomique pour le Développement
Montpellier, France

Judith Heyer
Oxford University
Oxford, United Kingdom

Lucio G. Reca
Inter-American Development Bank
Washington, D.C., USA

Peter Rieder
Institut fuer Agrarwirtschaft
Zurich, Switzerland

Pasquale Scandizzo
Il Università di Roma
Rome, Italy

Ammar Siamwalla
Thailand Development Research Institute
Bangkok, Thailand

Peter Svedberg
University of Stockholm
Stockholm, Sweden

Wouter Tims
Centre for World Food Studies
Amsterdam, The Netherlands

Eric Tollens
Katholieke Universiteit
Leuven, Belgium

Winfried von Urff
Technische Universitaet Muenchen
Freising-Weihenstephan
Federal Republic of Germany

BOARD OF TRUSTEES

Dick de Zeeuw, Chairman, Netherlands, is president of the Agricultural University of Wageningen and professor of world food problems at the Catholic University of Nijmegen. He previously served as general director of agricultural research at the Ministry of Agriculture and Fisheries of the Netherlands.

Harris Mule, Vice Chairman, Kenya, has served in the Kenyan government in various senior posts, including chief economist and deputy permanent secretary of the Ministry of Economic Planning and Development. Most recently he was the permanent secretary at the Ministry of Finance, a post he took on in 1980. He is currently a consultant for the International Fund for Agricultural Development, a member of the World Bank's Council of African Advisers, and chairman of the Advisory Committee to the African Economic Research Consortium.

Sjarifuddin Baharsjah, Indonesia, is currently the junior minister of agriculture in the Indonesian Ministry of Agriculture, a post he has held since 1988. He began his government career in 1977 as the director of the Centre for Agro-Economic Research, and in 1982 was appointed the secretary-general of the Ministry of Agriculture. He has also taught at the Institute Pertanian in Bogor, where he concurrently holds the post of professor.

Yahia Bakour, Syria, serves as secretary general of the Arab Agronomists' Union and chairman of the Syrian Agricultural Engineers Syndicate. His previous posts include that of professor at the Faculty of Agriculture, Damascus University.

Claude Cheysson, France, has served in high-level posts in government, the diplomatic service, and industry. He was the foreign minister of France from 1981 to early 1985, commissioner for Africa and the Caribbean of the Commission of the European Communities from 1973 to 1981, and, until recently, was the commissioner for European Policies and North-South Problems. He is now a member of the European Parliament.

Anna Ferro-Luzzi, Italy, is director of the Human Nutrition Unit at the National Institute of Nutrition in Rome. Her other activities include serving as an adviser to the World Health Organization and a lecturer at the University of Rome.

Yujiro Hayami, Japan, is a professor of economics at the School of International Politics, Economics and Business, Aoyama Gakuin University, Tokyo. He has won a number of awards from Japanese and American institutions for his published research.

Gerald K. Helleiner, Canada, a professor of economics at the University of Toronto, has taught and conducted research for a number of institutions. He is a member of several boards, including the Board of Governors and Executive Committee of the International Development Research Centre and the United Nations Committee for Development Planning.

Roberto Junguito, Colombia, is president of the Colombian Coffee Exporters Association. He was previously minister of finance and minister of agriculture. He also served as the ambassador to France and the European Community. His other posts have included president of the Colombian Farmers Society.

Dharma Kumar, India, has held several posts in the Indian government, including deputy director of the Reserve Bank of India's Rural Economics Division. She is currently professor of economic history at the Delhi School of Economics and has taught or conducted research at various institutions, including the World Bank and the Institute of Advanced Studies, Princeton University.

James R. McWilliam, Australia, is former director of the Australian Centre for International Agricultural Research. He has also served as professor of agronomy and soil science at the University of New England in Australia and as a research scientist with the Commonwealth Scientific and Industrial Research Organization in Canberra.

Theodore W. Schultz, U.S.A., is a Nobel laureate in economics. He is currently professor emeritus of economics at the University of Chicago.

