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REPORT

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IFPRI REPORT 1990
INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

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MESSAGE FROM THE CHAIRMAN

There were many changes at the International Food Policy Research Institute in 1990. The most important one for me occurred in July, when I was asked to assume the chairmanship of IFPRI's Board of Trustees. I have long been proud of my association with the Institute's solid record of research on issues of food policy and other aspects of Third World poverty. It is an unexpected honor to serve as chairman of IFPRI's Board. During the last six months I have found it both a challenge and a pleasure to play a more active role in planning IFPRI's future.

Dick de Zeeuw, my predecessor as chairman, resigned from the Board after more than 10 years of enthusiastic service to the Institute. It was IFPRI's good fortune that he left a strong and dedicated group of trustees to carry out the Board's responsibilities. There are now 16 of us from 16 of the countries where IFPRI is active, and as you will see from this annual report, we have had a very busy year.

In August, John Mellor announced that he wished to leave the post of director general and to devote himself to completing two books and to work on a number of other projects; he also sought time to consider how he might best contribute to the alleviation of world poverty during the next decade or two. On behalf of the entire Board of Trustees, I would like to express profound respect for John's immense talent and our deep appreciation for his 13 years of service to the Institute as its chief executive officer. The strong foundations on which IFPRI now builds are in large measure the product of his years of dedicated leadership, vision, and enthusiasm and of the outstanding team of colleagues he recruited.

The Institute was fortunate to be able to recruit a new director general of the caliber of Just Faaland to replace John. IFPRI had come to know Just well from his service as a member of our Advisory Committee and the preparatory work he had done after being appointed by the Consultative Group on International Agricultural Research (CGIAR) to head IFPRI's external management review (about which I will say more in a later paragraph). Just commands worldwide respect for his research, advisory, and managerial accomplishments. This includes his past presidency of the OECD Development Centre and his directorship at the Chr. Michelsen Institute in Norway. Just continues to serve on the United Nations Committee for Development Planning and as an advisor to governmental and private aid agencies concerned with economic and social development. The Board of Trustees is grateful that he has accepted its request to remain as director general through August 1992.

These changes in leadership undoubtedly created some uncertainty in the CGIAR community and among our staff and collaborators, but I can report confidently that the transition, though not without its rough spots, has been successful. The new director general has won the trust and confidence of both the Board and the staff. IFPRI's research momentum has not been impaired; on the contrary, the Institute is now moving forward with a renewed sense of collegiality, transparency, and common purpose.

We have been assisted in our job by the opportune timing of the external program and management reviews conducted at IFPRI this past fall. We are grateful to the Technical Advisory

Committee (TAC) and the CGIAR Secretariat for having selected and supported review teams of such high quality and to the members themselves for having worked so intensively and sensitively to understand IFPRI's program and the concerns of its staff. We appreciate the many compliments throughout both reports regarding the high quality of research at IFPRI, the dedication and capability of its research staff, and the significant impact of its work. In addition, we recognize the important contribution these external reviews have made to identifying IFPRI's strengths and weaknesses and charting appropriate paths both for our own development and for more effective interaction with our partners in the developing countries.

IFPRI also appreciates TAC's supportive response to the reviews. While agreeing with the reports that IFPRI has areas of weakness, TAC concludes that IFPRI has built a solid foundation for productive research relevant to the needs of the developing countries. Thanks should also be given to all our collaborative partners, other colleagues outside the Institute, and the donors who throughout the review process offered their support and assistance.

One of the issues of discussion in the management review was that of Board governance. We have made great progress in this area. A special meeting of the Executive Committee in December addressed some of the major issues regarding its own governance and the rules and procedures within the Institute. This led to a full set of recommendations for bylaw revisions, a new committee structure, and new guidelines, which were reviewed and approved by the full Board in February 1991.

Another area identified was the need for a strategic plan. I am pleased to report that during the last three months, all of IFPRI's senior staff has worked very hard to develop a strategic plan that sets priorities and seeks to incorporate new research thrusts. A draft was discussed at the February meeting of the Board of Trustees. Particularly rewarding in the internal development of this strategy statement is that it is being accomplished through an open, participatory, and collegial process. It is our belief that this kind of process will be the norm for IFPRI in the future. We are now discussing the strategy statement more widely with our research partners and will continue to hone and fine-tune it during the coming months.

A final area in which we have made progress is the search for a long-term director general of IFPRI. The Board has established a search committee and appointed Vernon Ruttan, professor of economics at the University of Minnesota, as its chairman. The committee already has developed the terms of reference for the position and advertised it widely. It expects to present recommendations for the Board's consideration by October 1991.

In 1990 IFPRI turned 15. I believe that as IFPRI moves forward in its next 15 years it will do so with a firm foundation in the form of its excellent staff, strong leadership by its new director general, and a new and more open and collegial decisionmaking style. I would like to express to all of you, our friends and colleagues, IFPRI's heartfelt thanks for your steady support and assistance over the years.

Gerry Helleiner
Chairman

INTRODUCTION

The year 1990 marked IFPRI's fifteenth anniversary. During its 15 years, IFPRI has built a research program focused on the complex issues associated with food production, distribution, consumption and nutrition, and trade in an effort to identify and analyze alternative strategies for improving the food situation of developing countries and reducing hunger and malnutrition. In 1990 IFPRI's Board of Trustees appointed a new chairman and a new director general. IFPRI also underwent its second quinquennial review of program and management. In addition, IFPRI embarked on the formulation of a new strategic plan for research and outreach. The process for this formulation has included institute-wide participation, extensive consultation within the research community worldwide, and with stockholders, clients, and beneficiaries, and ongoing guidance from the Board of Trustees. I am happy to report that the strategy is in the final stages of completion.

This annual report looks back at IFPRI's accomplishments in the areas of research and outreach during 1990. As in previous years, it presents the research results from IFPRI's five research programs on Food Data Evaluation, Food Production Policy, Agricultural Growth Linkages, Food Consumption and Nutrition Policy, and International Trade and Food Security. The research programs and the projects undertaken within them form the core of IFPRI's research efforts. Most of the projects required the collection of field data, usually through household surveys, by IFPRI staff in collaboration with staff in national institutions. It is this microeconomic focus that characterizes much of IFPRI's work.

The Outreach section highlights IFPRI's collaborative approach to research. IFPRI undertakes long-term projects jointly with national counterparts to build national research capacities. Collaborating researchers participate in workshops and seminars on their projects, courses organized within specific field projects, and informal discussions with government officials involved in the projects. The kind of long-lasting collaboration between IFPRI staff and national researchers and policy analysts—in which each learns from the other—is seen by IFPRI as one of the most effective means for improving skills and research.

The Outreach section includes a discussion of national institutions in developing countries with which IFPRI conducted its collaborative research during 1990. These were located in Algeria, Argentina, Bangladesh, Botswana, Brazil, Burkina Faso, Chile, People's Republic of China, Costa Rica, Côte d'Ivoire, Ethiopia, The Gambia, Guatemala, Honduras, India, Indonesia, Iraq, Jordan, Kenya, Republic of Korea, Malawi, Mexico, Morocco, Nicaragua, Niger, Nigeria, Pakistan, Panama, the Philippines, Rwanda, Senegal, Sri Lanka, Sudan, Swaziland, Syria, Tanzania, Thailand, Tunisia, Zambia, and Zimbabwe. It also contains a discussion of IFPRI collaboration with other centers in the CGIAR and with multilateral agencies and developed-country institutions. As part of its collaborative activities, IFPRI outposted eight members of its research staff, four each to national institutions in developing countries and other international agricultural research centers.

The results of the work undertaken in 1990 were reported in 6 research reports, 6 issues of *IFPRI Abstract*, a working

paper, 3 gray cover reports, 4 issues of the newsletter *IFPRI Report*, and 21 reprints. IFPRI also published 3 issues of *IFPRI Policy Briefs* on structural change in African agriculture, environmental aspects of agricultural development, and technology policy for sustainable agricultural growth. A complete list of published research appears in the Outreach section.

Also contained in the Outreach section is a report on workshops and seminars held in 1990. These included seminars on the GATT, agriculture, and developing countries; technology policy for sustainable agricultural growth; agriculture on the road to industrialization; and global food problems.

IFPRI's research fellows are predominantly economists, but some have training in agronomy, nutrition, political science, anthropology, and geography. The diversity and training of the senior 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, IFPRI's senior research staff come from 16 countries, half of which are developing countries. In addition, more than three-fourths of the countries from which the support staff come are developing countries.

I was asked to join IFPRI as director general in August 1990. During my first six months here, I have felt greatly challenged by the responsibility of leading IFPRI. With the help of the Board of Trustees and IFPRI's excellent staff, we have been able to move forward on a number of fronts. As part of the process of formulating a strategic plan and in response to recommendations of the external program review, the research programs will be reorganized with some change in focus into research divisions. IFPRI has begun recruitment of a senior resource economist to strengthen IFPRI's work on the environment and a senior trade and macro economist to expand IFPRI's work on trade, fiscal, financial, and exchange rate issues. We also expect to move forward in the area of human resource development in the developing countries through a more focused approach to training.

When I joined IFPRI, I was familiar with its work through my involvement with the IFPRI Advisory Committee, but I was a relative newcomer to the CGIAR. Attending my first meeting of the CGIAR in Washington in November, in which the new mission statement of the CGIAR was described, I was struck by how closely IFPRI's work program related to it. So much so, that it seems appropriate to quote it here. "Through international research and related activities, and in partnership with national research systems, to contribute to sustainable improvements in productivity of agriculture, forestry, and fisheries in developing countries in ways that enhance nutrition and well-being, especially among low-income people." Although IFPRI's focus has been on agriculture, we are moving forward on defining research issues in the forestry area and may take up consideration of fisheries in the future.

In addition, IFPRI's research directly addresses four of the nine goals identified as priority areas for the CGIAR. With our expansion in the area of the environment and natural resources, IFPRI is addressing the first goal of contributing "effective management and conservation of natural resources." The work of

IFPRI's Food Consumption and Nutrition Policy Program is specifically focused on the goal of "improv[ing] diets, family welfare and equity (including gender equity) through better understanding of the human linkages between production and consumption." Work in all of IFPRI's research programs strives to identify "appropriate policies for increased production within agriculture, food, fisheries and forestry and for the sustainable use of natural resources." And IFPRI's collaborative approach to research, with a new emphasis on training, is aimed at "strengthen[ing] institutions and human resources in order to accelerate the identification, generation, adaptation and utilization of technological interventions."

IFPRI values its association with the CGIAR system and its centers. During 1990 IFPRI collaborated on projects with the International Center for Maize and Wheat Improvement, the International Potato Center, the International Center for Agricultural Research in the Dry Areas, the International Crops Research Institute for the Semi-Arid Tropics, the International Livestock Center for Africa, the International Rice Research Institute, the International Service for National Agricultural Research, and the International Irrigation Management Institute, which was recently invited to join the CGIAR.

I came to IFPRI and the CGIAR at a time of redirection and self-examination, but also at a time of great productivity and excitement. This annual report highlights that productivity.

Just Faaland
Director General

FOOD DATA EVALUATION PROGRAM

Research activities in the Food Data Evaluation Program largely have involved the analysis of trends in food production, consumption, and trade in developing countries and, based on these trends, projections of food output and demand in the different regions of the Third World. This work has built on agricultural and economic data from other international organizations: the World Bank, the United Nations Secretariat and, especially, the Food and Agriculture Organization of the United Nations (FAO). Commodities studied have included the staple food crops and the major livestock and poultry products. Research on specific crops, like the work on trends in cassava production and consumption, has included case studies in several developing countries. As opportunities arose, the Program also conducted studies that used the more detailed national government statistics on agriculture in selected developing countries. Special attention has been given to the 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 Institute projects, the Program has also assembled requested processed and semiprocessed secondary data on food production, consumption, and trade in Third World countries.

In 1990, research was initiated on the long-term prospects of demand for livestock products and feedgrains in East Asian countries. The ongoing study on the economics of barley in North Africa/Middle East largely involved the collection of farm data and indications of future prospects from barley producers and scientists in the region. During the year, research followed up IFPRI's 1986 food trends and projections work with the use of updated estimates of production, consumption, population, and incomes, and expanded the global food assessment by including trend-based projections of food output and demand of the developed economies. Research was published on projections for the production and consumption of foodgrains in India. Research continued on poverty and technical change in China and the growth of Asian trade in horticultural crops with a focus on the Japanese market.

WORLD FOOD TRENDS AND PROJECTIONS DURING THIS DECADE

During 1990, ongoing research on trend-based projections continued as a follow-up to IFPRI's work published in 1986 in *Food in the Third World: Past Trends and Projections to 2000*, Research Report 52, by Leonardo Paulino. The current work incorporates trends for the developed economies and provides a global outlook for production and consumption by 2000.

PRODUCTION TRENDS

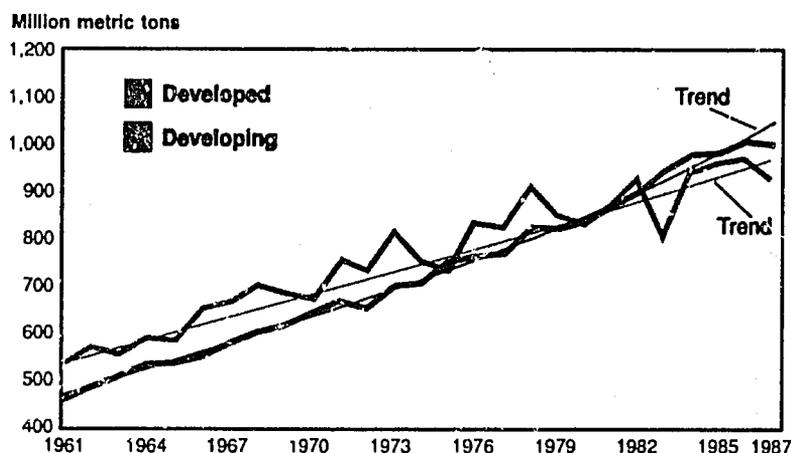
Between 1961-65 and 1983-87, the world's output of major food crops—cereals, roots and tubers, pulses, groundnuts, and bananas and plantains—increased by more than 75 percent, an equivalent annual growth rate of 2.6 percent. However, food

This is the final contribution of the Food Data Evaluation Program as an IFPRI research unit. The Program will be phased out in 1991 following one of the major recommendations of the 1990 IFPRI External Program Review. However, the Program's ongoing research activities, including its outlook work, will be absorbed by other IFPRI programs to which these studies closely relate.

production growth slowed from 3.0 percent during the first half of this period to 2.3 percent during the second half (see Figure 1). Contributing to these trends were large production increases in China and production decreases in the developed economy countries, particularly North America and Eastern Europe and the U.S.S.R.

During this period, nearly 60 percent of the increase in world food output came from the developing countries, whose total production of major food crops surpassed that of the developed countries in the early 1980s. Much of this growth is attributed to the increases made in cereal output. Annual increases of food production in Third World countries, excluding China, remained steady at about 2.6 percent. Regarding specific regions, Sub-Saharan Africa's output growth continued to be slow, and despite satisfactory long-term production growth rates, Latin America and North Africa/Middle East experienced declining output rates during the period. The offsetting accelerated increases in output were provided by the Asian developing countries other than China.

Figure 1
Production of major food crops in developed and developing countries, 1961-87

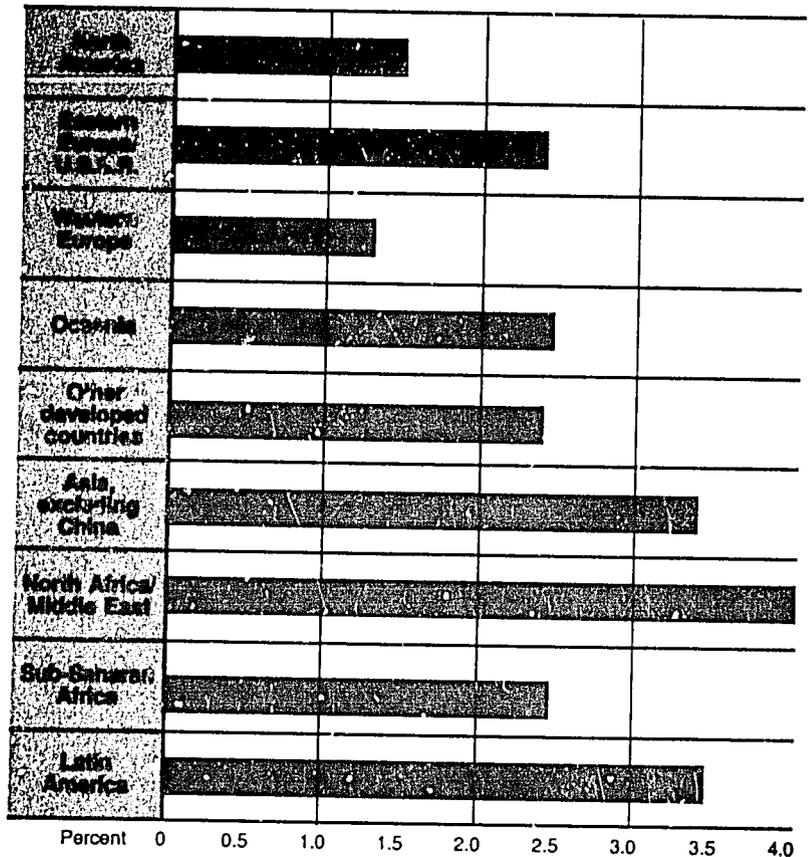


Source: Basic data from Food and Agriculture Organization of the United Nations, "Production Yearbook Tap. 1988," FAO, Rome.

CONSUMPTION TRENDS

Consumption of major food crops in the world rose 2.6 percent annually between 1961-65 and 1981-85 (see Figure 2). The use of these commodities for animal feed increased by more than 3 percent a year, which raised its relative share of total consumption from 37 percent in the earlier period to 41 percent in the early 1980s. Third World consumption of these basic food staples doubled while their consumption in the developed countries increased by less than 50 percent. Population growth coupled with rising incomes pushed food consumption to an average annual growth rate of 3 percent in the developing countries, while declining population rates and levels of per capita consumption of the basic food staples resulted in a growth rate of only 0.3 percent in developed economies.

Figure 2
Average annual growth rate of world food consumption, by country group, 1961-65 to 1981-85



Source: Basic data from Food and Agriculture Organization of the United Nations, "Agricultural Supply Utilization Accounts Tap_s, 1988," FAO, Rome.

Among the world regions there were slowdowns in consumption growth during the period in all developed regions, especially North America, Eastern Europe and the U.S.S.R., and Western Europe. Of the developing regions, North Africa/Middle East and Sub-Saharan Africa registered accelerated growth in the utilization of basic food staples.

PROJECTIONS TO 2000

Using the trends from the early 1960s to the mid-1980s, projections of global output and demand for the year 2000 indicate a food deficit of 5 million metric tons. Food projections for developing countries point to a deficit of 190 million tons, nearly half of which is accounted for by China. The developed countries are projected to have a surplus of 184 million tons.

(The research aggregates regional projections for the developed countries and country projections for the Third World. Output projections are extrapolations of food production trends to the end of the century. Demand projections for the developed countries are extrapolations of per capita consumption trends,

expanded using the United Nations-projected populations. For the developing countries, demand projections are based on available estimates of income elasticity, assumed growth rates of per capita income, and population projections.)

IFPRI's 1986 food projections showed a slight surplus of 7 million tons for China. However, revised income data and population projections for the country result in a considerable increase of projected food demand compared with only a slight increase in projected food production based on updated output estimates.

The world food projections presented above are largely oriented to historical trends in the production and consumption of the basic food staples. This is particularly so for the output and demand projections of developed countries, which are both solely trend-based. In the case of developing countries, a major determinant of their food situation in the 1990s will be China. As indicated here, the data problems attending the country's projections of food production and demand have affected the global and, especially, the Third World scenario results. A number of other considerations may be expected to affect the future food situation of developing countries. Among these are the reported declining effects of the green revolution, the impact of current environmental concerns and consequent actions, problems of Third World poverty and malnutrition, and the effect of the changes in Eastern Europe on development assistance to developing countries.

One fact, however, emerges from these projections. If historical trends of global production and consumption of basic food staples continue into the 1990s, developed economies can generate food surpluses that would amply fill the projected deficits in the Third World. Much will necessarily depend on the policies that major food-producing countries will pursue in the years ahead.

S PRODUCTION AND CONSUMPTION OF FOODGRAINS IN INDIA

Since the mid-1960s, India has shown an impressive performance in expanding foodgrain production. Acute shortages have given way to marginal surpluses in several recent years. However, the growth has been regionally concentrated, aggregate input productivities are declining, and the performance in raising foodgrain consumption, particularly of the poor, has been less than satisfactory. During 1990 IFPRI addressed these issues in *Production and Consumption of Foodgrains in India: Implications of Accelerated Economic Growth and Poverty Alleviation*, Research Report 81, by J.S. Sarma and Vasant P. Gandhi.

