

AGRICULTURAL DEVELOPMENT OPPORTUNITIES
FOR THE 1990s -- THE ROLE OF RESEARCH

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Opening Remarks

I am grateful for this opportunity to address you. You may recall that the last external program review (EPR) for IFPRI made two recommendations that provide the basis for this address. First, it recommended that the director of IFPRI should address the Group biennially on a policy issue of relevance to the Group. This will be the third occasion for me to do so. Second, the EPR urged the director of IFPRI to consider extrapolations, from the factual base of IFPRI research as well as that of others, in order to draw conclusions of immediate relevance to the complex food policy problems facing our society. The need for such extrapolation continues to rule. While our knowledge of policy processes increases year by year, it seems that the complexity and the dynamism of those policy problems changes even more rapidly. Hence, the need for policy recommendations seems continually to run ahead of the factual basis for making those recommendations.

The last time I had the opportunity to address you, we were faced with global food surpluses and overflowing stocks, many previously importing developing countries were exporting, and there were pressures from many directions to reduce expenditure on agricultural research and agricultural development generally.

I tried on that occasion to indicate the complexity of the policy problems that had to be solved if those plentiful harvests were to be used effectively to foster economic growth of the type that would lift the mass of people out of poverty. Since then, a number of developing countries have reverted to cereal imports, global stocks have been drawn down considerably, and substantial quantities of land in the United States are being returned to agriculture.

In this context, I would like to remark once again on the central role of food and agriculture in a strategy of development that produces high rates of growth and broad participation in those processes. It is the implementation of steady agricultural development policies that stimulates, directly or indirectly, rapid growth in effective demand for food on the part of low-income people. Effective pursuit of such policies typically results in demand for food increasing more rapidly than even an excellent record in production, thereby creating growth in food markets for the surplus-food-producing

* Address presented at International Centers Week of the Consultative Group on International Agricultural Research, Washington, D.C., November 4, 1988.

countries. Thus the slowing of growth in the 1980s has been unfortunate not only for the poor in developing countries, but for developed country exporters as well.

I see the 1990s as a decade of grand opportunities, following the difficult, depressing 1980s. It is worrisome that expenditures on agricultural research and irrigation investment have been declining in recent years (the latter dropped by half in the past decade in Asia). This puts into question whether poverty abatement and growth potentials will be reached.

Today, however, I would like to depart from the pessimism of the recent past and instead look ahead to a 1990s of grand opportunity. To do so, I must first be convincing that the 1960s and 1970s provide a clearer picture of what might occur in the 1990s than do the distorted, malfunctioning 1980s. I must then discuss the interaction of five elements in the 1990s -- poverty reduction, environment, food-cost reduction, trade, and stability. This is a lot to cover in a few minutes, but the interaction of the five is important and agricultural research and the CGIAR's role in it will be central to grasping opportunities offered.

The 1980s as an Aberration

The interacting effects of the second oil shock, the rapid growth in Third World debt, high real interest rates, unusually depressed primary commodity prices, increasingly distorted prices within many developing countries, and grossly unbalanced public budgets characterized the early to mid-1980s. The consequent need for major restructuring of policies and economies slowed growth in both developed and developing countries (Table 1).

The slower growth in developed countries further slowed trade potentials for developing countries. The results were additional reduction in growth in the Third World, much less progress in poverty reduction, and consequently diminished growth in demand for food. The latter, of course, provided an illusion of food self-sufficiency in many developing countries and added to surplus production capacity in developed countries. The consequences were most severe in Africa, where a poorly developed capacity for policy analysis and ill-considered foreign assistance policies compounded the underlying problems, and in Latin America where the debt crisis took on particularly enormous proportions.

Current pessimism arises from two sources: observation of the distorted 1980s and a view that growth in developing countries is driven by import demand of the developed countries whose own growth is now permanently slowed by maturity. A different view arises if growth is seen as largely the product of technological development that raises factor productivity, which in turn is the product of growth of human capital and the institutions that mobilize that human capital for productive purposes. Throughout the distorted 1980s, as in prior

decades, human capital stock has been growing rapidly, even in Africa, and institutional structures have also been improving. Thus the underlying basis for growth is more developed as we enter the 1990s than it was in the late 1960s and 1970s. However, for that growth to be driven by domestic demand and for capital resources to be spread thinly over a large, growing labor force requires, far more than in the past, that effective demand must rise from a technologically advancing, cost-reducing development of the agricultural sector.