Leopoldo Solís, Mexico, is director general of the Institute of Economic and Social Research. He previously served as chairman of the Mexican Council of Presidential Economic Advisers and deputy governor of the Central Bank of Mexico.

M. Syeduzzaman, Bangladesh, a development planner and administrator, began his government career in 1956. He has held various senior posts in the Ministries of Commerce, Planning, and Finance. Recently he was Minister of Finance of Bangladesh.

Charles Valy Tuho, Côte d'Ivoire, is his country's ambassador to the European Community. He has served as adviser to the Ministry of Scientific Research and rector of the University of Côte d'Ivoire.

John W. Mellor, Director, Ex Officio, U.S.A., has been the director of IFPRI since 1977. He was previously chief economist at the U.S. Agency for International Development and professor of economics, agricultural economics, and Asian studies at Cornell University. He has received awards for his research from the Wihuri Foundation in Finland, the U.S. government, and the American Agricultural Economics Association.

KPMG Peat Marwick

Certified Public Accountants

2001 M Street, N.W.
Washington, D.C. 20036

Independent Auditors' Report

The Board of Trustees
International Food Policy Research Institute:

We have audited the accompanying balance sheets of the International Food Policy Research Institute as of December 31, 1989 and 1988, and the related statements of revenue, expenses and working capital fund balance and cash flows for the years then ended. These financial statements are the responsibility of the Institute's management. Our responsibility is to express an opinion on these statements based on our audits.

We conducted our audits in accordance with generally accepted auditing standards. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free of material misstatement. An audit includes examining, on a test basis, evidence supporting the amounts and disclosures in the financial statements. An audit also includes assessing the accounting principles used and significant estimates made by management, as well as evaluating the overall financial statement presentation. We believe that our audits provide a reasonable basis for our opinion.

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of the International Food Policy Research Institute at December 31, 1989 and 1988, and the results of its operations and its cash flows for the years then ended in conformity with generally accepted accounting principles.

KPMG Peat Marwick

March 1, 1990

Member Firm of
Klynveld Peat Marwick Goerdeler

FINANCIAL STATEMENTS

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Balance Sheets as of December 31, 1989 and 1988

ASSETS

	1989	1988
Current Assets		
Cash and short-term investments (Notes 2 and 7)	$1,404,606	1,607,163
CGIAR unrestricted grants receivable	184,956	182,181
CGIAR restricted grants receivable	130,337	72,055
Special project contracts receivable (Note 4)	1,291,681	798,206
Other receivables	165,303	225,284
Prepaid expenses and other current assets	181,626	230,372
	3,358,509	3,115,261
Property and Equipment (Notes 3 and 8)	586,908	522,698
Total assets	$3,945,417	3,637,959

LIABILITIES AND FUND BALANCES

Current Liabilities		
Accounts payable	$ 479,316	189,601
Current portion of long-term debt (Note 8)	1,212	13,674
Accrued vacations	333,925	291,760
Advance payment of CGIAR unrestricted grant funds	150,000	150,000
Unexpended CGIAR restricted grant funds	568,745	522,022
Unexpended special project contract funds	1,107,725	1,082,452
Other liabilities	14,028	10,861
	2,654,951	2,260,370
Long-term Debt (Note 8)	—	1,212
Total liabilities	2,654,951	2,261,582
Fund Balances - Unrestricted		
Working capital fund	703,558	756,044
Net investment in property and equipment	586,908	470,333
Equipment replacement fund	—	150,000
Total fund balances	1,290,466	1,376,377
Total liabilities and fund balances	$3,945,417	3,637,959

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Statements of Revenue, Expenses and Working Capital Fund Balance
For the years ended December 31, 1989 and 1988