The study notes that foodgrain production has risen from about 57 million tons a year in the early 1950s to about 138 million tons a year in the early 1980s—a long-term compound annual growth rate of 2.6 percent. Underlying this substantial

growth has been a sharp decline in the growth of area and an increase in the importance of yield growth as the driving force behind raising production. Wheat, followed by rice, has dominated the growth in foodgrains, while pulses have shown growth in some regions only in recent years. Analysis indicates, however, that the aggregate productivities of the modern inputs associated with growth have declined, making growth less efficient and more expensive.

Despite the impressive increase in production, the per capita availability of foodgrains for human consumption has changed only from 145 kilograms a year in the early 1950s to 167 kilograms a year in the early 1980s. This is because production growth has been largely absorbed by population growth, import reduction, and building up of stocks.

With the Indian government's plan to accelerate economic growth and alleviate poverty, foodgrain demand can be expected to increase substantially. The report indicates that this plan calls for massive efforts to raise foodgrain production with higher productivities, which would require large increases in irrigation, areas sown in high-yielding varieties, and fertilizer use. However, even an impressive performance in production may leave deficits that require imports if acceleration of economic growth and poverty alleviation are achieved.

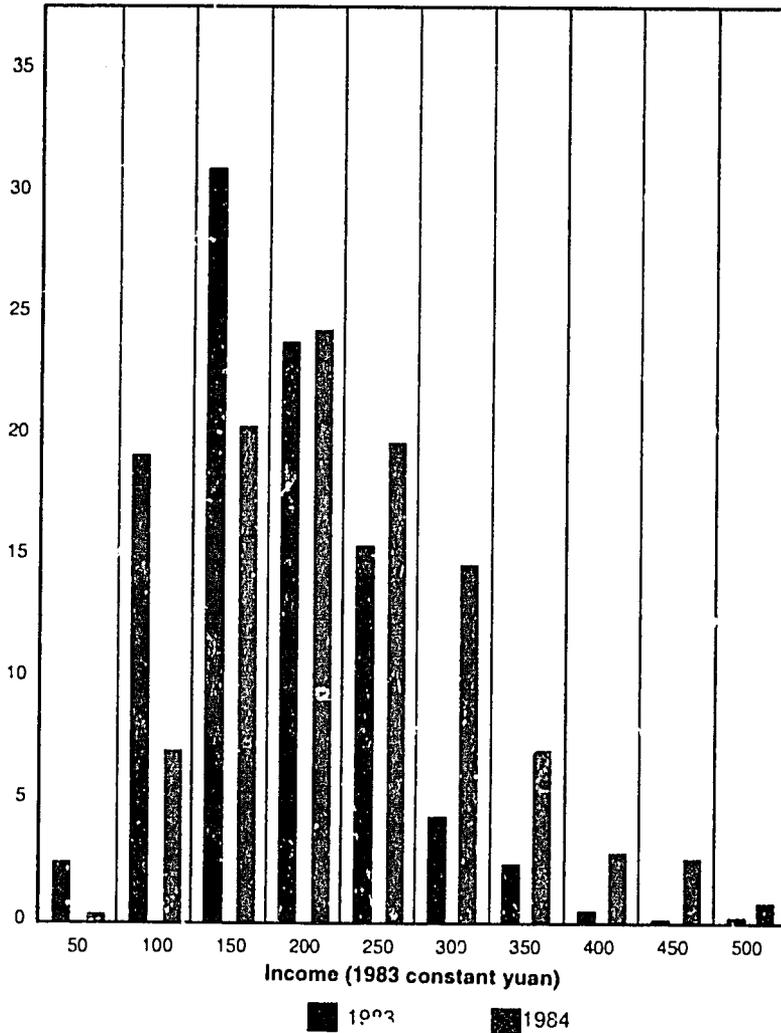
A POVERTY AND TECHNICAL CHANGE IN CHINA

As part of continuing research on economic reform and technological change in poorer and wealthier farming areas of China, research in 1990 found that from 1978 to 1984, rural incomes in average and wealthier parts of the country grew rapidly. This was initially due primarily to productivity growth associated with increased supplies of constraining inputs and to major price increases for public purchases of farm goods. It was later due to these factors and to economic liberalization that combined with the greater availability of resources to bring about rapid rural nonagricultural growth, agricultural diversification, and market development. To some extent poor areas benefited from this growth experience, as the number of counties with average per capita rural incomes below the poverty line fell by more than half. The greatest progress among poor counties occurred in 1983 and 1984 (Figure 3). But the gap between the poorest counties and the rest of rural China increased dramatically.

After 1984, efforts to fight rising inflation forced a reduction of income growth in the rural nonagricultural sector. Farm productivity growth slowed and average and marginal farmgate sales prices fell for major farm commodities, while retail and input prices increased sharply. Average real incomes in poor counties fell by no more than 1-2 percent per year; however, in wealthier regions, where production costs are a larger share of farm revenues and the rural nonagricultural sector is larger, real incomes were more affected.

Figure 3
Distribution of 664 counties in China, by real per capita income, 1983/84

Percent



Source: Tong Zhong and Bruce Stone.

The research indicates that despite stagnation in real incomes among poor counties, adoption of yield-increasing technology increased. Fertilizer use per sown hectare in poor counties, which has been constrained by insufficient supplies, increased from 70.5 kilograms of nutrients in 1984 to 94.5 kilograms in 1987 and to 97.7 kilograms in 1988. High-yielding varieties (HYVs) of rice, wheat, corn, and sorghum spread in poor areas even in the second half of the 1980s. Although most of the HYVs used in poor areas were bred for agroecological conditions elsewhere, they provided productivity and economic gains when used with appropriate inputs and cultivation practices. HYVs specifically bred for microenvironments in poor areas are now being developed in local research systems, but farm area under such varieties is still limited.

HORTICULTURAL TRADE

International trade in horticultural products has increased considerably during the last 20 years. Developing countries have benefited from this increase, and it is expected that continued expansion of the exports of cut flowers, vegetables, and fruits will contribute to agricultural diversification, employment increases, and foreign exchange earnings in developing countries (also see the International Trade and Food Security Program). IFPRI research in 1990 focused on the trends and other indicators of the rapidly expanding Japanese market for horticultural exports from developing countries in the Asian region.

On the consumption of horticultural products in Japan between 1970 and 1988, the share of imports in total supply has risen from 0.3 percent to 5.1 percent in cut flowers, from 2.9 to 7.2 percent in vegetables, and from 17.7 to 24 percent in fruits. The research, which analyzes 14 horticultural products, finds that Japanese imports of these commodities—particularly cut flowers, bamboo shoots, and ginger—are highly sensitive to price changes. It also finds that as incomes in Japan increase, demand for these same products also increases. These conditions suggest that there is considerable competition among countries of origin for these products. Thailand, for instance has realized a high export growth rate in cut flowers, bamboo shoots, and ginger by lowering prices, while Mexico has not been able to match the Philippines' success in mangoes, and Taiwan has had a low or negative export growth rate in ginger and bamboo shoots. The results indicate that horticultural trade is extremely competitive, not only between developing countries but between developed and developing countries as well. Keeping the price low while maintaining quality will be key to continued increases.

FOOD PRODUCTION POLICY PROGRAM

Accelerating sustainable food production growth with equity through improved technology and appropriate policies is the principal concern of the Food Production Policy Program. Better technology is essential to overcoming the land constraint in raising food production. It is also essential for the expansion of employment opportunities for the poor both on and off the farm. The acceleration of growth requires the generation and diffusion of agricultural technologies. This requires improved infrastructure, institutional development, and increased incentives for production. It also requires the appropriate management of environmental concerns.

In 1990, research in the Program focused on a special study of trends in lending for agriculture by the World Bank, adoption and use of new technologies in Sub-Saharan Africa, the relationship between agricultural change and population growth, and fertilizer policies and irrigation improvement in Asia and Sub-Saharan Africa. Work continued on commodity priorities and regional market outlets and income strategies of producers in semiarid West Africa, price stabilization, and infrastructure. In the area of environment, research was conducted on agroecological zones and their relation to agricultural changes and poverty and on combatting environmental degradation in Sub-Saharan Africa.

GENERATION AND DIFFUSION OF MODERN AGRICULTURAL TECHNOLOGY

AGRICULTURAL LENDING

The World Bank provides about one-third of all official capital flows to Third World agriculture and rural development. This is almost as much as total bilateral flows to these sectors. So it is a serious matter that World Bank lending to agriculture and rural development (ARD) projects fell by almost one-fifth between its 1977-79 peak and 1986-88. The share of ARD projects in total World Bank lending, excluding agroindustry and agricultural sectoral adjustment loans, declined from 30 to 17 percent during this period.

In *The Role of the World Bank in Agricultural Development in the 1990s*, Michael Lipton and Robert Paarlberg analyze the reasons for the decline, the challenges the Bank will need to respond to in the coming decade, and the capacity of the Bank to respond region by region. The study suggests that the plausible explanations for the cutbacks—the growing gloom in the 1980s over farm price trends, the poor performance of ARD projects, and the shift to loans for sectoral adjustment—did not justify them. Instead, with the 1980s' strategy of quick-disbursing, policy-based lending approaching its limits, the study calls for flexible, imaginative, research-based projects, mixed with policy-based activities as necessary, to meet the exceptional uncertainties faced by developing-country agriculture in the 1990s. Although the study proposes general guidelines, the challenges are essentially technical, country-by-country, sub-sector-specific, and microeconomic. The erosion in technical

staff during the 1980s is thus a major constraint on the reintroduction of carefully conceived ARD projects with adequate staff support.

ADOPTION AND USE

Zambia. IFPRI's continuing research in the Eastern Province of Zambia focused on determinants of fertilizer adoption and use on smallholder farms based on data collected from 330 households in 1985-86. The model examined three items—area to be cultivated, adoption of hybrid maize, and adoption and intensity of fertilizer use. Among the personal attributes considered—education, sex, family characteristics, and age—advanced age was the only barrier to fertilizer adoption. Access to markets and to credit were found to be important determinants of use. Fertilizers have become so well understood among smallholders in this area that almost all categories of farmers, including women and the uneducated, use it subject to capital and market constraints.

Results on intensity of fertilizer use—measured as quantities used per hectare—indicate that education played a positive role. Access to oxen led to higher fertilizer application. Plot-specific analysis indicated crop choice, timeliness of operations, and ease of plot supervision as determinants of intensity of use.

Fertilizers have been used in the area for 15 years, and research indicates that knowledge regarding the benefits of fertilizer use are widespread. However, when more sophisticated decisions are needed for specific situations, education and extension emerge as important.

Zimbabwe. Average fertilizer use in Sub-Saharan Africa is very low but in Zimbabwe its use has been raised to levels comparable to those in Asian developing countries. In an ongoing study of fertilizer use and user behavior in the Gazaland district of Zimbabwe, preliminary findings indicate that even in these high-use countries, in the communal farming areas fertilizer is used by only about one-third of the sample farmers. Of the two-thirds of the farmers who did not report using fertilizers, about half indicated that they did not know what they were. This suggests that information gaps are immense and need to be addressed before other policies can have an impact. Preliminary results indicate that extension agents are critical in determining the conversion of potential to effective demand for fertilizers. Credit and transport services, including bus service, play an important role. The sample farmers indicated that the magnitude of response to fertilizers is a major determinant of adoption.

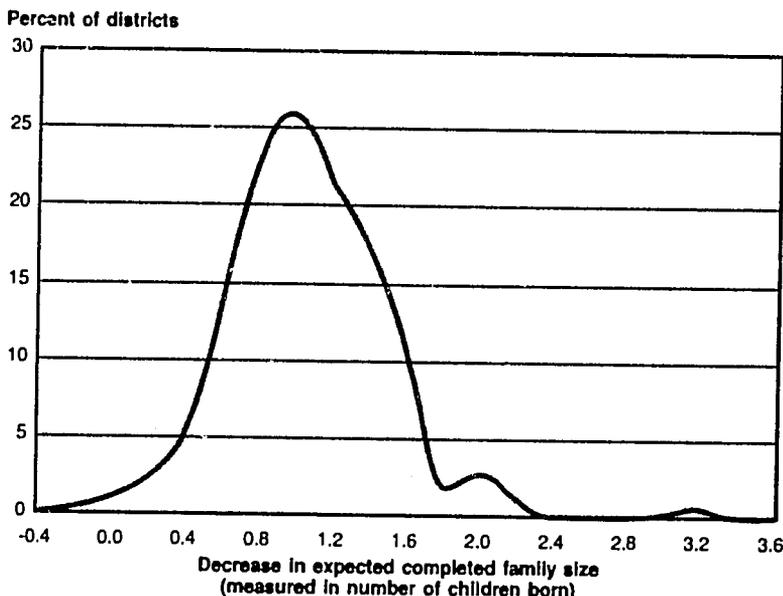
POPULATION CHANGE AND AGRICULTURAL DEVELOPMENT

In the early 1960s, population increase in rural South Asia reached a point where food supply could no longer be maintained only by increases in cultivated area. With high-yielding technologies, food supply was expected to stay ahead of population increases and create a "breathing space" for general socioeconomic development to bring about lower fertility. Modern technologies have raised food output substantially in Asia

and Latin America, and many advocate them as the main approach to agricultural development in Africa. But, do modern technologies affect fertility in ways that extend or shorten the "breathing space"? Do particular types of modern technologies have different effects on fertility patterns? During 1990, IFPRI undertook research to examine the links between agricultural improvements and changes in total fertility rates and the extent to which access to particular types of agricultural change affected declines in fertility rates. The analysis used data from 131 districts in eight Indian states between 1960/61 and 1980/81.

The data confirm the general declines in fertility rates and highlight the substantial variability across districts in total fertility rates during the 1971-81 period (see Figure 4). Preliminary analysis indicates that improved agricultural technologies were associated directly (through increased agricultural output and changes in input composition) and indirectly (through increased incomes) with declining fertility rates. Different types of modern technologies were also found to have different effects on fertility rates. Increases in both agricultural mechanization and the growth rate of yields of major staple crops were found to slow fertility declines. Increases in irrigation, fertilizer use and the percentage of area dedicated to high-yielding seeds had no effect on individual fertility rates. However, districts with above-average growth rates in real wages and crop-derived incomes had faster declines in fertility rates. These results suggest that different types of agricultural technologies can influence population change in ways that both extend and shorten the "breathing space" the green revolution was designed to provide. Agricultural researchers and policymakers alike should be cognizant of these potential trade-offs.

Figure 4
Distribution of change in total fertility rates in selected districts in India, 1971-81



Source: Stephen Vosti.

FERTILIZER POLICIES

India. During 1990, three conclusions emerged from IFPRI's ongoing collaborative research on fertilizer use in India. First, in land-scarce countries such as India, where there is a need for continuous increases in yields in areas with soil fertility constraints and a scarcity of organic manures, the question concerning chemical fertilizers is not whether to raise their use in light of concerns about safeguarding the environment, but how to raise it with minimum adverse effects. Second, many of the adverse effects of fertilizers on the environment in the Third World are the result of incorrect fertilizer practices and not necessarily the result of excessive use. Efforts are needed to correct practices such as the use of large doses of nitrogen without appropriate amounts of phosphates and potash, and incorrect timing and methods of fertilizer application. Third, the accelerated growth of correctly applied fertilizers is crucial for increasing yields in the semiarid tropical regions. To develop effective policies for this goal, a better understanding is needed of why most farmers periodically discontinue the use of fertilizers. Research is needed to determine the important factors such as weather-induced changes in cropping patterns, deficiencies in the fertilizer distribution systems that affect the timely availability of fertilizers, financial constraints, and beliefs about the long-term effects of fertilizer use.

Sub-Saharan Africa. Research on the constraints to fertilizer use in Sub-Saharan Africa continued during 1990. The International Fertilizer Development Center in conjunction with IFPRI published the proceedings of a workshop held in Lomé, Togo, in 1988 with agricultural experts from 12 Sub-Saharan African countries and 5 international organizations to identify the priorities for research for their ongoing work. *Fertilizer Policy in Tropical Africa*, edited by Tshikala Tshibaka and Carlos A. Baanante, suggests that the national procurement processes for fertilizers could be more efficient. In addition to solving managerial problems, measures for reducing procurement, storage, and distribution costs of fertilizers need to be undertaken. Among the measures suggested are eliminating custom and other duties and importing high-grade fertilizers in bulk for bagging in-country. In addition, the group suggested that fertilizers be classified as strategic products as is done for oil in many countries. The report indicates that there are institutional reforms that also should be considered.

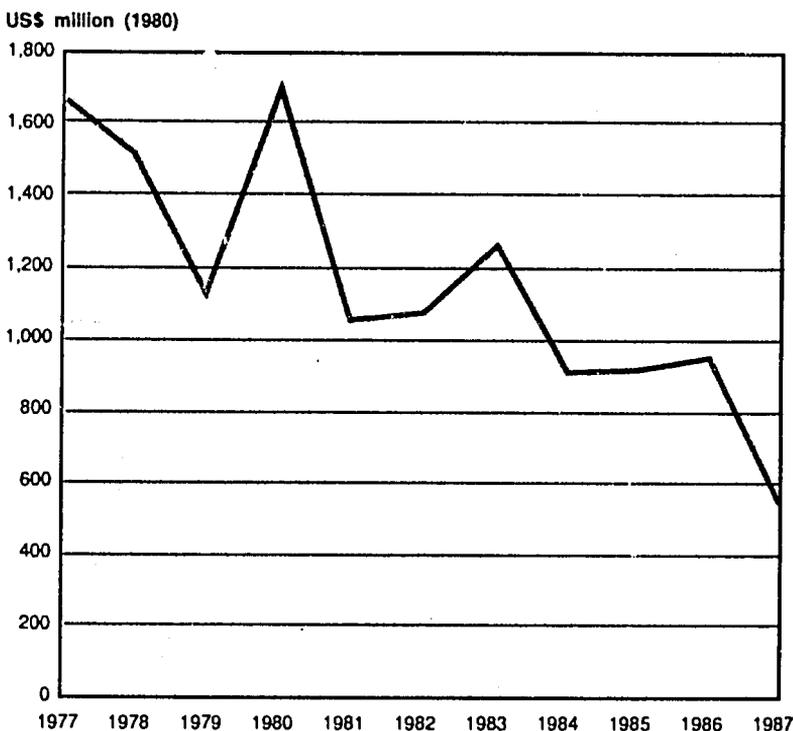
Analysis of the demand for fertilizers in the West African semiarid tropics indicates that nonfarm income is an important determinant of fertilizer use where formal credit institutions are lacking. However, there is an equity problem. The poorer farmers earn the least income off-farm, and thus still face the problem of the lack of a functioning credit market for inputs. In recent years, policy reforms have threatened to eliminate public credit institutions without assuring adequate and equitable alternatives. The research also indicates that farmers are willing to purchase fertilizers to redress environmental or soil fertility problems. Given the increasing degradation of the Sahel, these results reaffirm the need for reestablishment of institutional credit mechanisms, or alternative sources of financial resources in the lower-potential zones, or both.

IRRIGATION

Asia. Investment in irrigation has dropped significantly during recent years across much of the world—particularly in Asia (see Figure 5). Reasons for this decline are the rising cost of new irrigation construction and the increasing difficulty of locating appropriate and environmentally sound sites for new systems. As a result, an increasing share of new investment is directed at improving the performance of existing systems. Current improvement efforts extend beyond traditional physical rehabilitation projects to more sophisticated programs to improve system operations and maintenance through a variety of interventions. However, decisionmakers confront a number of problems in appraising such projects. The interventions vary widely from system to system, and there is no standardized way of predicting and evaluating results.

IFPRI has begun research in collaboration with the International Irrigation Management Institute (IIMI) to develop a common framework for assessing irrigation performance, develop indicators and tools for making these assessments, and begin to build a data base of irrigation performance information. As part of this work, a typology of irrigation systems was created to provide the structure for a data base of information on performance broken down by climate, size of system, irrigation technology, and other characteristics, and an expert system was developed to standardize classifications of individual systems.

Figure 5
Investment by major international donors in Asian irrigation, 1977-87



Source: Mark Rosegrant.

Zimbabwe. Irrigation plays an important role in Zimbabwe's agricultural strategy to meet the objectives of improving food security and the productivity of land, especially in drought-prone communal areas. The largest share of irrigated area lies in the large-scale commercial farm sector, which uses relatively sophisticated technology. But growing government attention to irrigation for communal smallholder farmers requires technological and organizational forms that perform well with moderate cost. IFPRI research is comparing the performance of different types of irrigation systems in the commercial and communal sectors to identify environmental conditions, technology, and management strategies that improve performance.

The research indicates that garden irrigation, a type of irrigation neglected by governments in the past, is one form of irrigation that shows considerable potential for increasing agricultural production. Although individual plots are small, collectively they encompass 20,000 hectares, nearly 10 percent of the country's total irrigated area. Garden irrigation provides dispersed, intensive production, often of high-value horticultural crops such as tomatoes, greens, onions, and other vegetables. These systems, which are entirely under farmers' control, along with other types of irrigation projects, expand the strategies available for irrigation development.