The prospect of growth offers extraordinary opportunities for reducing hunger and poverty and reversing the current onslaught on the environment. It does require cost-reducing technological change and open-trading regimes. It also requires that we directly confront the problem of increasing instability in global agriculture. I comment below on each of these five areas of opportunities and problems for the 1990s: hunger, environment, cost reduction, trade, and stability.

Abolishing Hunger

The 1990s can be a decade in which major strides made in abolishing hunger will clearly indicate its approaching end. For that to occur, a few key points must be central in our minds.

Hunger is a massive problem. We will enter the 1990s with at least 700 million hungry people by even the most minimal definition of food adequacy. A more humane definition would include a full one billion people.

Moreover, the poor are heavily concentrated in the rural areas of very low-income countries, and many are in rural areas where the potential for response to improved agricultural technology is high. Two-thirds of the poor are in Africa and South Asia; three-quarters are in low-income developing countries, and only one-quarter are in the middle-income countries (Table 2). The hungry poor are disproportionately children. And, although in general they appear not to be disproportionately in female-headed households, women have an influence on nutritional and health status far greater than their proportions among the poor.

Because the problem of poverty is so massive and the poor are so concentrated in the rural areas of low-income countries, it is difficult to envision eliminating the bulk of hunger through redistribution. Such redistribution would have to be substantially international and would have to grow enormously over time as the number of poor in the very poor, slow-growth countries continued to increase rapidly, as has been the case in the past. The reasons for these are twofold: poor countries have difficulty finding the resources to reduce poverty, and the proportion of their population that is poor is very large.

While radically reducing the numbers of poor purely through unending international redistribution seems unlikely, reducing their

numbers through growth is highly effective. Note that in the middle-income developing countries, the absolute number of poor dropped nearly in half from 1970 to 1980, while in the low-income countries the numbers increased by more than half (Table 3). In regional terms, it is the countries of Africa and South Asia in which poverty increased greatly in absolute numbers.

But there is a more important, although still controversial, reason to emphasize growth as a means of radically reducing poverty. We return here again to the fact that a large number of the poor in low-income countries, some 250 million, are located in areas that we know are highly responsive to modern, production-increasing technology, for which the employment multipliers are substantial within agriculture and as well as in the rural nonagricultural sector (Table 4). For example, in India, over half the poor are in the less than one-quarter of the area with the highest rural population densities; in Kenya, two-thirds of the poor are in three western districts characterized by high population density. In contrast, in the middle-income developing countries, the bulk of poverty has already been removed, largely by growth in the high-potential areas.

To emphasize the areas with high agricultural potential is not to ignore the other two-thirds. It is, however, to note that we now know what to do to rapidly eliminate hunger in the high potential areas; that more than a quarter of the hungry are in urban areas, for which vigorous growth in high potential rural areas is critical to reducing the pressures of urban poverty to manageable proportions; and, that the historical answer to problems of low-potential areas has always contained a major element of migration, which in turn depends on good performance in the high potential areas and their urban enclaves. I will return to the problems of the low-potential areas in a moment.

What is needed to move the high-potential areas? We now know that modern high-yielding agricultural technology is the key. This technology in turn is dynamic, requiring continuous effort; it is location specific, requiring a large dispersed effort; and it is complex, requiring effort on a wide front from research to input supply. The quarter of a billion hungry people in high-potential areas still lack adequate research and technology support suited to their specific conditions and circumstances. The CGIAR has much left to do for these areas in association with national systems of research and other structures of technological change. That research gap is notable in the Gangetic and Brahmaputra Plains in Asia and in the higher potential areas throughout Africa. Of course, the lack of appropriate technology interacts with other forces in explaining the lack of progress -- that is what makes the challenge.