	1989	1988
Revenue		
Grant income:		
CGIAR-unrestricted	$6,300,329	6,314,134
CGIAR-restricted	680,488	642,331
Special project income-restricted	3,839,662	2,387,613
Investment income	138,729	115,094
Other income	2,664	8,931
	10,961,872	9,468,103
Expenses		
Personnel	4,510,821	4,143,988
Fringe benefits	1,477,763	1,304,092
Collaboration	2,154,081	1,134,944
Travel (IFPRI staff and Board of Trustees)	604,552	542,271
Computer	216,198	190,071
External publications	514,077	322,947
Trustees' expenses (non-travel)	90,820	30,900
Office operations	1,255,064	1,246,126
Depreciation	224,407	160,625
	11,047,783	9,075,964
Excess (Deficiency) of Revenue Over Expenses	(85,911)	392,139
Transfer (to) from net investment in property and equipment	(116,575)	11,928
Transfer (to) from equipment replacement fund	150,000	(50,000)
Decrease in working capital fund	(52,486)	354,067
Working Capital Fund Balance, Beginning	756,044	401,977
Working Capital Fund Balance, Ending	$ 703,558	756,044

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Statements of Cash Flows
For the years ended December 31, 1989 and 1988

	1989	1988
Cash flows from operating activities:		
Excess (deficiency) of revenue over expenses	$ (85,911)	392,139
Adjustments to reconcile excess (deficiency) of revenue over expenses to net cash provided by operating activities:		
Depreciation	224,407	160,625
Decrease (increase) in:		
Grants receivable	(61,057)	64,159
Contracts receivable	(493,475)	(55,183)
Other receivables	59,981	(129,052)
Prepaid expenses and other current assets	48,746	(30,860)
Increase (decrease) in:		
Accounts payable	289,715	46,205
Accrued vacations	42,165	13,400
Advance payment of grant funds	46,723	(737,417)
Unexpended contract funds	25,273	374,683
Other liabilities	3,167	5,654
Net cash provided by operating activities	99,734	104,353
Cash flows from investing activities:		
Acquisition of property and equipment	(288,617)	(148,697)
Net cash used in investing activities	(288,617)	(148,697)
Cash flows from financing activities:		
Repayment of long-term debt	(13,674)	(12,226)
Net cash used in financing activities	(13,674)	(12,226)
Net (decrease) in cash and short-term investments	(202,557)	(56,570)
Cash and short-term investments at beginning of year	1,607,163	1,663,733
Cash and short-term investments at end of year	$1,404,606	1,607,163

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements
December 31, 1989 and 1988

Note 1. Summary of Significant Accounting Policies

Organization

By Executive Order 12359, the International Food Policy Research Institute (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 support received from agencies participating in the Consultative Group on International Agricultural Research (CGIAR) and is classified as restricted or unrestricted based on the donor's stipulations. Restricted grant income is recognized as the related expenses are incurred. Unrestricted grant income is recorded during the period stipulated by the donor. Unrestricted 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 advance payment of grant funds.

Special project income-restricted 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. 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 using the straight-line method over estimated useful lives 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 operations.

Some restricted 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 $26,845 and $39,329 for the years ended December 31, 1989 and 1988, respectively.

Working Capital Fund

Under guidelines of the CGIAR, the Institute is strongly encouraged to establish a working capital fund equivalent to 60 days of CGIAR expenses. 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.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements
December 31, 1989 and 1988 (continued)

Note 1. (continued)

The December 31, 1989 working capital fund balance of $703,558 includes the December 31, 1988 balance of $756,044 and reallocations between fund balances, as approved by the Executive/Finance/Audit Committee of the Board of Trustees. The reallocation to the working capital fund included $150,000 transferred from the equipment replacement fund and $52,365 transferred to the net investment in property and equipment fund balance. In addition, the December 31, 1989 working capital fund balance was reduced by the current year transfer to the net investment in property and equipment fund of $64,210 and the excess of expenses over revenue of $85,911.

The budgeted working capital fund balance, using the CGIAR criteria, was $1,085,259 at December 31, 1989. Therefore, the working capital fund was $381,701 less than the working capital fund balance using CGIAR criteria.