ACCELERATING GROWTH WITH EQUITY

S COMMODITY PRIORITIES AND REGIONAL MARKET OUTLETS IN SUB-SAHARAN AFRICA

Semi-arid West Africa. Since the mid-1980s, regional government organizations and international donors have put the issue of promoting regional agricultural trade at the center of development policy debates in West Africa. Although there is strong consensus about the desirability of this approach, researchers have different reasons for favoring it and thus have different ideas about how to implement it. IFPRI's ongoing work in this area attempts to contribute information on the costs and benefits of different options in order to facilitate the policy debate.

In the Sahelian countries, per capita consumption of rice and wheat has increased on average 16 kilograms or more a year during the last 20 years, leading to rising imports. Some policymakers and donor organizations view these rapidly increasing imports as a major threat to smallholder agriculture and have favored protecting regional cereals markets by increasing cereal prices in order to raise producer incomes and increase the supply of cereals in rural areas. Initial IFPRI research indicates that this strategy would not slow rice imports into the region and that the higher cereal prices would hurt large numbers of people in both rural and urban areas. Research in Burkina Faso, for example, found that from 1981 to 1985 rural households purchased up to 50 percent of the cereal they consumed. In Burkina Faso, income sources from crop production were as low as 25 percent, and households were found to

have off-farm income that was greater than that from cereal production.

In addition, cereals may not have the greatest potential for intraregional trade. Results suggest that the patterns of specialization in production and trade among West African countries allow for a much more diversified exchange of commodities at significantly higher levels. For example, whereas West African exporters of vegetable oils, mainly groundnuts, complain about declining demand in distant foreign markets, findings show that the regional market for vegetable oils has been growing two-and-a-half times faster than international demand. This raises the general question of the ability of West African exporters to capture the potential of regional markets. The results indicate that the contribution of cereals to regional market integration may be insignificant and that regional cereal protection is very likely to reduce food security in rural areas.

Zambia. Research in Zambia during 1990 examined the current and prospective market for sorghum to determine policy options for developing the commercial sorghum subsector. Research suggests that demand in Zambia for 110,000 tons of sorghum for the feedgrains and beer markets can be met if grain productivity is stabilized. This requires emphasis by national and international plant breeders on those traits that have market potential.

DETERMINANTS AND FOOD SECURITY EFFECTS OF INCOME DIVERSIFICATION

Research in Burkina Faso examining the determinants and effects of household income diversification indicates that harvest shortfalls and terms of trade drive diversification, but land constraints do not. It also finds that income diversification is associated with higher incomes and food consumption and more stable income and consumption over the long term. Development and intensification of agriculture in the high-potential zone would create more farm labor demand and lower grain prices, which would provide off-farm employment to the poor, promote the growth of nonagricultural activity, and benefit net purchasers of grain in the lower potential zones.

PRICE STABILIZATION

Past IFPRI research in Bangladesh indicated that price stabilization can be achieved through the use of a target price band within which price fluctuations are restricted. Follow-up research in Bangladesh has been concerned with determining the optimal levels of stocks within these price bands as well as the fiscal costs of the stabilization program.

One reason the Government of Bangladesh maintains stocks of foodgrains is to ensure the needed supplies for its rationing and targeted distribution programs. IFPRI research indicates that the ongoing activities of these programs, particularly open-market sales and procurement, contribute to the stabilization of prices in the market. More timely interventions through open-market operations and targeted food distribution to the poor may be accomplished with fewer stocks than the

government has been holding recently. However, the choice of optimal stocks is not the critical factor in budgetary costs of the price stabilization schemes; pricing rules and the extent of nonprice distribution largely determine the costs.

Estimates of stabilization practices in Bangladesh indicate that by late 1990 the government was maintaining 40 percent more stocks than necessary. IFPRI assisted in developing mechanisms for foodgrain production and demand projections that will enable the Government of Bangladesh to minimize the need for such large stocks. The research suggests that the estimates of optimal stocks vary with stabilization procedures, particularly pricing regulations related to public procurement and release of foodgrains.

INFRASTRUCTURE

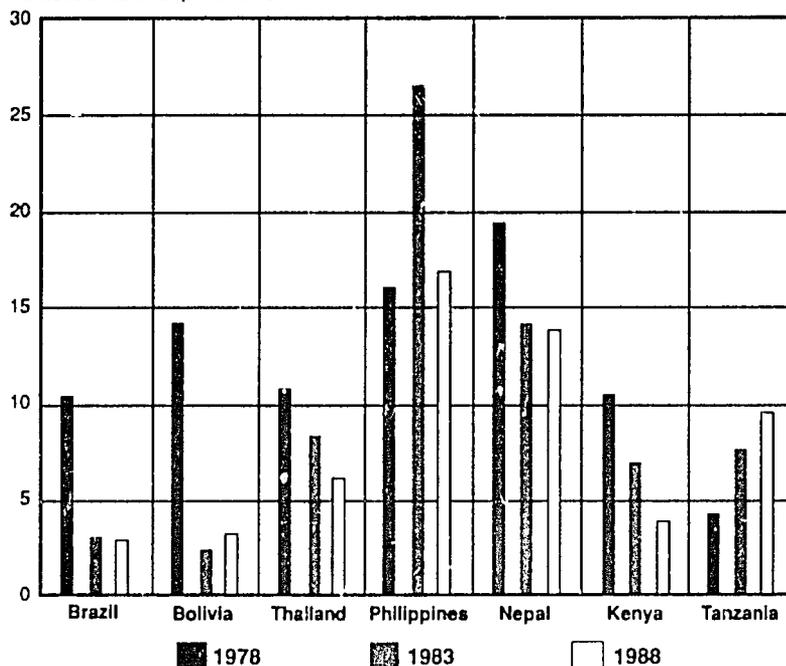
Developing countries generally focus their policies for agricultural development on direct production inputs including fertilizer, seeds, and farm machinery. Rural infrastructure, which plays a critical role, may be overlooked, often because of the difficulty of measuring its direct and indirect effects. But infrastructure contributes to employment opportunities off the farm, improvements in marketing, labor mobility, and strengthened linkages between the farm and nonfarm sectors. The difficulty of measuring the direct and indirect effects of infrastructure has contributed to the lack of data concerning its impact on the rural poor, an area of research that IFPRI continued to address during 1990.

An analysis of the state of infrastructure, including estimates of the costs of adequate infrastructure in the developing world, also continued during 1990. Road densities in Africa have been found to be very low, usually less than 0.5 kilometer per square kilometer of land, and deterioration is rapidly occurring. In spite of this, international lending and domestic investments in infrastructure have not been sustained over time, gradually becoming less important as structural lending and other sectors in the economy receive more funds. Analysis of World Bank lending commitments shows that lending for infrastructure projects in the 1980s was 52 percent of total lending commitments in the late 1960s. From 1978 to 1988, many developing countries reduced their allocations to transportation and communications relative to other sectors (see Figure 6). Kenya, for example, reduced expenditures from 10.9 of the total to 4.2 percent during this period. A few countries, including Tanzania, increased the proportion of expenditures to transport and communications, but they were exceptions.

A survey of country-level statistics for selected countries in Asia, Africa, and Latin America indicates a serious lack of basic information concerning the quantity and quality of infrastructure. Estimates of the cost of rural road construction vary greatly across regions and between different construction techniques. Initial study results indicate that road construction costs are substantially lower in Africa than in Asia. In an analysis of 60 road construction projects, the lowest cost was for gravel roads in Africa, averaging US\$11,000 per kilometer. The costs of roads of similar quality in Asia averaged US\$34,000 per kilometer. The difference was even greater for paved road construction, with African roads costing an

Figure 6
Government expenditures on infrastructure (transport and communications), 1978-88

Percent of total expenditures



Source: Basic data from International Monetary Fund, *Government Finance Statistics Yearbook* (various issues), IMF, Washington, D.C.

average of US\$80,000 and Asian roads US\$265,000 per kilometer. Part of the difference in cost between Africa and Asia can be attributed to the presence of more rivers and watersheds in Asia. Further work is needed on the construction and maintenance processes as well as decision tools for resource allocation to infrastructure. Current methods are inappropriate across different sectors of the economy.

IFPRI also completed a study that establishes an empirical basis for evaluating the effect of infrastructure development on rural areas. In *Developmental Impact of Rural Infrastructure in Bangladesh*, Research Report 83, Raisuddin Ahmed and Mahabub Hossain find that infrastructure is the central element of rural growth strategies and that its effects are positive and profound. The study examines the effects of infrastructure in 16 villages grouped according to their degree of infrastructure development.

Related to agricultural production, the study finds that fertilizer costs were 14 percent lower, wage rates were 12 percent higher, and crop output was 32 percent higher in villages with more developed infrastructure. Income levels in the three most developed villages increased by 24 percent from agricultural output and 78 percent from livestock and fisheries compared to the three least developed villages. The study suggests that these findings are likely to hold true for many developing countries in Asia and Africa and that in view of the crucial role of infrastructure in the economic development of Bangladesh, a fresh look at rural infrastructure is needed.

AGRICULTURAL RESOURCES AND THE ENVIRONMENT

AGRICULTURAL CHANGES IN AGROECOLOGICAL ZONES

IFPRI has begun a line of research to identify and measure the extent to which agroecological constraints determine (both independently and vis-à-vis agricultural policies) the direction and speed of agricultural transformation. Research in Brazil includes analysis of agricultural change from 1970 to 1985 for 55 agroecological zones characterized by soil type, rainfall, topography, and altitude.

Preliminary results for output per hectare and production techniques suggest that there are major differences across agroecological zones, wide differences within agroecological zones, and substantial overlaps in these differences by agroecological zones. For example, in 1980 maize yields varied dramatically across agroecological zones with different agricultural potential. A poor, low-potential zone in northeastern Brazil averaged 0.3 ton per hectare, which was substantially less than the 2.3 tons per hectare average yield of an affluent, high-potential zone in the southeast. Moreover, wide ranges of yields were discovered—0.1 to 1.4 tons per hectare in the northeastern zone, and 0.7 to 6.0 tons per hectare in the southeastern zone. These ranges are likely due to variations within the zones in the natural resource base and the application of already-existing, yield-boosting technologies. This finding indicates the enormous potential for enhanced productivity through broader use of current production technologies and points to wide distribution of intensity of input use as a common element spanning agroecological zones.

The research also suggests that during the early stages of agricultural development, agroecological constraints are more important than the policy environment in determining agricultural production—both in terms of crop choice and input use. As development proceeds, however, technical change and the policy environment that promotes it become increasingly important and may eventually override ecological and climate constraints.

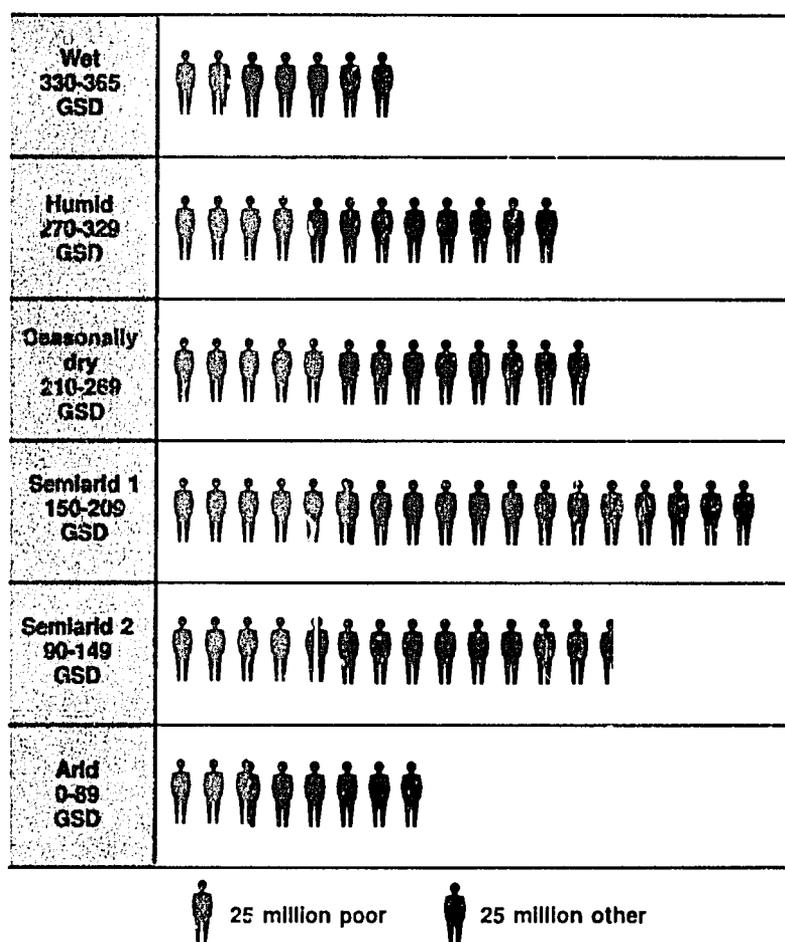
POVERTY AND AGROECOLOGICAL ZONES

During 1990, on behalf of the Technical Advisory Committee to the CGIAR, IFPRI undertook research on the distribution of poverty within the developing countries, based on agroecological zones for each of the major geographic regions. The research characterizes poverty according to calorie consumption and uses data from household surveys conducted principally by IFPRI and the World Bank in Sub-Saharan Africa, South and Southeast Asia, South America, and Central America and the Caribbean. The research uses the FAO agroecological zone classification, based on the number of days in the growing season. The six zones include wet, 330-365 days;

humid, 270-329; seasonally dry, 210-269; semiarid 1, 150-209; semiarid 2, 90-149 days; and arid, 0-89 days. The extremes range from the rain forests in the wet zone to the deserts in the arid zone. Most of the world's agricultural production occurs in the seasonally dry and semiarid 1 zones.

Of the 1.8 billion people surveyed thus far in 72 countries, the analysis indicates that the wettest and driest zones together account for only 21 percent of the population and 19 percent of the poor. Forty-three percent of the population, or about 780 million, live in the seasonally dry and semiarid 1 zones (see Figure 7). Overall, 35 percent of these are classified as poor. However, there are important regional differences. Forty percent of the people in these zones of Sub-Saharan Africa and almost 50 percent in Central America and the Caribbean are classified as poor. In South Asia these zones account for 35 percent of the poor, in Southeast Asia for 44 percent, and in South America only 25 percent.

Figure 7
Distribution of total and poor populations for 72 developing countries, by agroecological zone



Note: GSD = growing-season days.

Source: Peter Cram.

This ongoing research suggests that to reach the greatest number of poor, technological improvements in agriculture in the seasonally dry and semiarid zones would have the greatest effect. Thus research focused on the problems of natural resource management, farming systems, and agricultural commodities that form the main components of the diets of the poor in those agroecological zones. In aggregate the seasonally dry and semiarid 1 zone¹ represent 45-50 percent of total calorie production in all geographic regions except South America (22 percent), where the largest share of total calorie production comes from the wetter zones.

COMBATTING ENVIRONMENTAL DEGRADATION IN SUB-SAHARAN AFRICA

Combatting environmental degradation, from deforestation, overgrazing, and cultivation of marginal lands is one of the strategies for increasing food production in many parts of Sub-Saharan Africa. In countries in the Sahelian region and Ethiopia, for example, where the high degree of land degradation plays a large part in increasing the susceptibility of farming systems to the shocks of drought, projects that provide employment in resource conservation and restoration show particular promise. IFPRI has begun to look at the contribution of these projects to food security through their payment in kind or cash (see the Food Consumption and Nutrition Policy Program). In countries like Ethiopia, where soil loss from cropped area in the 1980s reached about 42 tons per hectare and resulted in production losses of 1-2 percent a year, and Niger, where 75 percent of the land is classified as desert, it is hoped that these types of projects begun primarily with international support will contribute to reducing further degradation.

AGRICULTURAL GROWTH LINKAGES PROGRAM

Research in the Agricultural Growth Linkages Program examines how technological change in agriculture affects national economic growth and the welfare of the poor. A central question addressed in this research effort is, To what extent does increased agricultural productivity and the higher incomes associated with adopting technological change contribute to increased demand for other goods and services? An important component of the research undertaken in the Program is the nature and effect of government policies on agriculture.

During 1990 the research effort included analysis of data from rural Zimbabwe, analysis of data in Pakistan, Brazil, and the Republic of Korea, and continued work on the historical and quantitative aspects of resource transfers in Chile and in Punjab, India.

R GROWTH AND EQUITY IN RURAL AREAS

Research in this area is designed to provide a better understanding of the effects of technological change on rural poverty so that projects, policies, and institutions can be designed to mitigate the negative and enhance the positive effects. During 1990, analysis was completed on a comparison between the availability and use of services in rural Zimbabwe, and work continued on the links between education and economic growth in Pakistan, Brazil, and the Republic of Korea.

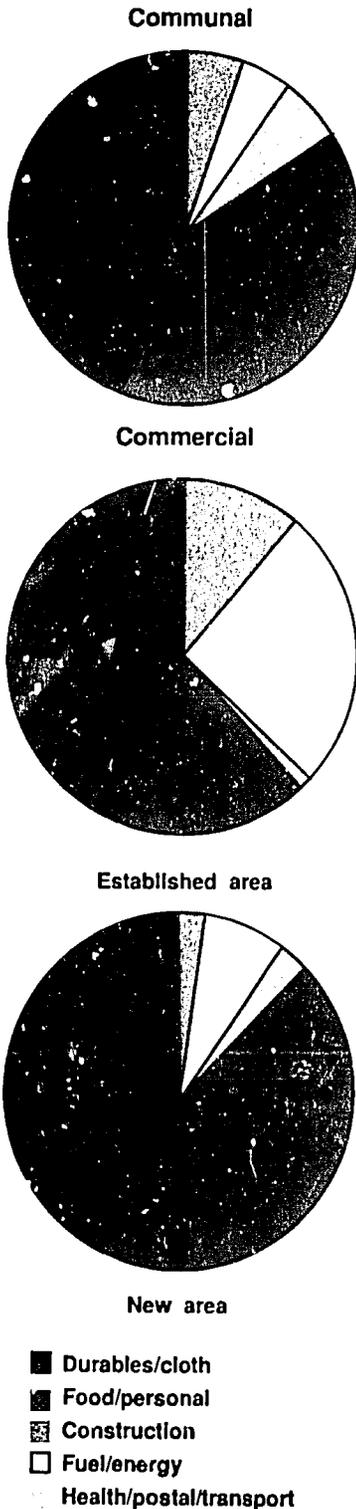
RURAL SERVICE USE IN ZIMBABWE

Historically, Zimbabwe has had one of the best agricultural performance records in Africa, primarily because of policies to promote the commercial sector. In recent years the government has shifted attention to the smallholder, or communal, sector in an effort to boost its performance record. IFPRI has been conducting research that compares the commercial and communal farming sectors. Specifically, IFPRI has been investigating the effect of access to rural infrastructure on agricultural development.

Research finds that communal and commercial farmers in Zimbabwe differ in what they produce and what services they use. In Gazaland District, approximately half of the typical communal farmer's 5 hectares is sown with local and hybrid maize, and one-third of the holding is allocated to vegetables, fruits, and other cash crops. Almost half of the typical commercial farmer's 170 hectares is used for cultivating cotton, and the remainder is sown with other cash crops.

The differences in type and scale of production are dramatically reflected in the contrasting demand for consumption and production services. Three-fourths of the communal farmers rely on Ministry of Agriculture extension agents, while commercial farmers rely on these and market board agents, cooperative societies, contract farmers, friends and neighbors, and demonstration plots. The more reliable sources of extension used by commercial farmers have higher associated costs. The newly established and well-established commercial farm-

Figure 8
Expenditures of communal and commercial farmers in Gazaland District, Zimbabwe, 1987-88



Source: Sudhir Wanmali.

ers spend, respectively, from 4 to 40 times more on extension services than communal farmers. Commercial farmers spend 10 to 30 times what communal farmers spend on inputs and 3 to 30 times as much as communal farmers on implements. Commercial farmers market 700 to 900 times the amount of crop and animal products marketed by communal farmers (see Table 1). On the consumption side, differences in purchasing patterns are less dramatic (see Figure 8), but the transitions between the communal, newly commercialized, and established commercial farms are apparent.

The analysis indicates that access to service centers, measured as distance to the nearest transport access for communal farmers and as distance to Chipinge town for the more mobile commercial farmers, has a greater effect on annual demand for services by communal farmers than on demand by commercial farmers. Distance does not affect the purchase of consumer goods and services for commercial farmers, but if access to transportation were brought one kilometer closer to the village, the average communal farmer would spend an additional Z\$110 on durables and cloth, an additional Z\$320 on food and personal items, an additional Z\$26 on fuel and energy, and an additional Z\$48 on postal services. The average communal farmer would also buy an extra Z\$85 dollars of inputs and sell an extra Z\$303 of output.