The other broad category of need that we now know is critical to eliminating hunger and extreme poverty from high-potential areas is roads and other infrastructure that allow the technology to spread to all farmers and allows the employment multipliers to work to make adequate jobs for the poor. An IFPRI study in Bangladesh found that

areas with good infrastructure used four percent more labor per hectare than areas with poor infrastructure and 92 percent more fertilizer. The linkage effects of that growth produced a level of nonagricultural employment that was 30 percent higher than in the poor infrastructure areas and wage rates that were 12 percent higher.

Infrastructure investment provides the link between long term, self-reliant removal of poverty, and short-term amelioration. Rural public works provide massive increases in immediate employment and are clearly the most proven, targeted means of redistribution of food and income to the poor. Fifteen billion dollars a year, about one-quarter in food aid, built up over a five year period and continued for another 10 or 15 years would provide near immediate relief for the bulk of the rural poor in the developing countries. This in conjunction with improved agricultural technology would provide employment multipliers that would sustain that income increase and access to food.

It should be noted that for such an effort to be properly growth-oriented, the resources for rural roads and other elements of infrastructure must fulfill their development function. Unfortunately, at present such efforts are driven so much by immediate employment objectives that they fail to provide the larger permanent employment multiplier of which they are capable. Projects that build unpaved roads that wash away quickly, for example, are clearly insufficient. Additional resources are needed. Thus, the food component for labor, which currently dominates the total cost of these projects, should drop to between 15 and 40 percent of total cost, so that there can be additional funds for materials. But more important, there must be coordination of food/employment programs and development programs in both national governments and international agencies, something which is usually lacking in both.

What about the low-potential areas? They, of course, contain a major proportion of the poor in the low-income countries and are the dominant reservoir of poverty in the middle-income countries. The preceding discussion has indicated that efforts in these areas should not be pursued in the low-income countries at the expense of the high-potential areas if the objective is to obtain maximum reduction in poverty per financial unit of expenditure and unit of time. This inevitably means that, in poor countries, large-scale foreign assistance is needed. And such assistance is important in the middle-income countries for reducing diversion from the growth that is itself part of the long-term solution for low-potential areas. Note in this context that in the middle-income developing countries, little poverty remains in high-potential rural areas and that poverty declined rapidly in absolute numbers in periods of economic growth (Tables 3 and 4). Increasing numbers in absolute poverty is a characteristic of low-income countries with a high proportion of poor in high-potential areas.

What does one concentrate on in low-potential areas? We know much less about this. The most we know is that there is little difference in emphasis in low-potential areas and in high-potential areas, but the risks are higher and the returns lower. There needs to be research focused on breakthroughs that will make these areas high potential, with relatively more emphasis on low-cost innovation. Infrastructure must be developed to deal with instability through market integration and to attain employment multipliers; and, education must be expanded. Massive rural public works can deal with the short-run problem in a redistributive manner, while increasing the potential for growth. But the difficult task of improving agricultural technology is central to any possibility of dealing with the problems in these areas through internal growth. And precisely because these are long-term, high-risk investments, it is appropriate that foreign aid and international programs pay for a disproportionate share.

Preserving the Environment

The solutions to hunger and poverty are very much at the core of the solution to the environmental assault occurring in developing countries. Of course, environmental degradation occurs in both developing and developed countries. But a broad distinction can be made. In developed countries environmental destruction is primarily a product of wealth, while that in very poor countries is primarily a product of poverty. The most serious environmental destruction in developing countries occurs as population pressure expands against a limited land resource base and pushes cultivation out onto more fragile resources.

We see the complex ramifications of population pressure within the context of technological advances dramatically illustrated in an IFPRI study on Nepal. In less than a decade, the destruction of forest resources has added one-hour per day to the time required for women to collect firewood. Deforestation also contributes to a decline in the nutritional status of children through the reduced cooking time available and reduced time of the mother for preparation of food. As women put more time into gathering firewood, they also have less time for cultivation.

In addition, declining productivity of the land from increased cultivation in marginal areas encourages more extensive cultivation and further clearing of the land. In other words, the degradation of forest areas is leading to further degradation of the land, which adds to the degradation of the forest areas. There is a clear downward spiral in this situation. And it is made more difficult by recurring scarcities of food and higher prices.