Net Investment in Property and Equipment

The December 31, 1989 net investment in property and equipment balance of $586,908 includes the December 31, 1988 balance of $470,333 and a reallocation to the net investment in property and equipment of $52,365 from the working capital fund, as approved by the Executive/Finance/Audit Committee of the Board of Trustees, plus the current year transfer from the working capital fund of $64,210.

The net investment in property and equipment represents a reserve for the future depreciation of the Institute's existing undepreciated property and equipment.

Equipment Replacement Fund

The balance of funds in the equipment replacement fund were transferred to the working capital fund as approved by the Executive/Finance/Audit Committee of the Board of Trustees.

Reclassifications

Certain reclassifications of the prior year's information have been made to conform with the current presentation.

Note 2. Cash and Short-Term Investments

Cash and short-term investments at December 31, 1989 and 1988 consist of the following:

	1989	1988
Cash and interest-bearing deposits	$ 418,556	1,260,960
Certificates of deposit	—	200,000
U. S. government and agency investments	986,050	146,203
	$1,404,606	1,607,163

The market value of U.S. government and agency investments approximated costs at December 31, 1989 and 1988.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements
December 31, 1989 and 1988 (continued)

Note 3. Property and Equipment

Property and equipment at December 31, 1989 and 1988 are summarized as follows:

	1989	1988
Furnishings	$ 275,261	270,111
Equipment	273,309	256,035
Computer Equipment	753,115	499,485
Leasehold Improvements	141,289	128,726
	1,442,974	1,154,357
Less: accumulated depreciation	856,066	631,659
	$ 586,908	522,698

Note 4. Restricted Grants/Contracts Receivable

CGIAR restricted grants receivable at December 31, 1989 and 1988 consist of the following:

	1989	1988
Amounts billed	$ 23,289	34,109
Recoverable costs, not yet billed	107,048	37,946
	$130,337	72,055

Special project contracts receivable at December 31, 1989 and 1988 consist of the following:

	1989	1988
Amounts billed	$ 576,291	183,892
Recoverable costs, not yet billed	715,390	614,314
	$1,291,681	798,206

Note 5. Leases

The Institute occupies office space under various leases expiring through 1992. 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, 1989, are as follows:

1990	$679,421
1991	694,232
1992	347,116
	$1,720,769

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements
December 31, 1989 and 1988 (continued)

Note 6. Retirement Plan

The Institute maintains a defined contribution retirement plan for substantially all full time employees under which the Institute contributes 5%-20% of an employees 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 Alliance Capital Management International and Generali. Total contributions were $ 606,931 and $535,053 for the years ended December 31, 1989 and 1988, respectively.

Note 7. Restricted Foreign Accounts

As part of certain special project provisions, various foreign bank accounts have been opened to receive payments from donors in the local currencies.

Note 8. Long-term Debt

Long-term debt consists of an installment note for $55,860, payable in 60 monthly installments of $1,221, including interest at 11.25% per annum. A copier with a carrying value of $5,880 at December 31, 1989, serves as the collateral for this note. The outstanding balance at December 31, 1989 and 1988 follows:

	1989	1988
Note payable	$ 1,212	14,886
Current portion	(1,212)	(13,674)
Long-term debt	$ 0	1,212

Note 9. Lines of Credit

The Institute has a line of credit available with First American Bank in the amount of $800,000. At December 31, 1989, the Institute had no amount outstanding relating to the line of credit.

Note 10. Contingency

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. Until such audits are completed there exists a contingent liability. Management believes the effects of any such audits would not be material to the financial statements presented. The Institute's cost records have been audited through 1988 by the Defense Contract Audit Agency.

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.

1989 DONORS

Arab Fund for Social and Economic Development
Australia
Belgium
Brazil
Canada
People's Republic of China
Denmark
Ford Foundation
France
Federal Republic of Germany
India
Inter-American Development Bank
International Development Research Centre (Canada)
International Fund for Agricultural Development
Italy
Japan
Netherlands
Norway
Organisation for Economic Cooperation and Development
Philippines
Rockefeller Foundation
Spain
Sweden
Switzerland
United Kingdom
United Nations Development Programme
United States
World Bank

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