The results suggest that access improvement could be a viable way to develop intraregional linkages while reducing inequities between commercial and communal households.

Table 1
Purchases and sales, communal and commercial farmers in Gazaland District, Zimbabwe, 1987/88

Factor/ Output	Communal	Commercial	
	Aggregation of Six Areas	Established Area	New Area
	(Zimbabwe dollars)		
Purchases			
Inputs	132.19	3,654.77	1,039.50
Implements	70.06	2,258.41	272.66
Extension	7.57	357.77	28.71
Sales			
Crops/livestock	419.54	374,134.99	286,264.67

Source: Sudhir Wanmali.

EDUCATION AND DEVELOPMENT

IFPRI's work on education and development addresses a number of questions. Among them: How much is education an investment good that increases labor productivity and contributes to economic growth? How far does educational expansion yield the social advantage of reducing various kinds of economic inequality? What are the determinants and consequences of the rapid increases in educational attainment of rural populations currently occurring in many developing countries?

Pakistan. IFPRI's research on human capital accumulation in rural areas continued during 1990 with analysis of the data generated in Pakistan during the prior two years. 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. The data indicate that there is a large gender gap in cognitive skills. For example, in the 20- to 24-year-old group the mean cognitive skill score (on literacy and numeracy tests) for women was only 24 percent of that for men. Preliminary analysis indicates that contrary to conventional wisdom, three-fifths of this gender gap in cognitive achievement in rural Pakistan, where there is a predominance of single-sex schools, is directly accounted for by the low availability of schools for girls. Lack of demand for education of girls does not seem to be the main source of the problem. The results suggest that to eliminate the cognitive achievement gender gap, policies are needed to eliminate the school supply gap rather than to address biases embedded in incentive structures or household preferences.

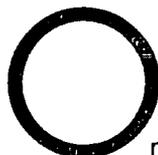
Brazil and the Republic of Korea. The rapidly growing countries of East Asia have had a substantially more equal distribution of income than those of Latin America. Korea and Brazil fit the general pattern. The ratio of the income share of the top 20 percent to the bottom 20 percent was 8 in Korea and 33 in Brazil in the early 1980s. Countries experiencing rapid economic growth and equality of wages usually have large numbers of educated people. IFPRI research undertaken in 1990 comparing Brazil and Korea during the 1970s and 1980s suggests that Brazil underinvested in education, constraining the growth of labor productivity and limiting progress toward a more equal income distribution (see Table 2). During the same period, Korean educational expansion continued to reduce inequalities of pay. The research found that as much as 25 percent of the difference in the inequality of wages between the two countries may be attributed to their different educational policy regimes.

Table 2
Inequality, economic growth, and school enrollment in Brazil and Korea

Country	Income Share			Average Annual Growth In GNP, 1960-81	School Enrollment			
	Bottom 20 Percent	Top 20 Percent	Ratio of Top to Bottom		Secondary		Post-Secondary	
					1965	1985	1965	1985
	(percent)			(per capita)	(percent)			
Brazil	2.0	66.6	33.30	5.1	16	35	2	11
Korea	5.7	45.3	7.95	6.9	35	94	6	32

Source: Richard Sabot.

RESOURCE TRANSFERS IN THE NATIONAL AND PROVINCIAL ECONOMIES

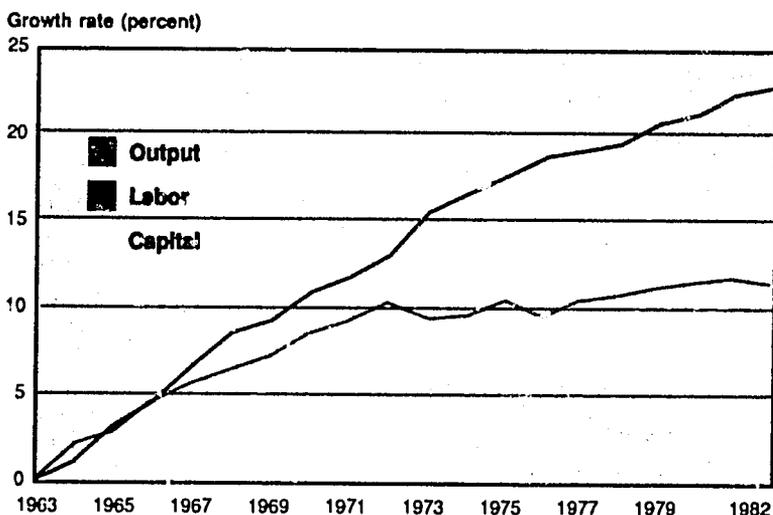


AGRICULTURE AND ECONOMIC GROWTH IN CHILE

One focus of IFPRI research has been the evaluation of policies that affect the determinants of growth within the national economy. The evaluation of the effectiveness of these policies requires an evaluation of their impact. Much of the ideological basis for policies directed toward agriculture, particularly the case in Latin America, rests on the assumption that agricultural output is unaffected by prices. But this suggests that either farmers are indifferent to income or that they have no way to take advantage of changing opportunities. It is probably the latter that has led to the view that agriculture is unresponsive.

During 1990, IFPRI continued research on the supply response in agriculture using a multisector model of the Chilean economy that is estimated econometrically using data from 1962-82. The analysis indicates that output responds to price changes and that the strength of the response increases with time. The response of agriculture to prices is evaluated based on total resources in order to highlight the substitution effect. The response to a 10 percent change in the real price of agriculture resulted in a 4.4 percent increase in output after 4 years and converged to a 10 percent level after 10 years (see Figure 9). This increase in output was achieved by an increase in employment and investment. The response of labor was stronger and was achieved by a decline in the off-farm migration.

Figure 9
Changes in agricultural inputs and output with a 10 percent increase
in agricultural prices in Chile, 1963-82



Source: Yair Mundlak.

The research suggests that policies, such as taxation of agriculture, are often followed for many years because there is little effect on output in the earlier years. However, the damaging effect may be cumulative.

The research analyzes in detail the determinants of productivity in agriculture. It indicates that productivity responded favorably to the expected rate of return to capital as well as to the availability of comprehensive (human and physical) capital. Also, the research examines the effect of land reform implemented during 1965-73. The reform had a slight positive effect on productivity in the first four years, but the situation was reversed thereafter to yield negative results.

AGRICULTURAL GROWTH AND DEVELOPMENT IN PUNJAB

Punjab has emerged as the richest Indian state since the introduction of new agricultural technology in the 1960s. Agriculture has grown at an annual rate of 4.5 percent, manufacturing at 5.6 percent, and services at 6.8 percent. During 1990, IFPRI published *Agricultural Growth and Structural Changes in the Punjab Economy: An Input-Output Analysis*, Research Report 82, by G.S. Bhalla, G.K. Chadha, S. P. Kashyap, and R. K. Sharma, which shows how rapid agricultural transformation can not only become a potent instrument for generating phenomenal growth in agriculture, but can also lead to even faster growth in the manufacturing and service sectors through close input, output, and consumption linkages.

Although agriculture dominates the state's economy, growing diversification in Punjab can be seen in the decline of agriculture from a share of about 60 percent in 1960/61 to 50 percent in 1983/84, while manufacturing increased from 14 to 17 percent and services from 25 to 33 percent. The structural changes that occurred are reflected in the increasing capitalization and greater use of intermediate inputs in the production process, the strengthening of intersectoral linkages, and the generation of higher indirect and induced income and employment in a larger number of sectors.

Public investment in rural infrastructure—irrigation and power, scientific research, extension services, credit institutions, roads, and markets—has been the most crucial element in the successful adoption of the new agricultural technology in Punjab. Its assured profitability has encouraged farmers to make substantial private investments in irrigation, land improvement, and other farm assets.

FOOD CONSUMPTION AND NUTRITION POLICY PROGRAM

Analyzing alternative policies for the alleviation of hunger and malnutrition in the Third World is central to the work of the Food Consumption and Nutrition Policy Program. Research in the Program is focused on improving the diets, family welfare, and equity of the populations of the Third World through better understanding of the linkages between production, employment, consumption, and nutrition.

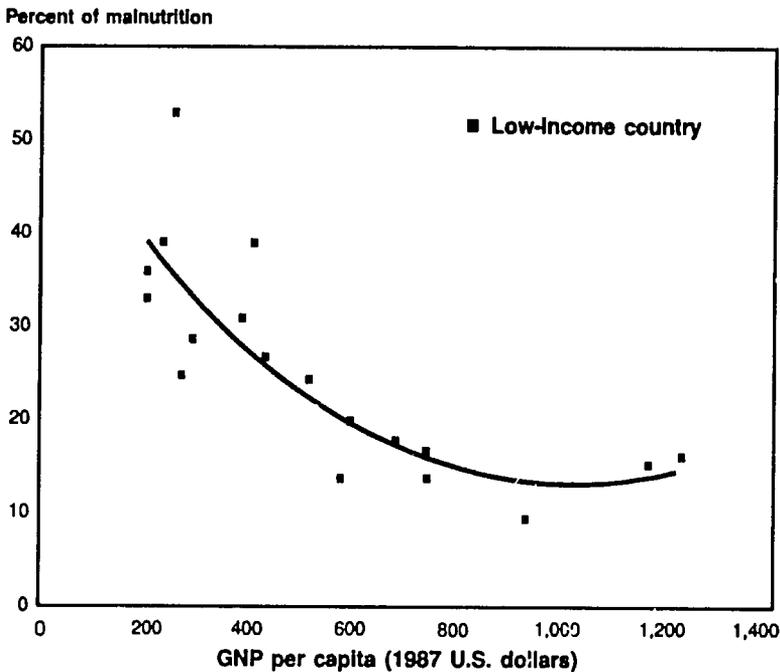
During 1990, research in the Program dealt with identification of recent trends in the nutritional status of Third World populations, improvement of food security through public works and credit programs, as well as through technological change and commercialization of agriculture, prevention of food crises and famines, the nature of hunger and malnutrition, and regional networking for nutritional improvement. Research was conducted in Sub-Saharan Africa, Asia, and Central America.

T NUTRITIONAL TRENDS

The Consumption and Nutrition Program and the United Nations Subcommittee for Nutrition are undertaking research to identify trends since the 1970s in the nutritional status of the populations of the developing countries. Results indicate that in many parts of the world, average dietary energy intakes improved during the last 25 years. Specifically, food availability for the marginal populations of South and Southeast Asia, Central America, and the Near East increased, while in Sub-Saharan Africa per capita food availability declined. The number of undernourished in Sub-Saharan Africa rose to 100 million in 1983/85, the highest level recorded in the preceding 20 years. In addition, estimates of the nutritional status of children indicate that improvements witnessed in the 1970s ceased during the 1980s.

A basic premise of the Program's work is that economic growth coupled with public actions to improve nutrition and health are the key factors influencing household food security and nutrition. Research has shown that when economic growth occurs and incomes rise, there is a downward trend in malnutrition in the least-developed countries (see Figure 10). However, there is a range of variance around the trend, suggesting that some low-income countries are more successful than others in reducing malnutrition levels. For those that are less successful, there is a need for increased attention to policies that are country specific and scope for learning from the success stories.

Figure 10
Rural malnutrition in 18 low-income countries in the mid-1980s



Source: Joachim von Braun.

FOOD SECURITY THROUGH INTERVENTIONS IN LABOR AND FINANCIAL MARKETS

Past IFPRI research has demonstrated that food subsidies, if properly targeted, can increase household food consumption at manageable costs. Interventions that increase incomes through enhanced employment opportunities and stabilize consumption through improved access by the poor to financial markets can also have favorable effects on food security. During 1990 IFPRI initiated research on increasing food security through public works programs in Sub-Saharan Africa and improving financial markets in the Third World.

PUBLIC WORKS FOR FOOD SECURITY

Food security is defined as the ability of all of the members of a household to secure sufficient food, in terms of quantity and quality, for a healthy life. Food insecurity is often linked to a lack of income and, by extension, to a lack of employment opportunities. Public works programs—assistance programs that create public infrastructure through labor-intensive means—can mitigate food insecurity. These programs have been widely undertaken in Asia. Past research at IFPRI has examined their

effectiveness in Bangladesh and India. But public works programs have been used less extensively in Africa, and there has been little study of their potential effects.

In 1990 IFPRI reviewed the experience of public works programs in 13 African countries. Sharp increases in unemployment and high costs of foreign exchange resulting from structural adjustment programs during the 1980s led 10 of these countries to actively expand their public works programs. The analysis indicates that the types of programs have varied by country. For example, in Zimbabwe and Botswana, public works activities, particularly road construction and irrigation projects, have been implemented by the government during and after food emergencies. In Niger, pilot employment-creation projects have focused on resource conservation and afforestation. And in Kenya, employment opportunities have been used to control erosion and build roads. The research is examining which approaches are successful under which circumstances.

CONSUMPTION CREDIT

A major constraint for those facing temporary food insecurity is a lack of credit opportunities. Access to rural financial systems enhances the ability of the poor to purchase food during seasonal shortfalls, promotes the use of new technologies, and contributes to the capital investments and education opportunities. Recent IFPRI research in Pakistan shows that the rural poor borrow mostly from the informal market and that a large proportion of credit is for the purchase of food when crops have not yet been harvested, when shortfalls in production occur, and so on. During 1990, IFPRI initiated research on the design and potential of sustainable credit and savings schemes for reducing food insecurity of the rural poor in Sub-Saharan African countries. A better understanding of existing indigenous informal institutions at the household and community levels is seen as the key to designing viable credit and savings schemes to address food security problems.

T TECHNOLOGICAL CHANGE AND COMMERCIALIZATION

Technological change and commercialization in agriculture are important elements of a rural poverty alleviation strategy. IFPRI research suggests that, usually, the effects of technology and commercialization stimulate agricultural growth, improve employment opportunities, and expand agricultural supplies. When these benefits are not found, it is often because bad policies related to constraints on trade, production disincentives, or the like create adverse scenarios. However, this research also indicates that while some cost-effective targeting schemes exist, technology and commercialization cannot be easily targeted to the poor. Ongoing research at IFPRI focuses on how to enhance the overall positive effects of these programs for rural economic growth while avoiding the negative ones.

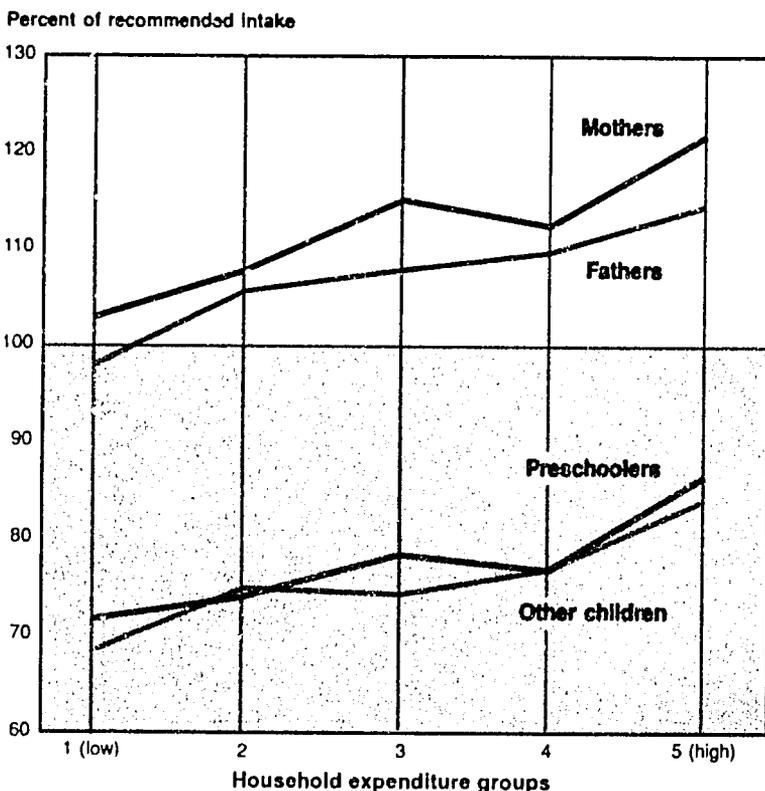
CORN AND SUGAR PRODUCTION IN THE PHILIPPINES

One of several studies of commercialization of agriculture undertaken by IFPRI in recent years, *Effects of Agricultural Commercialization on Land Tenure, Household Resource Allocation, and Nutrition in the Philippines*, Research Report 79, by Howarth E. Bouis and Lawrence J. Haddad, looks at the shift from corn to sugar production in Bukidnon Province.

The study, which surveyed households that had switched to sugarcane production and corn-producing households for which sugarcane production was not profitable because of their distance from the mill, found that the introduction of sugar resulted in a deterioration in access to land, particularly for corn tenants. All households that shifted to sugar production continued to grow some corn. However, sugar production was more profitable for smallholders than corn production, with net returns for corn averaging 2,050 pesos per hectare a year and for sugar averaging 4,500 pesos per hectare a year.

The study found that for all persons surveyed, on average mothers and fathers were meeting required calorie intakes, while their children were not (see Figure 11). Preschool children in sugar households were sick more often than those in households primarily involved in corn production.

Figure 11
Calorie adequacy ratios of parents and children in Bukidnon Province, Philippines, 1984/85



Source: Howarth E. Bouis and Lawrence J. Haddad.

The study suggests that export cropping can contribute significantly to raising incomes of smallholders in the Philippines, but that improving corn productivity to prevent further deterioration in access to land, expanding export cropping among smallholders, and educating parents about health and nutrition are some government initiatives needed in this area.

STRUCTURAL ADJUSTMENT AND NUTRITION IN THE GAMBIA

During the past decade, the growth of food production in West Africa was even lower than the highly unsatisfactory growth in Sub-Saharan Africa as a whole. The Gambia was no exception. In *Structural Adjustment, Agriculture, and Nutrition: Policy Implications in The Gambia*, Working Paper 4 in IFPRI's series on commercialization of agriculture and nutrition, Joachim von Braun, Ken Johm, Sambou Kinteh, and Detlev Puetz assess changes in consumption and nutrition during a period of structural adjustment. As a result of adjustment, rice availability increased in rural areas and its price decreased, the price of groundnuts increased, input markets were privatized, and credit for agriculture was restructured.

The study finds that calorie consumption increased slightly during the study period because oil and sugar became less-expensive sources of calories. However, the percentage of malnourished children—measured as children falling below 80 percent of the median weight-for-age—increased by 11 percent, and weight-for-height in others decreased by less than 1 percent. The decline in nutritional status was linked to adverse health and sanitation conditions.

Although structural adjustment provided incentives for the agricultural sector, most of the price policy changes produced substitution effects between groundnuts and staple foods, particularly millet. In one area of the study, the share of groundnuts in total production increased from 56 to 75 percent between 1985 and 1987. In addition, fertilizer use fell by 60 percent between 1984 and 1987. The study suggests that efforts to increase agricultural production in The Gambia should focus on improving access to and increasing the use of fertilizer, increasing the use of low-cost irrigation, and promoting mechanization where land is in excess supply.

WOMEN AND CASH CROPS

As part of the work on technological change and commercialization, it has been possible to examine a range of their effects on women's economic roles and on nutrition within rural households. IFPRI studies have been carried out in Guatemala, the Gambia, Kenya, Rwanda, Zambia, and the Philippines. Because of the diversity of the regions studied and the complexity of the issues involved, it is difficult to draw generalizable conclusions on the overall impact on women's health and nutrition. During 1990, in-depth analysis of the results of these studies continued.

The research indicates that women have had limited involvement in using new technologies. Limited access to inputs and credit by women was a contributing factor, even when the projects tried to include them, as in The Gambia, where irrigated

land was given to women for growing rice—traditionally a women's crop. In The Gambia, women controlled 10 percent of the rice fields in the new pump-irrigated scheme, compared with between 70 and 90 percent of the traditional rice fields.

In general, the share of labor input by women in the new crops was less than their share of the traditionally grown crops, for which they may have had a greater responsibility. The only exception was in the case of Guatemala, where women contributed 31 percent of family labor for the new crop of snow peas, compared with 25 percent for traditional vegetables and 9 percent for maize. Also, on a per hectare basis, the labor input of women was lower than that of men for new crops. In addition, farm size usually increases with commercialization, and an increase in farm size is generally accompanied with a decline in the share of women's labor and an increase in hired labor.

These observations suggest that women's labor declined with commercialization. However, in some cases this was not true. For example, in The Gambia, where women's labor share was 60-80 percent for traditional rice, but only 29 percent in the new pump-irrigated rice, the total labor of women in agriculture increased by about 16 percent. In the Gambian case and elsewhere, the new crops were largely incremental in area to existing crops, and women continued their work there as well. Thus, while on a per hectare basis women's labor seemed lower in the commercializing households, when total hectares are computed, it is likely to be higher. Similar results were found for Zambia and Rwanda. Changes in labor inputs are important when assessing changes in nutritional status, adequacy of child care and nutrition, and use of health and other services, and therefore need to be measured and analyzed carefully.