There are two solutions to these environmental problems. First, increase the agricultural capacity of the less fragile land to help relieve the pressure in the more fragile areas. This will produce a synergism between environmental preservation and a major attack on

poverty in the more responsive areas. Second, conduct research and provide infrastructure in the more fragile areas. The former to help find less destructive systems of farming, the latter to relieve the environmental stress from hunger in years of poor production and by increasing nonfarm jobs. Again, we find a synergism between hunger abatement through growth and environmental protection.

Reduced Cost of Production

The original momentum of the green revolution is running out. Food self-sufficiency is waning. In part, the latter is good because it reflects accelerating demand for food rather than slowing production growth rates. But, in part, it reflects a slackening of research and investment effort resulting in a return to food production increases that can only be obtained through rising prices and rising costs. This hurts poverty alleviation because of the loss of the employment multiplier from the potential savings from new, cost-reducing technology.

Thus we see a need for redoubled effort to increase agricultural productivity. In Africa, of course, such technological breakthroughs have hardly occurred. The World Bank MADIA study shows that in Africa the proportion of output coming from poor, environmentally fragile areas is increasing -- the antipathy of the case for technologically-led development -- while in Asia the proportion of total food production occurring in the already high-yield areas has grown rapidly. But in Indonesia, the growth rate in cereals production has dropped dramatically. When and from where are the new IR8s and the Sonora 64s to come? Have we aligned our resources to provide them? Poverty alleviation and environmental protection both require that we return to these questions in the 1990s. Our greater human resource capacity should allow this and new initiatives as well.

Trade

With few exceptions, development cannot be led by export growth in the sense that the bulk of the demand for increased output from a developing country will come from abroad. Development must be largely driven by growth in the domestic demand of developing countries. To provide that effective demand for overall growth is the principal function of agricultural growth through cost-decreasing technological change. That is the proper engine of growth -- not the markets in some distant countries that some would suggest.

Nevertheless, trade is extremely important to the development process. Most obviously, we know that once countries accelerate their growth substantially, even their best efforts in their agricultural sector cannot keep up with the domestic growth in demand for food. This is true at least as long as their low-income consumers are spending 60 to 80 percent of increments to income on agricultural commodities. Thus trade is needed to facilitate the import of basic food staples, including cereals and vegetable oils, into developing

countries. These countries, of course, must be able to export in order to pay for those commodities.

Equally important, if developing countries are to grow rapidly, they must spread their own capital resources across a high proportion of their labor force. This means they cannot concentrate on capital-intensive industries like steel, petrochemicals and fertilizer. They must import those capital-intensive goods and services. And again, they must be able to export something to pay for those imports.

Agriculture, itself, can play an important role in meeting export needs. The opportunities are particularly great in labor-intensive agricultural commodities like fruit, vegetables, and certain types of livestock commodities. The message for research is clear. While we are striving for new breakthroughs in the basic food staples, new efforts must be added in the labor-intensive agricultural commodities for which demand is still growing even in developed countries.

Four lessons from the past can guide us in these important trade issues of the 1990s. First, developing countries are already increasing their share of the international market for labor-intensive agricultural commodities and command between a third and half of that market already. Second, even as countries move into middle-income status, agricultural exports dominate the exports of developing countries, hence continued growth in exports requires growth in agricultural exports. Third, developing countries do best in labor-intensive agricultural exports when their own markets for those commodities are growing rapidly. Thus broad-based internal markets that derive from successful rural development strengthen agricultural trade performance. Fourth, a strong research effort is needed both in production to reduce costs and in marketing if new export markets are to develop.

What is the trade lesson for the CG system? First, it is that we should stick to our areas of demonstrated expertise -- alternative efforts are to little avail if the basic agricultural sector is not moving ahead. Second, we should broaden our efforts, as resources allow, doing so in the direction of labor-intensive agricultural commodities, such as horticulture, which are good for poverty alleviation, good for growth, and good for trade.

Stability

I have saved for last what will be the most difficult problem of the 1990s -- instability. Note that instability has profound implications for the poor and poverty alleviation, for environment, for trade, for the agricultural research system, and hence for the CGIAR system.