With commercialization, substantial increases in household incomes were observed in all of the studies, and increased incomes were linked to increased household food consumption. However, in many cases nutritional status for women did not improve. The lack of a significant improvement in individual nutritional status could be the result of increased labor input without a concurrent increase in caloric intake.

In cases where it was possible to measure the level of women's income derived from both agricultural and nonagricultural sources, research confirmed that women have a higher propensity to spend on household food consumption than men. However, it is not clear why this is the case. This effect is most evident for certain types of female-headed households.

FOOD CRISES AND FAMINES

FPR's continuing work on famine examines the extent to which production fluctuations and policy and market failures contribute to the causes and effects of famine. This is an area in which policymakers have been impaired in their work by a lack of empirical data. In an effort to identify better famine relief and rehabilitation interventions and to fill this information gap, research during 1990 focused on how vulnerable households cope in times of crisis.

Household survey data for Sudan and Ethiopia suggest that despite the wide range of experiences encountered at different locations in these countries, the underlying conditions of vulnerability are similar across sites. These include climate-associated production fluctuations, low-level farm technology, lack of employment opportunities, limited asset bases, isolation from major markets, lack of education and training opportunities, and poor health and sanitation conditions.

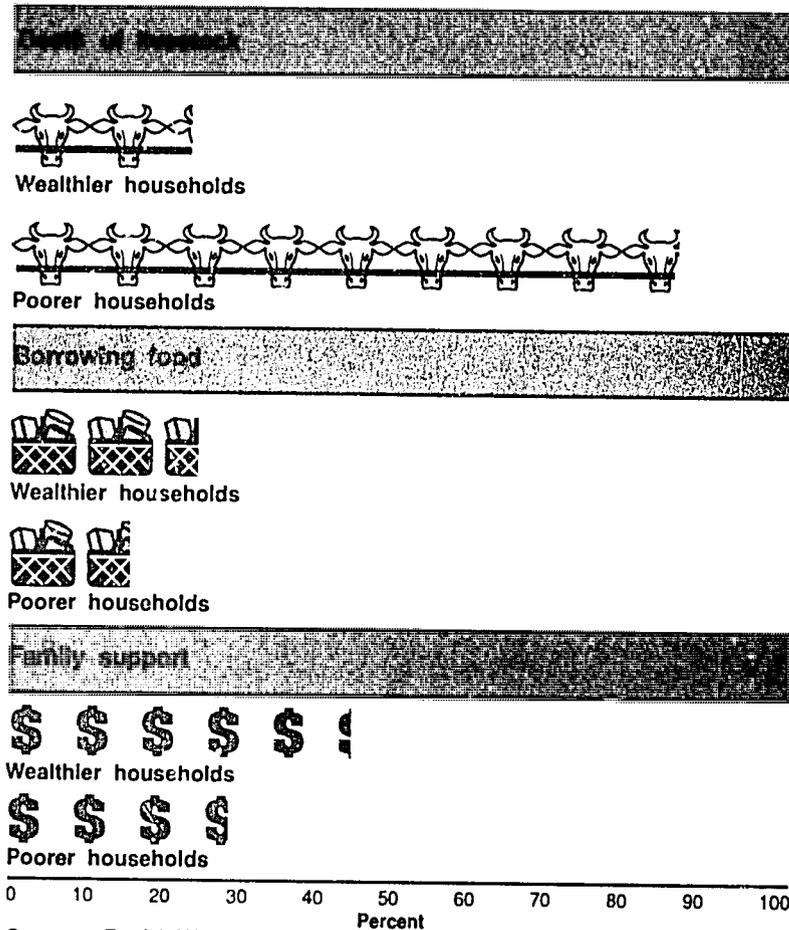
Sudan. In 1990, severe drought conditions, a lack of public policy response to early warnings, and underlying economic policy failures laid the foundation for a new famine in Sudan. Previous IFPRI research on Sudan in the aftermath of the 1985 famine showed that households in the famine-prone areas had hardly recovered by 1988. Because of distress sales and livestock deaths the household asset base was reduced by about 60 percent in 1988 as compared with 1983 in some famine-prone regions such as Kordofan. Thus the vulnerability of the population to current famine conditions has increased.

During 1990, IFPRI research involved the analysis of a representative nutrition survey in northern Sudan that included some 30,000 children. It reveals that in 1986/87—a year between famines—35 percent of the children surveyed were stunted and 15 percent were wasted. The analysis indicates that this is as much due to a lack of community health and sanitation as to a lack of food in poor households. Also during this nonfamine year, 14 percent of the children surveyed lived in households that consumed less than three meals a day. The level of malnutrition was found to be 17 percent higher in these households. It is expected that, as in 1985, the number of households in this group will increase as prices rise and incomes fall as a result of the current famine.

The analysis also found that when parents had attended school, their children had lower levels of malnutrition, and that the education of mothers had twice as great an effect on this as that of fathers. The research found that children with mothers who had attended school were 19 percent better off nutritionally than the average.

Ethiopia. Research in areas of Ethiopia affected by famine finds that response strategies to drought vary with the level of wealth. During the 1984/85 drought, a sample survey in the famine areas found that households with incomes in the top third of the income group maintained crop yields three times higher than households in the bottom third. During the 1984/85 drought, households coped with famine by increasing their dependence on nonfarm income, selling livestock and household and personal valuables, borrowing food and capital, and reducing the number of meals consumed. In each of their response activities, the wealthier households fared better than the poorer. The wealthier households were better able to feed their livestock and lost only 23 percent of their holdings, while the poorer lost about 88 percent of their livestock (see Figure 12). Twenty-five percent of the wealthier households were able to borrow food, compared with 16 percent of the poorer. Similarly, some 43 percent of the wealthy obtained nonfood support from relatives, compared with only 29 percent of the poor.

Figure 12
Responses to famine, wealthier and poorer households, Ethiopia,
1984/85



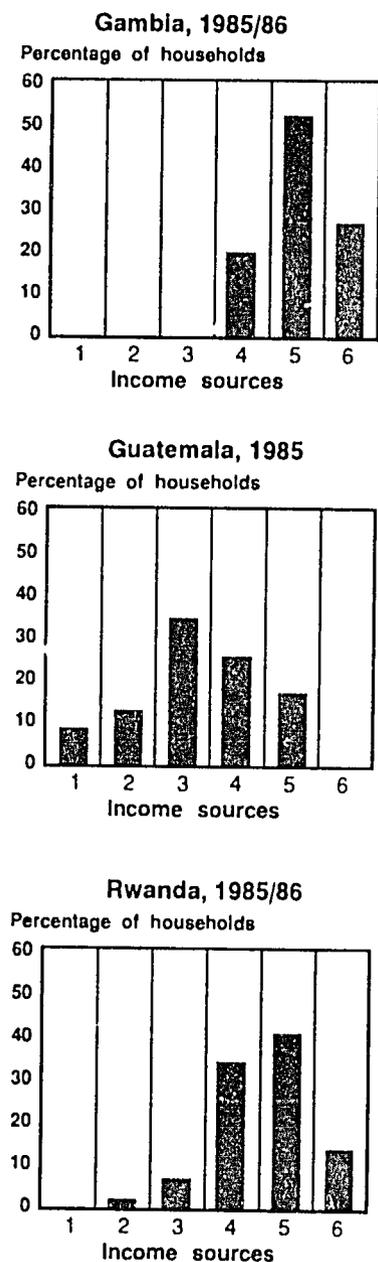
Source: Patrick Webb.

The results suggest that the depth of poverty determines the precise impact of drought and famine, which underlines the importance of incorporating mechanisms to combat the root causes of poverty into strategies for famine prevention. They also point to the need for improved targeting of the absolute poor by relief interventions, such as food-for-work, cash-for-work, and asset distribution programs.

NATURE OF HUNGER AND MALNUTRITION

FPRI and other research have established the links between increased income and increased household food security; however, the links between increased income and an individual's nutritional status are complex and often conditioned by factors other than household food availability. Specifically, intrafamilial distribution of food, weaning and child feeding patterns, health and sanitation conditions, allocation of time and resources of women and children, reproductive behavior, control of income,

Figure 13
Number of income sources of
the malnourished poor, selected
countries



Source: Joachim von Braun and Rajul Pandya-Lorch.

and decisionmaking power all influence nutritional status. During 1990, IFPRI research examining these factors continued.

MONITORING FLUCTUATIONS IN NUTRITION

In order for policymakers to design specific efforts to deal with hunger and malnutrition, they need to know who the hungry and malnourished are, where they are located, and how they are affected by policies and programs already in place. During 1990 IFPRI initiated research to identify this information. Specifically, the research involves taking inventory of and analyzing successful monitoring programs, identifying alternative indicators of nutritional well-being, monitoring community-level programs for nutritional improvement, and monitoring the nutritional status of women. Work has begun to identify case study sites in Sub-Saharan Africa and Latin America.

STRATEGIES OF THE POOR FOR COPING WITH MALNUTRITION

Any effective nutritional improvement program must be based on an understanding of how the malnourished poor earn their incomes and manage the growing, selling, buying, and sharing within the household of food supplies. Using 13 microhousehold surveys collected by IFPRI in the 1980s in Asia, Africa, and Latin America, IFPRI analyzed the sources of income of the malnourished poor. The research finds that in order to cope with risk, the poor diversify their incomes through such activities as subsistence food production, sale of crops, off-farm employment, and self-employment. Fifty-four percent of the malnourished households in Rwanda and 80 percent in The Gambia had five or more income sources, whereas in Guatemala, where there is more specialization of production and more market integration than in Africa, only 17 percent of the households had as many income sources (see Figure 13). The research suggests that policies focused on raising incomes of the poor must be carefully targeted.

Other research focused on the sources of income within the household, comparing the contributions of the male and female members. Research usually deals with the cumulative income without differentiating the source. In the IFPRI study of about 840 households in the Philippines, results suggest that more of a woman's income is spent on food than of a man's. The research found that, at the margin, for every dollar earned by women, 59 cents was spent on food as compared with 47 cents of every dollar earned by men. In the lower-income groups this gap was even wider. The results suggest that policies designed to improve employment and education opportunities for women will likely produce higher levels of welfare in the household as a whole.

PRICE AND INCOME EFFECTS ON MICRONUTRIENT INTAKES

Calorie intake is one indicator of food security; however, dietary quality is closely associated with specific problems related to undernourishment and malnutrition. In the past, most economic

studies of demand for nutrients in low-income countries focused on demand for calories. This resulted from a widely held view among nutritionists that inadequate calorie consumption is the most serious nutrition problem affecting normal health and well-being. However, IFPRI research is beginning to look more closely at the importance of vitamin and mineral consumption, particularly vitamin A, iron, and iodine, by the very poor.

Building on research in the Philippines, during 1990 IFPRI undertook research that analyzed the determinants of household demand for micronutrients in a manner similar to existing studies on the determinants of demand for calories. The study, conducted in sugar- and corn-producing areas, was undertaken during a one-year period when prices of green leafy vegetables doubled. The study found that at the beginning of the period, when prices were low, household intake of vitamins A and C averaged 95 percent and 46 percent above recommended levels. By the end of the period, when prices were high, the intakes dropped to 29 and 47 percent below recommended levels. During this period morbidity levels increased markedly. It also found that although intakes of iron and other minerals were sensitive to income and increased as incomes rose, intakes of vitamins A and C were not related to income levels. The study suggests that although households were aware of levels of calorie consumption and were able to maintain acceptable levels of calorie consumption by adjusting their behavior when prices and incomes changed, they were unaware of fluctuations in intakes of micronutrients.

The research suggests that programs to educate consumers about the importance of receiving the recommended daily allowances of vitamins A and C by eating more green leafy (often home-grown) vegetables could improve nutrition. However, because iron is found in diverse sources of the diet and its use is strongly related to income, such programs would be less successful for increasing intakes of iron. Food fortification or supplement programs may be better for increasing iron intakes in poorer groups.

REGIONAL ANALYSIS OF FOOD SECURITY AND NUTRITION

D

uring 1990 IFPRI continued work in Central America to strengthen the analytical capacity there by training analysts and contributing to institutional networks for information-sharing in the region. The data analysis involved the evaluation of national and household food security conditions and the nutritional status of rural populations and is expected to contribute to a redirection of policies and programs in the region. In collaboration with a number of national and regional institutions, IFPRI undertook studies in five countries—Costa Rica, El Salvador, Guatemala, Honduras, and Nicaragua—in the context of a deteriorating food situation and increasing reliance on food aid. For example, during 1985-88, 28 percent of Guatemalans, 17 percent of Hondurans, and 18 percent of El Salvadorans received food aid.

With collaborators from several countries, IFPRI developed an analytical framework to analyze existing data on household food security and the nutritional status of preschool children in specific rural areas. Initial analysis indicates that chronic malnutrition (based on height-for-age) is much more prevalent than acute malnutrition (based on weight-for-age) among preschool children of the region. The percentage of chronically malnourished rural children ranged from 13 percent in Costa Rica to 74 percent in Guatemala (see Table 3).

To better understand the factors contributing to chronic and acute malnutrition, determinants of food intake—including food production, availability, and use—and of health—including the incidence of disease, sanitary conditions, and access to health services—were included in the analysis. The results differ by country. For example, in Honduras, Costa Rica, and Guatemala, household income—not expenditures on food—was associated with nutrition. Poor health was associated with poor nutritional status in all countries when health variables such as vaccinations, expenditures on health, and the incidence of diarrhea and acute upper-respiratory infections were examined. Although access to piped water was associated with improved nutrition in Honduras and El Salvador, in Guatemala no such association was found. This suggests that rural piped water systems do not guarantee that the water is potable, particularly when resources are lacking to maintain these systems. Overall, the results indicate that reductions in different poverty dimensions are linked with improvements in nutrition.

Table 3
Malnourished children in rural Central America

Country	Acutely Malnourished, Weight-for-Age	Chronically Malnourished, Height-for-Age
	(percent)	
Costa Rica	4.8	12.9
El Salvador	20.2	41.2
Guatemala	40.4	74.0
Honduras	29.2	46.8

Source: Maarten Immink.

INTERNATIONAL TRADE AND FOOD SECURITY PROGRAM

Developing countries typically have open economies in which agriculture is of dominant importance. From a national perspective, a country's trade and macroeconomic policies affect its ability to meet short-term food consumption needs, the incentives for food production growth, and the development of both the agricultural and nonagricultural sectors. World market conditions and the behavior of food exporters and importers often exert pressure on the food systems of developing countries. Research in the International Trade and Food Security Program examines both the national and international issues that affect agricultural growth and rural income in developing countries.

During 1990, research on national policy issues examined the effects of trade and exchange rate policies on production incentives and growth in agriculture, the fiscal effects of agricultural pricing policies, intraregional trade in agricultural products, and structural adjustment in Sub-Saharan Africa. Analyses of international policy issues focused on agricultural protectionism and multilateral trade negotiations and world trade in horticultural products.



NATIONAL POLICY ISSUES

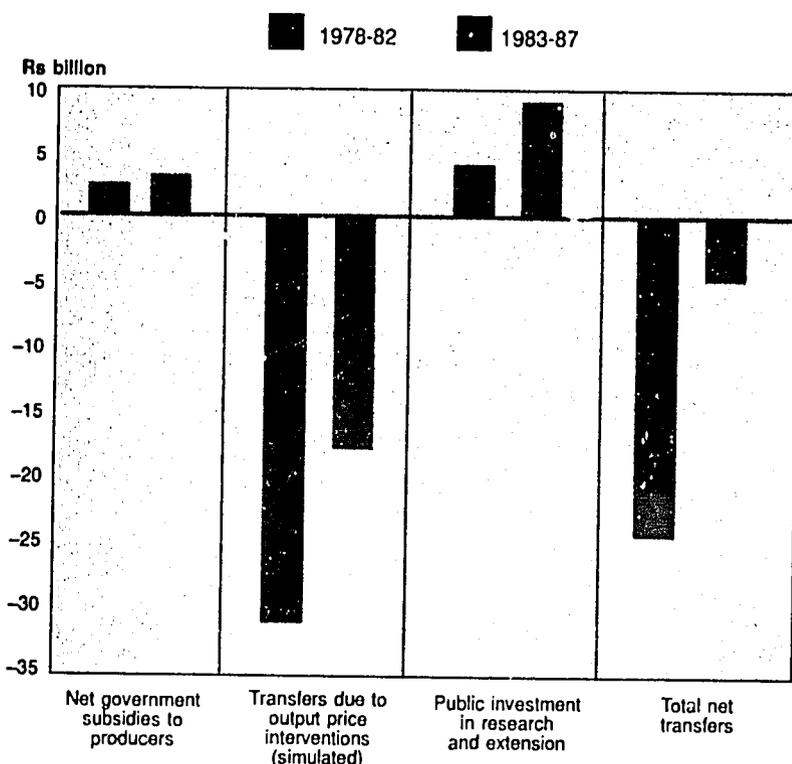
TRADE AND EXCHANGE RATE POLICIES IN PAKISTAN

Ongoing research at IFPRI on trade and exchange rate policies shows that these policies have had a far greater effect on agricultural incentives than policies specific to agriculture and that the effects have generally been adverse.

In Research Report 84, *Effects of Exchange Rate and Trade Policies on Agriculture in Pakistan*, Paul Dorosh and Alberto Valdés describe how trade policy bias toward domestically produced importable products, primarily in the industrial sector in Pakistan, has led to an appreciation of the real exchange rate of 18-20 percent since the mid-1970s. This distortion reduced and sometimes reversed the direct protection provided to agricultural importables through trade policy. In the 1960s, for example, the overvaluation of the rupee outweighed the protection provided by sectoral policies for wheat, ordinary rice, and cotton, and increased the taxation of basmati rice. From 1972 to 1987, direct taxation of agricultural exportables was reinforced by indirect taxation for a negative total of 38 percent. In the same period, indirect effects reduced the protection of import-competing products from 48 to 7 percent.

The decline in the value of agricultural production caused by the combined direct and indirect effects of policies averaged Rs 25 billion per year during 1978-87 for the five major crops (see Figure 14). This large transfer of resources out of the agricultural sector was equivalent to 36 percent of realized agricultural GDP and thus acted as a significant disincentive for private investment in agriculture. The implicit tax on agriculture was also about nine times the estimated level of net government subsidies to producers (both budgetary and off-budget) and three-and-a-half times the Rs 7 billion per year spent on research, extension, and infrastructure for agriculture during the same period.

Figure 14
Net transfers into and out of agriculture as a result of price interventions and public investments



Source: Paul Dorosh and Alberto Valdés.

FISCAL EFFECTS OF PRICE AND TRADE POLICIES IN EAST ASIA

Although there is wide agreement on the need to undertake policy reform to liberalize trade regimes and reduce agricultural price distortions, one source of anxiety for developing country governments concerns the possible adverse effect on public revenues. If raising the agricultural terms of trade results in lower tax revenue, the government's capacity to finance public investment in agriculture may be impaired. This in turn will likely have a negative effect on agricultural production, offsetting in part the output increases induced by the improvement in agricultural prices.

Research completed in 1990 examined the influence of agricultural price and trade policies on public revenue and the relationship between public revenue and agricultural investment in the Philippines, Malaysia, and the Republic of Korea since the mid-1960s. The distortionary effect of agriculture-specific policies on government revenue was found to be generally small: the largest revenue effect was 11 percent of the government budget (in 1974) for Malaysia.

Reform of agricultural pricing policies must also address the overvaluation of the domestic currency induced by economy-wide policies, including the protection of domestic industry.

This requires a lowering of trade barriers, which leads to a reduction in both tariff revenue from industrial imports and tax receipts on primary exports. Trade taxes accounted for only about 17 percent of total government revenue in each of the three East Asian countries in the late 1980s (see Table 4). The research indicates that if existing import quotas had been replaced by tariffs, even at relatively low rates, the revenue loss from import liberalization would have been alleviated.

The study finds that for every 100 units of domestic currency (Philippine pesos, Malaysian dollars, or Korean won) added to government revenue, only 5 to 8 units are spent on agricultural investment. Thus the marginal effect of total government revenue on public investment in agriculture is modest. It suggests that because the composition of government revenue does not significantly influence public investment in agriculture, a compensatory rise in total government revenue from sources other than agricultural and trade taxes will not change the level of government investment in agriculture.

Table 4

Share of international trade taxes in government revenue

	1972	1982-83	1987
	(percent)		
Philippines	23.0	25.3	16.9
Malaysia	27.9	28.3	17.6
Republic of Korea	10.6	14.6	17.3

Source: Romeo Bautista.

STRUCTURAL ADJUSTMENT IN SUB-SAHARAN AFRICA

For 9 of 11 African countries studied in *Demand-Side Constraints and Structural Adjustment in Sub-Saharan African Countries*, a gray cover report by Ulrich Koester, Hartwig Schafer, and Alberto Valdés, the external account crisis and overall macroeconomic imbalance in their economies have created an unsustainable situation. The structural adjustment policies urged on these countries as a remedy by institutions such as the World Bank and the International Monetary Fund could expand production of agricultural tradables, particularly exports.

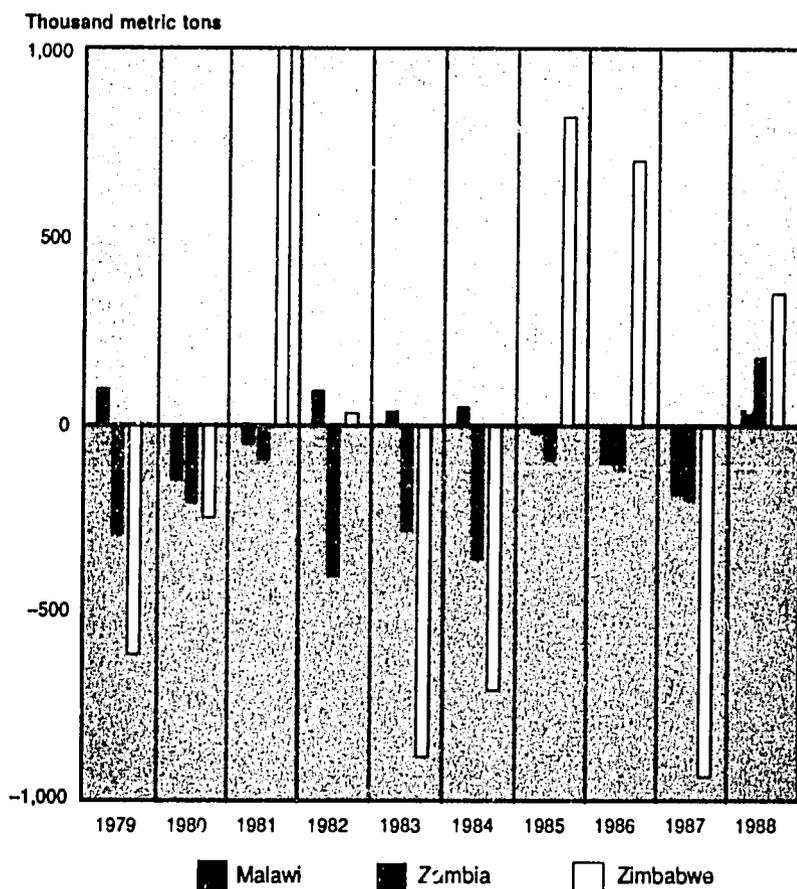
According to the study, although about three-fourths of agricultural export earnings in Sub-Saharan Africa came from six products during most of 1962-84, it is unlikely that structural adjustment policies will depress world market prices. A worst-case scenario—in which all Sub-Saharan African countries promote the same exports at the same time, causing world prices to fall—would lead to bleak prospects for coffee and cocoa in the short run. Long-run prospects for other products are

brighter, however. Other countries with more diverse exports could draw back if world prices drop, and Sub-Saharan Africa could regain some of its lost market shares by taking advantage of European Community (EC) trade preferences.

INTRAREGIONAL TRADE IN SOUTHERN AFRICA

In related research, IFPRI examined the scope for intraregional trade and harmonization of agricultural policies within the Southern African Development Coordination Conference (SADCC) countries. A significant potential for trade between Malawi, Zambia, and Zimbabwe exists, even with existing production and consumption patterns. In the case of maize, for example, the deviations in production are in opposite directions, often during the same year, for the three countries from 1979 to 1988 (see Figure 15). This suggests advantages for integrating their food markets.

Figure 15
Deviation from maize production trends in Malawi, Zambia, and Zimbabwe



Source: Ulrich Koester.

The potential for trade would be even higher if economy-wide policies were harmonized and liberalized. The degree of overvaluation and price interventions differs significantly among these countries, but in all cases they substantially reduce the competitiveness of agricultural products, a substantial number of which are potentially tradable. For the period 1980-87, the three countries pursued agricultural price policies that had a strong antitrade bias and promoted import substitution. A reduction in trade restrictions on exportables and importables would likely result in more trade overall both within SADCC and with the rest of the world. A realignment of real exchange rates and adjustment of internal patterns of consumption and production resulting from this realignment would give rise to additional trade flows.

Transport is considered a major bottleneck in all three countries. The research suggests that a minimal-cost transport model designed to meet requirements in the deficit regions by linking them to the surplus regions could minimize current transport costs and reduce the strain on the already-stressed internal transport systems of the three countries.

INTERNATIONAL POLICY ISSUES

MULTILATERAL TRADE NEGOTIATIONS IN AGRICULTURE

The political and economic costs of the severe disagreements over international agricultural trade have been high during recent years, but there now exists an understanding about the principle that can provide the basis for specifying how government support, both domestic subsidies and border measures, for agriculture can be reduced and the framework within which agriculture can be brought fully into the General Agreement on Tariffs and Trade (GATT) system. During 1990, IFPRI published *The GATT, Agriculture, and the Developing Countries*, a gray cover report edited by Nurul Islam and Alberto Valdés, which addresses the modalities for achieving both these goals.

The study examines the proposals put forward by the EC, the United States, the Cairns Group, and Japan on reforming agricultural trade in light of a general agreement to reduce subsidies. It suggests that a compromise involving a rule of tariffs, a ban on export subsidies, and removal of most quantitative restrictions is possible and that negative effects on developing countries of the outcome of negotiations can be mitigated through a multilateral framework. For example, donor compensation for the inevitable price rise due to trade liberalization could be used to protect low-income consumers. The study estimates that if the United States, the EC, and Japan eliminate tariff and nontariff barriers, Third World export earnings in horticultural trade would increase from 6 to 36 percent.

True compensation for increases in import costs of developing countries, however, requires access to developed-country markets, which should have lower and uniform tariffs and an

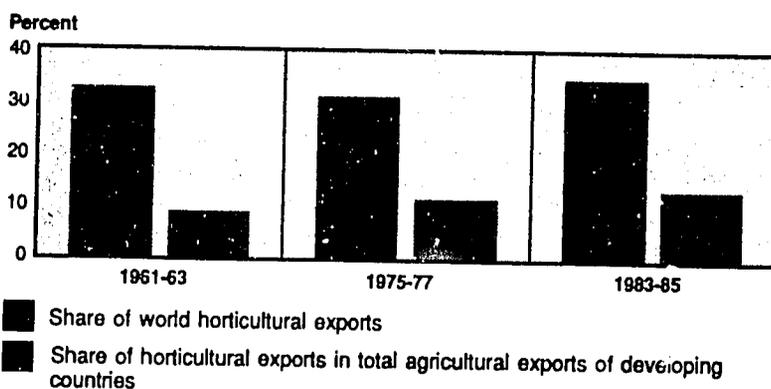
absence of quantitative and other nontariff barriers. In turn, developing countries should keep low and fairly uniform tariffs and remove quantitative restrictions on trade. Additionally, the multilateral institutions need to assist in the structural adjustment that will be necessary during the transition if developing countries are to benefit from liberalization in the long run—benefits that include not only greatly expanded earnings from labor-intensive exports, but also a more than two-thirds reduction in volatility of world food prices if industrialized and developing countries used noninsulating policies.

WORLD TRADE IN HORTICULTURAL PRODUCTS

From 1983 to 1985 the developing-country share of world horticultural exports was 37 percent and rising (see Figure 16). In recent years, policymakers and trade analysts have expressed increased interest in the role of horticultural products in agricultural diversification and the generation of foreign exchange in developing countries. In 1990 IFPRI published a report that examines the world trade in 150 horticultural products between 1961 and 1985. *Horticultural Exports of Developing Countries: Past Performances, Future Prospects, and Policy Issues*, Research Report 80, by Nurul Islam, indicates that total exports of horticultural products—fruits and vegetables—from developing countries could increase 1.6-3.4 percent a year by 2000, amounting to US\$12-15 billion in 1983-85 prices, or even higher if trade is liberalized. But the report indicates that advantages in lower labor costs in developing countries were often offset by the technological advances in the developed world. Whether developing countries can seize a larger share of the market depends, first, on whether they can improve marketing, packaging, and distribution, as well as the quality of their products, and second, on whether tariff and nontariff barriers (NTBs) can be reduced.

Tariffs range from 5 percent on fresh fruits to 15 percent on processed fruits, with vegetables falling in between. Differences between import and domestic prices due to NTBs range from 22 to 180 percent on fruits and from 30 to 80 percent on

Figure 16
Developing countries' share of horticultural exports, 1961-85



Source: Nurul Islam.

vegetables. However, a significant number of NTBs are the sanitary regulations, which are sometimes not motivated by genuine concerns. An international agreement to standardize these regulations among importing countries is mandatory for future export growth.

The report indicates that developing countries can benefit from specializing in selected horticultural products and improving marketing techniques, information flows, and infrastructure.

OUTREACH

IFPRI's outreach activities—collaborative projects, policy seminars and meetings, and publications and information dissemination—are geared to reach its audience of policymakers in developing and developed countries, policy analysts and natural and social scientists around the world, and opinion formers in the international political arena. The dissemination of research results through these various activities—and the policy dialogues they generate at the national level, among regional groupings, within the CGIAR, and among the donor community—makes possible the adoption of better food and agricultural policies. The different aspects of the outreach process are detailed below.

M PUBLICATIONS AND INFORMATION

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 and to a more general audience. In 1990 analyses were also reported in a working paper series on 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 and other articles by IFPRI staff; and a quarterly newsletter. A complete listing of 1990 titles appears in the Publications and Papers section.

These publications were distributed through the mailing list and special requests to about 14,000 individuals, libraries, educational institutions, research organizations, and government organizations. About 23,000 publications were distributed in addition to those sent out through the mailing list.

In an effort to improve communication on development issues with a more general audience, IFPRI organized and participated in a media seminar funded by the Rockefeller Foundation on "Feeding the World, Protecting the Earth: Advances in International Agricultural Research," held May 13-16 in Annapolis, Maryland. The seminar was the outgrowth of the Public Awareness Association of the CGIAR and affiliated international agricultural research centers. It was a pilot effort based on two premises: 1) that greater awareness of the role of international agricultural research and development is needed for reaching certain key publics to build and sustain a more supportive financial and policy climate for these enterprises; and 2) that although specialized and mass media are effective means to reach many of the target publics, journalists themselves must first be helped to learn more about the roles and contributions of international agricultural research. The seminar was attended by 35 representatives of mass and specialized media outlets and 17 scientists from around the world.

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

COLLABORATIVE RESEARCH

IFPRI conducts virtually all of its field-based research in partnership with developing-country institutions. It also undertakes joint research with other CGIAR centers and developed-country institutions and multilateral agencies. The goals of IFPRI's collaborative efforts in the Third World are to build research capabilities and attune research with the need for appropriate policies. With its CGIAR partners IFPRI provides a focus on the policy environment, which critically affects the use and development of new agricultural technologies developed by the other centers. And with its multilateral and developed-country collaborators IFPRI is able to identify gaps in knowledge and take advantage of new developments in methodology.

COLLABORATION WITH INSTITUTIONS IN DEVELOPING COUNTRIES

IFPRI recognizes that the key to successful policy formulation and implementation ultimately lies in the building of developing-country institutions with adequately trained staff. IFPRI undertakes this capacity building in several ways. Long-term research projects proceed jointly with national counterparts, from data collection and methodological application to analysis and conclusions. Nearly a third of these collaborative efforts are in the ministries of agriculture, followed by universities, development research centers, and ministries of economics and planning, thus enabling direct and indirect links with the policymaking process.

Collaborating researchers improve their skills during the field component of the project as well as during their stay at headquarters. Workshops and seminars related to specific projects and to IFPRI research in general also provide a means of informing and training researchers, as do informal discussions with government officials. Because the training is integrated with actual research participation, it is more effective than independent training, which may not be related to the work responsibilities of the trainee. Currently four IFPRI research fellows are posted in Bangladesh, Senegal, and Zimbabwe as part of ongoing projects.

Within a field project, courses are organized as necessary to teach analytical techniques to implement the project, and graduate students can collect survey data for a project, completing theses based on the data, sometimes under the supervision of IFPRI staff. When the research output is a model—for example, a sectoral model for the analysis of price and investment policies in the Philippines—courses are held to train those who will use the model in their work. A current project in Central America is training national collaborators to use an analytical framework to address policy issues concerning nutrition. The

project includes training in computer analysis techniques as well.

Close and long-lasting collaboration between IFPRI staff and national researchers and policy analysts, in which each learns from the other, is one of the most effective means of improving skills and research effectiveness. As the national collaborators increase in seniority and responsibility, a further dimension is added. In countries where research collaborators have moved to senior positions in ministries, they have incorporated IFPRI's training and research approach into their own organizational programs.

In 1990 IFPRI collaborated with the following 93 institutions in 40 developing countries.

Africa

Botswana

■ Southern African Development Coordination Conference (SADCC), Gaborone, on how crop and agroindustrial production and marketing policies in the SADCC region can be attuned with the production opportunities for sorghum and millet.

Burkina Faso

■ Centre d'Etudes, de Documentation, de Recherche Economique et Sociale (CEDRES), University of Ouagadougou, Ouagadougou, on a study of the determinants, structure, and level of transaction costs on rural agricultural markets in the border areas of Burkina Faso, Côte d'Ivoire, Mali, and Senegal, and on research on the substitution in consumption of wheat and rice for traditionally grown millet and sorghum and the substitution in production of maize and rice.

Côte d'Ivoire

■ Centre Ivoirien de Recherches Economiques et Sociales (CIRES), Abidjan, on a study of the determinants, structure, and level of transaction costs on rural agricultural markets in the border areas of Burkina Faso, Côte d'Ivoire, Mali, and Senegal.

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 Central Committee for Planning, Food Security Unit, Addis Ababa, on famine prevention and relief.

The Gambia

■ Programming, Planning, and Monitoring Unit for the Agricultural Sector, Banjul, on a study published in 1990 on structural adjustment, agriculture, and nutrition in The Gambia.

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.

Malawi

■ National Research Council, Lilongwe, on the effect of pricing policy reforms on fertilizer use in Malawi.

Niger

■ Institut National de Recherches Agronomiques du Niger (INRAN), Niamey, on house-

hold income diversification and agricultural supply and consumption strategies in Niger.

Nigeria

■■■■ African Groundnut Council (AGC), Lagos, on research on the potential for promoting trade in groundnut products in AGC countries and the role of regional markets in such trade.

Rwanda

■■■■ Ministry of Agriculture 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 a study of the determinants, structure, and level of transaction costs of rural agricultural markets in the border areas of Burkina Faso, Côte d'Ivoire, Mali, and Senegal; and on household income diversification and agricultural supply and consumption strategies in Senegal. An IFPRI research fellow is posted here.

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.

Swaziland

■■■■ Department of Agricultural Research, Malkerns, on an overview of the sorghum sub-sector.

Tanzania

■■■■ Market Development Bureau, Dar Es Salaam, and Soikoine University, Morogoro, on small grain marketing and use in Tanzania.

Zambia

■■■■ Eastern Province Agricultural Development Project, Chipata, on adopting improved farm technology.

■■■■ Ministry of Agriculture, Lusaka, on a study of marketing and processing of traditional crops in rural Zambia.

■■■■ National Commission for Development Planning, Lusaka, on a study of marketing and processing of traditional crops in rural Zambia.

■■■■ National Council for Scientific Research, Lusaka, on a study of marketing and processing of traditional crops in rural Zambia.

■■■■ National Food and Nutrition Commission, Lusaka, on adopting improved farm technology.

■■■■ Small Industries Development Organization, Lusaka, on a study of marketing and processing of traditional crops in rural Zambia.

■■■■ University of Zambia, Lusaka, on a study of marketing and processing of traditional crops in rural Zambia and on adopting improved farm technology.

Zimbabwe

■■■■ Ministry of Local Government, Rural and Urban Development, Harare, on service provision and its impact on agricultural and rural development in Zimbabwe.

■■■■ University of Zimbabwe, Harare, on a study of coarse grain market behavior in small-holder farming areas, a comparative study of irrigation system performance, and on research on regional integration of agricultural markets in southern Africa. A research fellow is posted here.

Asia

Bangladesh

■ Bangladesh Agricultural Research Council, Dhaka, on a review of the agricultural research system in Bangladesh.

■ Bangladesh Institute of Development Studies (BIDS), Dhaka, on studies on the development effects of rural infrastructure (which was published in 1990), agricultural price and distribution policies, and agricultural diversification and its potential role in the economic development of Bangladesh.

■ Ministry of Agriculture, Dhaka, and Select Committee on Higher Agricultural Education, Dhaka, on a review of the role of higher educational institutions in building human resource capacity for research and extension systems in Bangladesh.

■ Ministry of Food, Dhaka, on agricultural price and distribution policies and agricultural diversification and its potential role in the economic development of Bangladesh.

People's Republic of China

■ Beijing Agricultural University, Center for Integrated Agricultural Development, Beijing, on a study of potato and sweet potato production trends, productivity constraints, markets, patterns of use, and policy problems in Inner Mongolia and Shanxi, Shaanxi, Hebei, Hubei, and Guizhou Provinces, and on research on extension system reform in China.

■ Chinese Academy of Agricultural Sciences, Agricultural Economics Institute, Beijing, on research on rice productivity constraints and policy problems in poor regions of Chinese rice-growing provinces, and on a study of potato and sweet potato production trends, productivity constraints, markets, pat-

terns of use, and policy problems in Hunan and Anhui Provinces.

■ Chinese Academy of Sciences, Institute of Geography, Beijing, on studies of water management in Liaocheng Prefecture, Shandong Province, the agricultural economy of poor rice-growing counties in China, and rural development, infrastructure, and service provision in Liaocheng County.

■ Chinese Academy of Social Sciences, Economic Research Institute, Beijing, on an analysis of public works projects in China, especially in Guizhou and Sichuan Provinces.

■ Chinese Academy of Social Sciences, Rural Development Institute, Beijing, on micro-economic research on potato and sweet potato production trends, productivity constraints, markets, patterns of use, and policy problems in Shanyang County, Shaanxi Province, and on a study of Chinese cereal production variability at national and provincial levels.

■ Departments of Agriculture and Water Control, Liaocheng Prefecture, Shandong Province, on water management research.

India

■ Centre for the Study of Regional Development, Jawaharlal Nehru University, New Delhi, on a study of the emerging farm structure in India and on a study published in 1990 on agricultural growth and structural changes in the Punjab economy.

■ Commission on Agricultural Costs and Prices, Government of India, New Delhi, on the efficiency of technological change in the production and productivity of major crops in India.

■ Gujarat Institute of Area Planning, Ahmedabad, on a

study to increase fertilizer use in dryland agriculture, given the lessons emerging from the experience of the state of Gujarat.

■ Indian Agricultural Research Institute, New Delhi, on research on farmers as buyers of fertilizer and microlevel constraints on availability.

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

■ Indian Institute of Management, Ahmedabad, on a management audit of irrigation systems with good performance.

■ Rajendra Agricultural University, Pusa, on a study of the transfer of agricultural technology in India.

■ Tamil Nadu Agricultural University, Coimbatore, on studies of irrigation system responses to drought; water scarcity and the impact of irrigation investment on food-crop supply; the transfer of agricultural technology in India; and rural infrastructure, settlement system, and the development of the regional economy.

Indonesia

■ Center for Agro Socio Economic Research, Bogor, on a study of trends and determinants of irrigation investment in Indonesia.

Republic of Korea

■ Korea Labor Institute, Seoul, on the relationships between education, economic growth, and income inequality in Brazil.

Pakistan

■ Applied Economic Research Centre, Karachi, Centre for Applied Economic Studies, Peshawar, Pakistan Institute of Development Economics, Islamabad, and Punjab Economic

Research Institute, Lahore, 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

■ Department of Agriculture, Manila, on updating an agricultural sector model for the Philippines and training personnel in its use; and in developing a policy framework for analyzing the issues related to the corn and livestock sectors.

■ Philippine Institute for Development Studies, Manila, on studies of the comparative saving behaviour of rural and urban households and the effects of trade and macroeconomic policies on growth in rural industry.

■ Southeast Asian Regional Center for Graduate Study and Research in Agriculture (SEARCA), Los Baños, on the establishment of a project office in order to look into research collaboration in Asia on the impact of agricultural technologies on environmental sustainability and economic efficiency.

■ University of the Philippines, Los Baños, on research on the marketing of corn and livestock production in the Philippines.

■ Xavier University, Cagayan de Oro, on a study that was published in 1990 on the food consumption and nutrition effects of the shift from semi-subsistence maize to commercialized sugarcane production in the Philippines.

Sri Lanka

■ Agrarian Research and Training Institute, Colombo, on a framework for studying the comparative advantage of different crops in Sri Lanka.

Thailand

■ 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 an analysis of trends and determinants of irrigation investment in Indonesia.