The world has experienced rapidly increasing production instability in recent years. The coefficient of variation of total world cereal production rose from 2.8 to 3.4 percent between 1961-71 and

1974-81, an increase of 22 percent (Table 5). Most of that increase was accounted for by increasing variability in maize, barley, and some other cereals. On the other hand, it appears that sizable increases in world wheat and rice production were not accompanied by significant increases in instability.

Increased production instability can be attributed in part to factors associated with modern seed/fertilizer technologies. For example, if all of a country's production of a crop has a single parent, its susceptibility to a particular disease outbreak may lead to widespread losses. An extreme example was the devastation to the United States' corn crop in 1970, caused by the southern corn leaf blight (Figure 1). In addition, policies affecting the availability of fertilizer, electricity, and water inputs increase in importance with the modernization of agriculture. Hence, instability in those policies can have a large and unfavorable effect on production stability.

Increasing price instability has accompanied greater production instability between 1961-71 and 1974-81 (Table 6). The coefficients of variation for world prices for the two periods increased 400 percent for wheat, 59 percent for rice, and 67 percent for maize. Many countries, however, have been able to insulate their domestic prices from fluctuations in world prices. Countries in the European Community have been particularly successful in that regard.

In the face of increasing world production, the United States has historically increased its own stocks, limiting the potential decline in international prices (Figure 2). However, because of the market-competitive actions authorized in the 1985 Farm Bill, the level of carryover stocks of all major grains was reduced drastically. The recent drought has accelerated the drawing down of U.S. stockpiles, reducing their stabilizing influence on world markets. The U.S. Department of Agriculture estimates a 56 percent drop in U.S. cereal stocks from the end of 1987 to the end of 1988.

The biggest losers from instability in food supplies and prices are, of course, the poor. A given reduction in supplies will result in a decrease in consumption by the bottom 20 percent of the income distribution in developing countries that is more than 10 times greater than by the top 5 percent.

Dealing with instability by building stocks sufficient for a single poor year is not an extraordinarily expensive phenomena, and we find that cultivators around the world commonly do so. The difficult problem is the requirement for two bad years in a row. The cost of providing for that through stocking policy is exorbitant and, hence, is rarely paid. A second successive bad crop year is most effectively dealt with through international trade. For poor countries, special financing problems arise, which can effectively be dealt with through the IMF cereal facility.

Given the desire for trade and growth in food consumption in developing countries, the international system should prepare itself to meet those needs. To do so, the following is required:

First, the International Monetary Fund cereal facility should be strengthened, rather than gradually weakened as it is at present.

Second, it is important that the developed countries, as they try to restrain excessive growth in their production, keep in mind the growing need for food in developing countries during this intermediate period when agricultural growth is accelerating with technological change in developing countries but demand for food is growing even more rapidly.

Third, the developed countries should consider at least a minimal-level stocking policy in order to stabilize their own prices and consumption and to provide some basis for stability in international markets.

Fourth, the CGIAR system must help increase stability and reduce environmental stress by breeding and developing practices for achieving higher stability of production.

Conclusion

I have spoken of five interacting forces that offer opportunities and problems in the 1990s. We can see that decade as putting us firmly on the path of eliminating the bulk of poverty and hunger in the world and, in so doing, see the seemingly relentless attacks on our environment abate. This is possible because of the vast investment in human capital and institutional structures that has been occurring for the past several decades. The returns are beginning to flow -- first in the richer countries of Asia and Latin America, then in the poorer countries in these regions, and finally in Africa.

The CGIAR System has a central role to play in these processes-- as a progenitor of research results, as a role model of research productivity, and as a partner in setting priorities. Those priorities must include achieving success in the easier portion of the task -- providing the base for an accelerated increase in resource productivity (lower cost of production) in the high-population-density, high-production potential regions of the low-income countries where the poor are most numerous and most concentrated. They must also include efforts on the more difficult environments, efforts which are disproportionately larger than what poor countries feel they can afford on their own, a disproportion that is necessary, morally and economically, but that poses difficult problems of interaction with national systems. But the CG System must also recognize that the dynamics of the demand structure in developing countries changes rapidly with rising income and as the opportunity to earn large amounts of foreign exchange from nontraditional agricultural exports

grows. This calls for dynamic expansion and adjustment of the research system.