Latin America

Argentina

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

Brazil

■ Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), Brasília, on 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).

■ Institute for the Study of Society, Population and Nature, Brasília, on the interrelationships between agricultural change, population change, and environmental degradation.

■ Instituto de Economia Agrícola, São Paulo, on an analysis of the forces influencing the adoption and diffusion of mod-

ern 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

■ Centro de Estudios y Publicaciones-ALFORJA, San José, on a study of urban food security and nutrition in Central America with people's participation.

■ Confederation of Central American Universities, San José, on a project on food security and nutritional improvement in Central America.

■ Ministry of Health and Ministry of Agriculture and Livestock, San José, on a project on food security and nutritional improvement in Central America, with in-service training of national technical personnel in data and policy analysis.

■ Tropical Agricultural Center for Research and Training (CATIE), Turrialba, on a project on food security and nutritional improvement in Central America.

Guatemala

■ Institute of Nutrition of Central America and Panama, Guatemala City, on a project on food security and nutritional improvement in Central America.

Honduras

■ Centro de Comunicación Popular de Honduras (CEN-COPH), Tegucigalpa, on a study of urban food security and nutrition in Central America with people's participation.

Mexico

■ National Institute of Nutrition, Mexico City, on a project of community food and nutrition

programs with people's participation.

Nicaragua

■ Instituto Mujer y Comunidad, Estelí, and Proyecto PRONORTE, Estelí, on a project on food security and nutritional improvement in Central America, with in-service training of national technical personnel in data and policy analysis.

■ Centro de Educación y Comunicación Popular-CANTERA, Managua, and Centro para la Participación Democrática y el Desarrollo-CENZONTLE, on a study of urban food security and nutrition in Central America with people's participation.

Panama

■ Regional Program on Food Security in Central America (PRSA), Panama City, on a project on food security and nutritional improvement in Central America.

North Africa/ Middle East

Algeria

■ Institut Technique des Grandes Cultures, Algiers, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

Iraq

■ Ministry of Agriculture and Irrigation, Baghdad, and Na-

tional Research Institute, Baghdad, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

Jordan

■ Ministry of Agriculture, Amman, and University of Jordan, Amman, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

Morocco

■ Ministry of Agriculture and Land Reform, Rabat, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

Syria

■ Arab Agronomists' Union, Damascus, and Ministry of Agriculture and Agrarian Reform, Damascus, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

Tunisia

■ Institut National de la Recherche Agronomique de Tunisie, Tunis, and Ministry of Agriculture, Tunis, on the preparation, adaptation, and conduct of a national survey of barley and wheat farmers and a Delphi survey of cereal scientists.

COLLABORATION WITH CENTERS IN THE CGIAR

The CGIAR's effort to increase resources for policy research within the system recognizes that development processes based on new technologies depend on appropriate policy environments. IFPRI's focus on policy research encourages policies to emerge that facilitate the use of and enhance the returns on the technological improvements produced at the other centers. 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 1990, with the return to headquarters of an IFPRI research fellow who had been posted to IIRI since 1980, three senior staff remained outposted to international agricultural research centers. Two of the staff members were at CGIAR center field offices.

During 1990 the following activities were undertaken in collaboration with other centers.

■ IFPRI and CIP collaborated on a project on potato and sweet potato demand elasticities for Bangladesh, Pakistan, and the Philippines and how price and income changes affect consumption. In addition a report prepared on production trends, regional use patterns, and policy issues related to potatoes and sweet potatoes in the People's Republic of China, with implications for social science research priorities, is being used by CIP as a basis for their work on these crops in China.

■ ILCA and IFPRI are working together to examine famine in the context of successions of bad crop years, the performance of rural markets, and different household food security strategies. The role of livestock assets in famine situations is also analyzed. Contemporary famine theory, policy, and practice are being reviewed and field data on production-income-consumption-nutrition linkages associated with drought and food shortages collected. A new project on seasonality in food security involves ILCA in examining agriculture-livestock linkages in household food security and productivity growth.

■ IFPRI and ICRISAT are studying the role of millet and sorghum in farmer-income and food-security strategies in Burkina Faso and Niger. IFPRI has posted a research fellow at ICRISAT/Niger. An IFPRI research fellow seconded to ICRISAT in Zimbabwe is look-

ing at the constraints to increased marketing and use of sorghum and millet in the Southern African Development Coordination Conference (SADCC) region.

■ With ICRISAT, IFPRI is examining soil fertility management and fertilizer-related policy issues in semiarid tropical regions of India.

■ IIRI and IFPRI are working on a study to determine the medium-term projections and policy implications of rice supply and demand in Asia.

■ CIMMYT and IFPRI are providing training in methods of policy analysis to economists in agricultural research programs in eastern and southern African countries.

■ With ISNAR, IFPRI reviewed the national agricultural research system of Bangladesh and is developing a paper for the World Food Council on the potential contribution of research and technological change to food security in Africa to the year 2000.

■ IFPRI and ICARDA completed their evaluation of the role of food legumes in farming systems and the economies of countries in the Middle East and North Africa. The two centers, along with the World Bank, are also preparing for a technical meeting on developing the potential for sustainable resource management in low rainfall areas of Middle East and North Africa.

ICARDA and IFPRI are also collaborating on the preparation, adaptation, and conduct of a survey of barley and wheat farmers in Syria.

With other CGIAR centers IFPRI is working on ways to improve public awareness of international agricultural research. As part of this effort, IFPRI organized and participated in a media seminar featuring scientists from the CGIAR and other institutions and North American journalists.

IFPRI's joint projects with non-CGIAR international agricultural research centers con-

tinue. With the International Fertilizer Development Center (IFDC), IFPRI is undertaking a study of policies conducive to accelerating fertilizer use in Sub-Saharan Africa. In 1990 IFPRI and IFDC jointly published the proceedings of a workshop on fertilizer policy in Sub-Saharan Africa. An IFPRI research fellow is posted in IFDC/Togo. IFPRI and IIMI are collaborating on a program to develop a common framework for assessing irrigation system performance, indicators and tools for making these assessments, and a database of comparative irrigation performance information.

COLLABORATION WITH INSTITUTIONS IN DEVELOPED COUNTRIES AND MULTILATERAL AGENCIES

Several projects noted above also involve collaboration with developed-country institutions or multilateral agencies. With the former IFPRI hopes to more closely integrate its expertise in applied policy research with advances in theory and econometrics developed mainly at universities. The forms of collaboration include shared staff appointments, joint projects, consulting arrangements, and conferences and seminars. An advisory committee of leading European and Third World analysts works to encourage collaboration between developing-country, European, and IFPRI researchers. (Committee members are listed in the Personnel section.)

IFPRI also works with multilateral agencies through joint projects, consultancies, formal and informal meetings, and sharing of data. Through these interactions IFPRI becomes aware of and can address important research and information gaps and controversial issues.

The list below encompasses collaborations for 1990.

- Centre de Coopération Internationale en
Recherche Agronomique pour le
Développement (CIRAD), Paris, France
- Cornell University, Ithaca, U.S.A.
- Food and Agriculture Organization of the
United Nations (FAO)
- Food Research Institute, Stanford University,
Stanford, U.S.A.
- Indiana University, Bloomington, U.S.A.
- Institute of Development Studies, University
of Sussex, Brighton, United Kingdom
- International Labour Office

National Nutrition Institute, Rome, Italy
National Research Institute of Agricultural
Economics, Ministry of Agriculture, Forestry
and Fisheries, Tokyo, Japan
Otaru University of Commerce, Otaru, Japan
Oxford University, Oxford, United Kingdom
United Nations Administrative Committee on
Coordination/Sub-Committee on Nutrition
(ACC/SCN)
United Nations Children's Fund (UNICEF)
United Nations Fertilizer Advisory Develop-
ment and Information Network for Asia and
the Pacific (FADINAP)
United States Agency for International Develop-
ment (USAID)
University of Guelph, Guelph, Canada
University of Hohenheim, Stuttgart, Federal
Republic of Germany
University of Kiel, Kiel, Federal Republic of
Germany
University of Laval, Quebec, Canada
University of Pennsylvania, Philadelphia,
U.S.A.
Vassar College, Poughkeepsie, U.S.A.
Williams College, Williamstown, U.S.A.
World Bank
World Food Programme

T POLICY SEMINARS

he global reach of IFPRI's mandate and the need to interact with both policymakers and analysts in developing and developed countries make it imperative that the policy messages emanating from IFPRI's research reach their target audiences. To make the results of the Institute's research more directly and immediately accessible to these audiences, IFPRI sponsors each year a series of policy seminars that translate the technical findings of IFPRI's work into policy options that can feed into the decisionmaking process of the planning agencies and ministries responsible for formulating and implementing food and agricultural policies. These outreach activities normally involve both IFPRI researchers and national collaborators from the developing countries to help ensure that national governments turn increasingly to their own national research systems for policy-relevant data and advice.

In 1990 IFPRI sponsored four policy seminars or conferences dealing with issues of global concern that require action at both the national and international levels.

THE GATT, AGRICULTURE, AND THE DEVELOPING COUNTRIES

IFPRI convened a seminar on May 30-June 1, 1990, in Montreux, Switzerland, with participation by a number of distinguished experts on GATT and developing-country officials engaged in the GATT negotiations. The seminar's deliberations focused on issues of negotiation of particular interest to developing countries and on options and strategies available to them that would derive significant benefits from the liberalization of world trade in agricultural commodities. Discussions focused on the scope for compromise among the European Community, the United States, the Cairns Group, and Japan and the effects of the outcome of negotiations on developing countries. Particular attention was devoted to the issue of special and differential treatment (S&D) for developing countries in GATT, and how it might be extended to agriculture. The prospects for eliminating tariff and nontariff barriers for horticultural exports of developing countries and the effects on export earnings from such liberalization were examined, as were the effects of trade liberalization on world agricultural prices and their implications for the poorer, food-deficit countries. Also analyzed were various ways of compensating developing countries against short-term adverse effects of trade liberalization as well as the ways in which structural adjustment might enable developing countries to benefit from liberalization in the long run. Finally, the seminar weighed the national and global gains to be derived from trade liberalization and identified national and international actions to contain the effects of international price variability on developing countries.

The proceedings of the seminar were published by IFPRI as a gray cover report (see the International Trade and Food Security Program).

TECHNOLOGY POLICY FOR SUSTAINABLE AGRICULTURAL GROWTH

Technological progress in agriculture is crucial for alleviating poverty in developing countries. It is essential for overcoming the constraint on food production growth imposed by limited land resources. Expansion of employment opportunities for the poor and hence a permanent solution of the poverty problem is quite difficult in most developing countries without technological innovation. But, although scientific advances are clearly the most important precondition for technological progress in agriculture, such progress also depends on agricultural production technologies appropriate to the physical, social, and economic environments of developing countries. Although these technologies are essential for agricultural productivity growth, it is also important that the growth they engender be sustainable and that any adverse effects on the environment be minimized.

On July 2-3, 1990, IFPRI held a policy seminar in The Hague to examine the interrelationship between technological change and preservation of the natural resource base in agriculture. Participants included senior officials from developing

and developed countries as well as analysts familiar with agricultural technology policies and with the nature and consequences of technology policy for agricultural sustainability. The discussion focused on the roles of research, infrastructure, credit, and pricing policies, as well as on policies to encourage the efficient development and use of inputs such as irrigation, fertilizer, and improved seed varieties. It was acknowledged that the level of awareness of the environmental dimension of agricultural technology has greatly increased, and that it is necessary to weigh the benefits of technological change in agriculture against the possible adverse effects of such change on the environment and to contain the adverse effects by developing or refining environmentally sound technologies. In this context, participants examined the potential of integrated watershed development, organic manures, biological pest control, and other environmentally friendly technologies for promoting sustainable agricultural growth. However, senior policymakers from developing countries stressed that any viable concept of sustainable agriculture must be consistent with at least maintaining and preferably increasing rates of growth in the agricultural sector, if progress in reducing poverty is to be maintained.

The briefing materials for the seminar were published in IFPRI's Policy Briefs series.

AGRICULTURE ON THE ROAD TO INDUSTRIALIZATION

On September 4-7, 1990, IFPRI and the Council of Agriculture, Republic of China, cosponsored a major international conference on agriculture on the road to industrialization. Held in Taipei, the meeting was inaugurated by Lee Teng-hui, president of the Republic of China. The conference was attended by Yu Yu-Hsien, chairman of the Council of Agriculture, and a group of internationally known experts on the strategic role of agriculture in economic development. The participants focused on the experience of nine countries in Asia, Africa, and Latin America.

The following points provided the basis for discussion: Adjustment policies are thought to be favorable to agriculture and have rekindled interest in agriculture's role in development. Yet there is a lack of understanding of the full role agriculture can play, and of the specific policies for stimulating agriculture. There is also mounting concern that the global trade regime will not sustain for other developing countries the rate of export growth characteristic of the countries with great success stories over the past few decades. This implies that a higher proportion of effective demand for increased output must come from the domestic markets of developing countries themselves. There is a recognition of varying efficiency in converting accelerated agricultural growth into accelerated growth in the nonagricultural sectors and uncertainty regarding the policies needed to increase that efficiency. Moreover, there is concern about the breadth of participation of those in the lower half of the income distribution in growth and the expectation that accelerated agricultural growth will prove to be labor demanding and hence instrumental in the reduction of poverty.

In the context of these concerns, conferees examined issues related to the interaction of agriculture and nonagriculture in the early stages of economic transformation in the nine countries—Argentina, Colombia, Costa Rica, India, Kenya, Nigeria, Philippines, Taiwan, and Thailand. Among the major findings of the discussion, it was observed that a rapidly growing agricultural sector, and a consequent increase in income per land unit and per worker, is often associated with an acceleration in the overall process of rural development and with a rise in real wage rates, a reduction in poverty, and a decentralization of the urbanization process. Conversely, where agriculture is stagnant there is rarely dynamic overall economic growth or rapid growth in nonagricultural employment in rural areas.

The implication is that expansion of agricultural production through expansion of the land area is not nearly as effective in stimulating overall growth as a denser form of growth that increases the value of output in a particular geographic area either through yield-increasing technologies or higher levels of intensity of production. The importance of the density of agricultural growth in stimulating overall growth lies in the reduction of overhead costs of physical infrastructure and institutions, particularly credit, that support the agricultural sector. This process of growth not only increases rural incomes but also the proportion of those incomes that enter into the commercial sector, stimulating effective demand for both consumer and producer goods and services. The stimulus to demand for producer goods creates particularly powerful linkages to regional and national markets.

Because production units in agriculture tend to be relatively small scale, labor-intensive, and regionally dispersed, policies that encourage an agriculture-based development strategy can lay the groundwork for a more dispersed, medium-scale, and less capital-intensive form of industrialization in developing countries. The conference looked at both sector-specific policies in the areas of agricultural intensification, infrastructure, rural education, and rural financial markets, as well as macropolicies in the areas of relative prices, exchange rates, and public expenditures that are needed to enhance the growth linkage effects of an agriculturally led strategy of development.

IFPRI plans to publish the analytical and country studies presented at the conference.

GLOBAL FOOD PROBLEMS

Because the policies of developed countries can have a large effect on the food and agricultural policies of developing countries, IFPRI's outreach activities often involve interaction with policymakers and researchers of developed countries and in particular with those influential in formulating development assistance policy. It was in this context that on May 14, 1990, IFPRI and the Swedish University of Agricultural Sciences cosponsored a one-day seminar in Stockholm on global food problems. The meeting was attended by leading economists and agricultural scientists from Swedish universities and research organizations and representatives of the Swedish Ministry of Foreign Affairs, Ministry of Agriculture, Swedish International Development Agency (SIDA), and Swedish Agency for Research Cooperation with Developing Countries

(SAREC). The purpose of the seminar was to explore the implications of the current and future world situation for development assistance policy, particularly as this relates to Sub-Saharan Africa. The agenda focused on growth-oriented strategies for rapid reduction of poverty and the implications for the environment of the population/technology/growth nexus. The discussion covered a broad range of issues from the agricultural, trade, and macroeconomic policies of the European Community to such national-level topics as human capital accumulation in post-"green revolution" Pakistan, cereals protection within the Sahelian region, and income diversification and intersectoral linkages in Sahelian agriculture.

The proceedings of the seminar will be published by the Swedish University of Agricultural Sciences.

IFPRI, EUROPEAN, AND THIRD WORLD COLLABORATION

IFPRI's Advisory Committee of Third World and European experts met on May 10-11 in Stockholm to identify priority topics and participants for seminars, provide feedback on current activities, and establish future needs. The committee heard a report on progress in organizing a seminar on agricultural sustainability, growth, and poverty alleviation to be cosponsored by IFPRI and the German Foundation for International Development (DSE) in Feldafing, Germany, in September 1991. The committee also considered proposals for seminars on areas such as rural-urban linkages and nonfarm employment and the role of agriculture in development strategy in Senegal. In addition, the committee heard detailed presentations on agricultural research issues in Latin America, the Soviet Union, and France. It is anticipated that these exchanges will lead to the identification of research topics of mutual interest and possible future collaboration between European, Third World, and IFPRI scientists.

IN-HOUSE SEMINARS

IFPRI's in-house seminar program serves the Washington, D.C. area's network of research and policymaking institutions concerned with food policy. These meetings typically involve researchers, administrators, and visiting officials from developing countries in informal discussions of the results and policy implications of IFPRI research. Seminars are also occasionally given by guest speakers. In 1990, 11 seminars were held on such topics as institutional finance for agricultural development in cross-national perspective, salinity management in irrigated agriculture in India, health and agricultural productivity in the Peruvian Andes, food security implications of political instability and macroeconomic policies in Sudan, rural common-property resources in Nepal, factor-market exchanges and technological choice in Chinese agriculture, the economic value of forest products, linking banking and technology in the development of dryland agriculture, and human resources and technology generation in Brazil.

PUBLICATIONS AND PAPERS

RESEARCH REPORT AND ABSTRACT SERIES

Research Report 79

Effects of Agricultural Commercialization on Land Tenure Household Resource Allocation, and Nutrition in the Philip pines, by Howarth E. Bouis and Lawrence J. Haddad, January 1990.

Research Report 80

Horticultural Exports of Developing Countries: Past Performances, Future Prospects, and Policy Issues, by Nurul Islam, April 1990.

Research Report 81

Production and Consumption of Foodgrains in India: Implications of Accelerated Economic Growth and Poverty Alleviation, by J. S. Sarma and Vasant P. Gandhi, July 1990.

Research Report 82

Agricultural Growth and Structural Changes in the Punjab Economy: An Input-Output Analysis, by G. S. Bhalla, G. K. Chadha, S. P. Kashyap, and R. K. Sharma, August 1990.

Research Report 83

Developmental Impact of Rural Infrastructure in Bangladesh, by Raisuddin Ahmed and Mahabub Hossain, October 1990.

Research Report 84

Effects of Exchange Rate and Trade Policies on Agriculture in Pakistan, by Paul Dorosh and Alberto Valdés, December 1990.

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

OTHER SERIES

"Gray" Report Series

Demand-Side Constraints and Structural Adjustment in Sub-Saharan African Countries, by Ulrich Koester, Hartwig Schafer, and Alberto Valdés, July 1990.

The GATT, Agriculture, and the Developing Countries, edited by Nurul Islam and Alberto Valdés, September 1990.

The Role of the World Bank in Agricultural Development in the 1990s, by Michael Lipton and Robert Paarlberg, October 1990.

Working Papers on Commercialization of Agriculture and Nutrition

Number 4

Structural Adjustment, Agriculture, and Nutrition: Policy Options in The Gambia, by Joachim von Braun, Ken Johm, Sambou Kinteh, and Detlev Puetz, April 1990.

IFPRI Policy Briefs

Number 5

Structural Change in African Agriculture (in English and French)

Number 6

Environmental Aspects of Agricultural Development

Number 7

*Technology Policy for Sustainable Agricultural Growth***IFPRI Reports**

The newsletter, *IFPRI Report*, is published four times a year in English, French, and Spanish.

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- Haddad, Lawrence. (With Ravi Kanbur.) 1990. How serious is the neglect of intra-household inequality? Reprinted from *The Economic Journal* 100 (No. 402).
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Fertilizer Policy in Tropical Africa, proceedings of a workshop in Lomé, Togo, edited by Tshikala B. Tshibaka and Carlos A. Baanante and published jointly with the International Fertilizer Development Center. (Available from IFDC.)

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BOOKS, JOURNAL ARTICLES, AND OTHER PUBLISHED WORKS BY IFPRI STAFF

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SPECIAL REPORTS

Caractéristiques des zones d'étude du projet IFPRI/ISRA: Résultats des enquêtes de reconnaissance des villages. Prepared by B. N. Diagana, Abdoulaye Fall, Valerie Kelly, and Thomas Reardon for the U.S. Agency for International Development.

The conversion of potential for fertilizers into effective demand and use in Sub-Saharan Africa: A study on aspects of the environment and small farmer behavior in rural Zimbabwe.

Prepared by Vasant Gandhi and Gunvant Desai for the U.S. Agency for International Development.

Coping with disastrous drought when there is no preparedness: The 1984/85 famine in North Kordofan, Sudan. Prepared by Tesfaye Teklu and Joachim von Braun as a background paper for the World Bank's *World Development Report*.

Effects of selected policies and programs on household level food security, health and nutrition. Prepared by Eileen Kennedy for the U.S. Agency for International Development.

Employment and income sources of the rural poor: Micro-level information for development of policy priorities. Edited by Joachim von Braun and Rajul Pandya-Lorch with contributions from IFPRI staff for the U.S. Agency for International Development.

Experience with public works in Africa for improving food security. Prepared by Joachim von Braun, Tesfaye Teklu, and Patrick Webb for the German Agency for Technical Cooperation (GTZ).

Food security and nutrition in Egypt. Prepared by Eileen Kennedy for the World Bank.

Poverty in Sri Lanka: Its extent, distribution and characteristics of the poor. Prepared by Neville Edirisinghe for the World Bank.

Strategies for the modification of the food stamp scheme in Sri Lanka. Prepared by Neville Edirisinghe for the World Bank.

PAPERS PRESENTED BY IFPRI STAFF

In addition to the publications mentioned above, IFPRI staff in 1990 presented more than 60 papers in various forums around the world other than those organized by IFPRI. Presentations were made at seminars, workshops, and conferences in institutional settings that included universities and academic society conferences, nationally and internationally organized research colloquia, and bilateral and multilateral advisory group meetings. These intensive interactions with policymakers and researchers on issues related to food policy enabled IFPRI to contribute to policy dialogues and discussions on research and methodology, complementing other forms of outreach.

Papers were presented at national, regional, and international meetings in five African countries, six countries in Asia, one in Latin America, one in the Middle East, five in Europe, as well as in Canada, the United States, and Australia. More than a third were presented at nationally or regionally sponsored meetings and bilateral or multilateral agencies, another third at symposia held at universities, and the remainder at national or international research institutions and academic society meetings.

PUBLICATIONS REVIEW COMMITTEE AND REFEREES

All manuscripts submitted for publication as IFPRI research reports undergo extensive review, both inside and outside IFPRI.

The Publications Review Committee oversees these reviews and makes recommendations for publication. Committee members include Guntant Desai, chairman, Romeo Bautista, Joachim von Braun, Maarten Immink, Nurul Islam, Dayanatha Jha, Marc Nerlove, Richard Sabot, and Barbara Rose (ex officio).

IFPRI is most grateful for the efforts of the following external referees who reviewed manuscripts for the research report series during 1989 and 1990.

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S. Ahmed <i>Research Assistant, Bangladesh</i>	L. Aspillera <i>Secretary, Philippines</i>
Y. Amde <i>Research Assistant, Ethiopia</i>	J. Willis <i>Word Processor, U.S.A.</i>
S. Bhattarai <i>Research Assistant, Nepal</i>	

International Trade and Food Security Program

R. Bautista <i>Acting Program Director, Philippines</i>	M. Thomas <i>Research Analyst, U.S.A.</i>
N. Edirisinghe <i>Research Fellow, Sri Lanka</i>	R. Haque <i>Research Assistant, Bangladesh</i>
H. Ezekiel <i>Research Fellow, India</i>	S. Frost <i>Secretary, Trinidad and Tobago</i>
B. Kinsey <i>Research Fellow, U.S.A. (outposted to the University of Zimbabwe, Zimbabwe)</i>	L. Hinayon <i>Secretary, Philippines</i>

Visiting Researchers

More than 50 researchers from around the world spent time at IFPRI during 1990. Those listed below spent periods of a month or more at IFPRI.

- F. Abeyratne, Agrarian Research and Training Institute, Sri Lanka
- W. A. T. Abeysekera, Agrarian Research and Training Institute, Sri Lanka
- J. B. Andrade, Brazilian Agricultural Research Company (EMBRAPA), Brazil
- C. Ayres, Brazilian Agricultural Research Company (EMBRAPA), Brazil
- E. Coeymans, Pontificia Universidad Católica de Chile, Chile
- B. Desai, Indian Institute of Management, India
- A. Fall, Senegalese Institute of Agricultural Research (ISRA), Senegal
- U. Koester, University of Kiel, Federal Republic of Germany
- M. Lipton, Institute of Development Studies, University of Sussex, U.K.
- X. Lu, Institute of Geography, Chinese Academy of Sciences, People's Republic of China
- J. T. Milimo, Rural Development Studies Bureau, University of Zambia, Zambia

- I. Nyborg, Norwegian Center for International Agricultural Development,
Agricultural University of Norway, Norway
- S. K. Raheja, Indian Agricultural Statistics Research Institute, India
- S. Ramagem, Brazilian Agricultural Research Company (EMBRAPA),
Brazil
- C. Ramasamy, Tamil Nadu Agricultural University, India
- D. Rubin, University of the Pacific, U.S.A.
- S. A. Shugeiry, Hubert Humphrey Institute of International Education,
U.S.A.
- T. Takavarasha, Ministry of Agriculture, Zimbabwe
- P. Temu, World Food Council
- Z. Tong, Agricultural Economics Research Institute, Chinese Academy
of Agricultural Sciences, People's Republic of China, and University
of Guelph, Canada
- E. A. A. Zaki, Ministry of Finance and Economic Planning, Sudan

RESEARCH SUPPORT

G. Votaw
*Director of Development
and Administration, U.S.A.*

B. Cordero
*Administrative Assistant,
Philippines*

Budget and Contracts

A. Orlin
Administrator, U.S.A.

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

R. Zamora
*Assistant to Administrator,
Philippines*

Accounting

M. DeVoi
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

J. Cabahug
Personnel Coordinator, Philippines

L. Gaskell
*Office Services Coordinator, Philip-
pines*

M. Hebert
Travel Coordinator, Philippines

S. Arora
Travel Assistant/Secretary, India

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

C. Soto
Receptionist, U.S.A.

A. Thomas
Office Services Assistant, U.S.A.

Computer Services

N. Walczak
Head, U.S.A.

W. Alvarado
Senior Programmer, Philippines

M. Leong
Microcomputer Specialist, Malaysia

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

Information

B. Rose <i>Director, U.S.A.</i>	U. Mohan <i>Information Specialist, India</i>
P. Klosky <i>Librarian, U.S.A.</i>	B. Rosencrantz <i>Information Coordinator, U.S.A.</i>
M. Harben <i>Editor, U.S.A.</i>	A. Basilio <i>Manuscript Word Processor, Philippines</i>
P. Skillman <i>Editor, U.S.A.</i>	L. McCoy <i>Typesetter, U.S.A.</i>

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

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 <i>PAI Associates International Ibadan, Nigeria</i>	Peter Rieder <i>Institut fuer Agrarwirtschaft Zurich, Switzerland</i>
Louis Emmerij <i>Organisation for Economic Co- operation and Development Paris, France</i>	Pasquale Scandizzo <i>Il Universita di Roma Rome, Italy</i>
Michel Griifon <i>Centre de Coopération Interna- tionale en Recherche Agrono- mique pour le Développement Montpellier, France</i>	Ammar Siamwalla <i>Thailand Development Research Institute Bangkok, Thailand</i>
Judith Heyer <i>Oxford University Oxford, England</i>	Peter Svedberg <i>University of Stockholm Stockholm, Sweden</i>
Evgeni Kovalev <i>Academy of Sciences of the USSR Moscow, USSR</i>	Wouter Tims <i>Centre for World Food Studies Amsterdam, Netherlands</i>
Lucio G. Reca <i>Inter-American Development Bank Washington, D.C., USA</i>	Eric Tollens <i>Katholieke Universiteit Leuven, Belgium</i>
	Winfried von Urff <i>Technische Universitaet Muenchen Freising-Weihenstephan, Federal Republic of Germany</i>

**BOARD OF
TRUSTEES**

Gerald K. Helleiner, Chairman, Canada, a professor of economics at the University of Toronto, has written several books on economic development and advised a number of international institutions. He is chairman of the board of the North-South Institute and a member of the board of governors and executive committee of the International Development Research Centre.

Harris Mutio Mule, Vice Chairman, Kenya, has served in the Kenyan government in various senior posts, including chief economist and 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 assistant president of the International Fund for Agricultural Development, a member of the World Bank's Council of African Advisers, chairman of the Advisory Committee to the African Economic Research Consortium, and a member of the executive board of the African Capacity Building Foundation.

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.

Anna Ferro-Luzzi, Italy, is director of the Human Nutrition Unit at the National Institute of Nutrition in Rome. She is also in charge of the World Health Organization's Collaborating Centre for Nutrition in Rome. She conducts international nutrition research in various developing and developed countries. Her other activities include serving as an adviser to the European Commission in Brussels, the World Health Organization, the Food and Agriculture Organization of the United Nations, and the Italian ministries of agriculture, health, and foreign affairs.

Ibrahim Saad Ahmed Hagrass, Egypt, has served his government in various posts, including general director for agricultural reform, deputy minister in the Ministry of Planning, president of the General Board for Agricultural Reform, and deputy minister in the Ministry of Agriculture and Land Reclamation, the post he held until his retirement in 1982. He is currently president of the Agricultural and Irrigation Committee both in the National Productivity Committee and the Senator Assembly.

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.

James Charles Ingram, Australia, has been the executive director of the United Nations World Food Programme since 1982. He previously served

as executive head of the Australian International Development Assistance Bureau and as ambassador to Canada (and concurrently to Jamaica, Barbados, Guyana, and Trinidad and Tobago) and the Philippines.

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 and president of the board of directors of Banco Sudameris.

Dharma Kumar, India, is a development economist and economic historian. She is currently professor of economic history at the Delhi School of Economics and has worked in the Reserve Bank of India, the Indian Ministry of Finance, the World Bank, and the Institute of Development Studies, University of Sussex. She has been a visiting fellow at various academic institutions, including the Institute of Advanced Study, Princeton University.

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 administrator with long experience in financial management and coordination of external assistance, began his government career in 1956. He has held various positions in the Ministries of Finance and Planning and was actively involved in macroeconomic management and structural adjustment initiatives in the 1980s. Recently he was minister for finance of Bangladesh and is currently chairman of a new foundation for assisting rural employment.

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. From 1980 to 1985 he was on the board of the United Nations University.

Just Faaland, Director General, Ex Officio, Norway, joined IFPRI in 1990. He was associated with the Chr. Michelsen Institute from 1952 to 1988, both as fellow and director. During the course of his career Faaland has been president of the Development Centre of the Organisation for Economic Cooperation and Development, member of the UN Committee for Development Planning and the UN Science and Technology Advisory Committee for Development, and member of the boards of the Norwegian Agency for International Development and the Norwegian Institute of Foreign Affairs.



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, 1990 and 1989, and the related statements of revenue, expenses and changes in 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, 1990 and 1989, and the results of its operations and its cash flows for the years then ended in conformity with generally accepted accounting principles.

Our audits were made for the purpose of forming an opinion on the basic financial statements of the International Food Policy Research Institute taken as a whole. The supplementary information included in the Schedule is presented for purposes of additional analysis and is not a required part of the basic financial statements. Such supplementary information has been subjected to the auditing procedures applied in the audits of the basic financial statements and, in our opinion, is fairly stated in all material respects in relation to the basic financial statements taken as a whole.

KPMG Peat Marwick

March 1, 1991



Member Firm of
Klynveld Peat Marwick Goerdeler

FINANCIAL STATEMENTS

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Balance Sheets December 31, 1990 and 1989

ASSETS

	<u>1990</u>	<u>1989</u>
Current Assets		
Cash and short-term investments (Notes 2 and 7)	\$2,447,238	1,404,606
CGIAR unrestricted grants receivable	310,981	184,956
CGIAR restricted grants receivable	...	130,337
Special project contracts receivable (Note 4)	1,515,678	1,291,681
Other receivables	262,033	165,303
Prepaid expenses and other current assets	185,872	181,626
Total current assets	<u>4,721,802</u>	<u>3,358,509</u>
Other Assets		
Property and equipment (Note 3)	421,944	586,908
Total assets	<u>\$5,143,746</u>	<u>3,945,417</u>

LIABILITIES AND FUND BALANCES

Current Liabilities		
Accounts payable	\$ 683,953	479,316
Current portion of long-term debt	...	1,212
Accrued vacations	409,554	333,925
Advance payment of CGIAR unrestricted grant funds	1,200,000	150,000
Unexpended CGIAR restricted grant funds	837,684	568,745
Unexpended special project contract funds	859,013	1,107,725
Other liabilities	8,533	14,028
Total current liabilities	<u>3,998,737</u>	<u>2,654,951</u>
Fund Balances - Unrestricted		
Working capital fund	723,065	703,558
Net investment in property and equipment	421,944	586,908
Equipment replacement fund
Total fund balances	<u>1,145,009</u>	<u>1,290,466</u>
Commitments and contingencies (Notes 5 and 9)		
Total liabilities and fund balances	<u>\$5,143,746</u>	<u>3,945,417</u>

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Statements of Revenue, Expenses and Changes in Working Capital Fund Balance For the years ended December 31, 1990 and 1989

	<u>1990</u>	<u>1989</u>
Revenue		
Grant income:		
CGIAR-unrestricted	\$6,741,900	6,300,329
CGIAR-restricted	295,686	680,488
Special project income-restricted	5,292,230	3,839,662
Investment income	112,777	138,729
Other income	8,154	2,664
	<u>12,450,747</u>	<u>10,961,372</u>
Expenses		
Program services:		
Direct research	8,128,921	7,117,591
Direct research support (information dissemination and computer services)	766,883	975,091
External reviews	307,625	...
Total program services	<u>9,203,429</u>	<u>8,092,982</u>
General and administrative:		
Indirect support	3,392,775	2,954,801
	<u>12,596,204</u>	<u>11,047,783</u>
Excess of Expenses Over Revenue	(145,457)	(85,911)
Transfer (to) from net investment in property and equipment	164,964	(116,575)
Transfer from equipment replacement fund	...	150,000
Increase (decrease) in working capital fund	<u>19,507</u>	<u>(52,486)</u>
Working Capital Fund Balance, Beginning	<u>703,558</u>	<u>756,044</u>
Working Capital Fund Balance, Ending	<u>\$ 723,065</u>	<u>703,558</u>

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Statements of Cash Flows For the years ended December 31, 1990 and 1989

	<u>1990</u>	<u>1989</u>
Cash flows from operating activities:		
Excess of expenses over revenue	\$ (145,457)	(85,911)
Adjustments to reconcile excess of expenses over revenue to net cash provided by operating activities:		
Depreciation	222,730	224,407
Loss on disposal of property and equipment	2,900	...
Decrease (increase) in:		
Grants receivable	4,312	(61,057)
Contracts receivable	(223,997)	(493,475)
Other receivables	(96,730)	59,981
Prepaid expenses and other current assets	(4,246)	48,746
Increase (decrease) in:		
Accounts payable	204,637	289,715
Accrued vacations	75,629	42,165
Advance payment of grant funds	1,318,939	46,723
Unexpended contract funds	(248,712)	25,273
Other liabilities	(5,495)	3,167
Net cash provided by operating activities	<u>1,104,510</u>	<u>99,734</u>
Cash flows from investing activities:		
Acquisition of property and equipment	(65,266)	(288,617)
Proceeds from disposal of property and equipment	4,600	...
Net cash used in investing activities	<u>(60,666)</u>	<u>(288,617)</u>
Cash flows from financing activities - repayment of long-term debt	<u>(1,212)</u>	<u>(13,674)</u>
Net increase (decrease) in cash and short-term investments	1,042,632	(202,557)
Cash and short-term investments at beginning of year	<u>1,404,606</u>	<u>1,607,163</u>
Cash and short-term investments at end of year	<u><u>\$2,447,238</u></u>	<u><u>1,404,606</u></u>

See accompanying notes to financial statements.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements December 31, 1990 and 1989

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 unconditionally 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 are 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. Accordingly, 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 was \$42,651 and \$26,845 for the years ended December 31, 1990 and 1989, 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.

The December 31, 1990 working capital fund balance of \$723,065 includes the December 31, 1989 balance of \$703,558 plus the current year transfer of excess of expenses over revenue adjusted for the transfer from the net investment in property and equipment.

The budgeted working capital fund balance, using the CGIAR criteria, was \$1,102,752 at December 31, 1990. Therefore, the working capital fund was \$379,687 less than the working capital fund balance using CGIAR criteria.

(continued)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements December 31, 1990 and 1989 (continued)

Note 1. (continued)

Net Investment in Property and Equipment

The December 31, 1990 net investment in property and equipment balance of \$421,944 includes the December 31, 1989 balance of \$586,908 less the current year decrease in net fixed assets of \$164,964. This amount was transferred to the working capital fund.

The net investment in property and equipment represents an allocation of fund balance for the future depreciation of the Institute's existing undepreciated property and equipment.

Functional Allocation of Expenses

The costs of providing program services and general and administrative activities have been summarized on a functional basis in the statements of revenue, expenses and changes in working capital fund balance. Accordingly, certain costs have been allocated among program services and general and administrative activities.

Reclassifications

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

Note 2. Cash and Short-Term Investments

Cash and short-term investments at December 31, 1990 and 1989 consist of the following:

	<u>1990</u>	<u>1989</u>
Cash and interest-bearing deposits	\$ 31,603	418,556
Interest-bearing deposits collateralized by U. S. government and marketable securities	2,415,635	986,050
	<u>\$2,447,238</u>	<u>1,404,606</u>

The market value of U.S. government and marketable securities approximated cost at December 31, 1990 and 1989.

Note 3. Property and Equipment

Property and equipment at December 31, 1990 and 1989 are summarized as follows:

	<u>1990</u>	<u>1989</u>
Furnishings	\$ 276,516	275,261
Equipment	275,316	273,309
Computer Equipment	734,847	753,115
Leasehold Improvements	146,560	141,289
	1,433,239	1,442,974
Less: accumulated depreciation	1,011,295	856,066
	<u>\$ 421,944</u>	<u>586,908</u>

(continued)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements December 31, 1990 and 1989 (continued)

Note 4. Restricted Grants and Contracts Receivable

CGIAR restricted grants receivable at December 31, 1990 and 1989 consist of the following:

	<u>1990</u>	<u>1989</u>
Amounts billed	\$. . .	23,289
Recoverable costs, not yet billed	. . .	<u>107,048</u>
	\$. . .	<u>130,337</u>

Special project contracts receivable at December 31, 1990 and 1989 consist of the following:

	<u>1990</u>	<u>1989</u>
Amounts billed	\$ 381,478	576,291
Recoverable costs, not yet billed	<u>1,134,200</u>	<u>715,390</u>
	<u>\$1,515,678</u>	<u>1,291,681</u>

Note 5. Leases

The Institute occupies office space under a lease expiring in 1992. The lease provides for additional rents based on increases in building operating costs and the Consumer Price Index.

Minimum lease payments for the above noncancellable lease are as follows:

1991	\$758,838
1992	<u>379,419</u>
	<u>\$1,138,257</u>

Total operating lease payments for the years 1990 and 1989 amounted to \$707,813 and \$632,441, respectively.

Note 6. Retirement Plan

The Institute maintains a defined contribution retirement plan for substantially all full time employees under which the Institute contributes 15% of an employee's base compensation. 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 Fund. Total contributions were \$695,763 and \$606,931 for the years ended December 31, 1990 and 1989, 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 currency. Local currency expenditures during the year are recorded at the exchange rates in effect at the time the expenditures are made. The remaining balances at foreign banks are included on the balance sheets at the December 31 exchange rates, and amounted to \$12,257 and \$23,566 at December 31, 1990 and 1989, respectively. These amounts are restricted to expenditures made in accordance with the special project provisions.

(continued)

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE

Notes to Financial Statements December 31, 1990 and 1989 (continued)

Note 8. Lines of Credit

The Institute has a line of credit available with First American Bank in the amount of \$800,000. At December 31, 1990, the Institute had no amount outstanding relating to the line of credit.

Note 9. Contingency

A substantial portion of special project revenue is from 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 with respect to the ultimate recognition of all such revenue. 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.

INTERNATIONAL FOOD POLICY RESEARCH INSTITUTE**Schedule of Expenses by Type
For the years ended December 31, 1990 and 1989**

	<u>1990</u>	<u>1989</u>
Expenses		
Personnel	\$ 5,345,495	4,510,821
Fringe benefits	1,743,173	1,477,763
Collaboration	1,859,677	1,536,735
Travel	1,122,844	1,195,053
Computer	170,676	216,198
External publications	437,440	514,077
Trustees' expenses (non-travel)	109,127	90,820
Office operations	1,542,391	1,255,064
Equipment purchases - special/restricted projects	42,651	26,845
Depreciation	222,730	224,407
Total	<u>\$12,596,204</u>	<u>11,047,783</u>