Finally, the CG System is well placed to understand the critical problem of instability in global food production and prices, and from that understanding to convey the need to increase stability by scientific research, by appropriate rural investment opportunities, by increased incomes, and by international and national policies to both reduce instability and help poor countries to cope with instability.

There is an exciting prospect just ahead of us. Those of you who have labored long and hard to provide growth, stability, and equity during this period of adjustment, distortion, and slow progress deserve to share in that vision.

Thank you.

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Table 1--Growth in GNP and GNP per capita, developing countries, 1961 to 1983 (1983 = 100)

	Real GNP		Per Capita GNP	
	Compound Annual Growth 1961 to 1980	Average Annual Growth 1981 to 1983	Compound Annual Growth 1961 to 1980	Average Annual Growth 1981 to 1983
 (percent) (percent)
Asia (excl. China)	6.11 5.58	6.02 5.32	3.73 3.15	4.12 3.02
North Africa/ Middle East	9.03	2.30	6.15	-0.34
Sub-Saharan Africa	4.76	-1.91	1.87	-4.84
Latin America	6.12	-1.87	3.44	-4.11
Developing Countries (excl. China)	6.60 6.51	1.93 1.18	4.09 3.91	-1.17 -0.15

Source: World Bank (various years).

Table 2--Projected incidence of undernutrition, 1990

	Total	Low-Income Countries	Middle-Income Countries
 (millions of people)		
Africa	137	99	38
South Asia	350	350	-
East Asia/Pacific	31	-	31
Latin America	72	2	70
Near East	34	4	30
China	76	76	-
Total	700	531	169

Note: The estimated incidence of hunger in 1990 is calculated using the proportions undernourished in 1979-81 as reported by FAO (1985) and the projected population for 1990 as reported in World Bank (1988). The breakdown of the Near East into South Asia and East Asia/Pacific is on the basis of the distribution of poor in the two areas as given in World Bank (1986). Estimates on China are based on Riskin (1987). Division on the basis of low income and middle income is by the distribution of population in the two groups in each region. Incidence of poverty among low-income countries is assumed to be double that in the middle-income countries and this proportion is applied to each region specific number. Low-income countries are those with per capita income of \$400 or less in 1983. Given the various assumptions in the calculations both in the original estimates and the projections, the numbers should be seen as indicative, and not definitive.

Table 3--Changes in the prevalence of energy-deficient diets,
1970 to 1980

	Percentage change in share of population	Percentage change in number of people
Developing Countries	-2	+14
Low-Income	+3	+54
Middle-Income	-9	-44
Sub-Saharan Africa	+4	+49
East Asia and Pacific	-14	-57
South Asia	+2	+47
Middle East and North Africa	-14	-68
Latin America, Caribbean	-4	-21

Source: World Bank (1986).

Note: The norm used is a calorie level which the World Bank defines as the benchmark below which there is "not enough intake to prevent stunted growth and serious health risks." The FAO in the Fifth World Food Survey shows somewhat different trends in that the proportions of hungry people declined in all regions, though for the least developed countries as a group the proportions increased. It should be noted that not only is the FAO methodology different but their definitions of the regions are also not identical to the World Bank, e.g. the FAO does not separate out the poorer regions of South Asia from South East Asia aggregating them together as the Far East so that the disparate trends within the region are obscured. Nor do they separate out Sub-Saharan Africa from the North Africa. Since we are interested in separating out the economically different regions, we use the World Bank trends. China is not included in the analysis.

Table 4--Rural-urban distribution of poverty and the estimated number of people living in areas of high potential, 1990

	Total	Urban	Rural	Agricultural Potential	
				High	Low
..... (millions of people)					
Africa	137	14	123	61	62
South Asia	350	70	280	140	140
East Asia	31	5	26	6	20
Latin America	72	29	43	11	32
Near East	34	-	-		
China	76	-	76	26	50

Note: The distribution by rural and urban classification is based on a survey of country poverty studies. All poverty in China is grouped under rural poverty. There are indications that there is little malnutrition in urban areas but this should not be seen as a statement on the absence of poverty in urban China, rather a reflection on the paucity of definite data. All numbers are tentative and should be seen as merely indicative.

Table 5--Changes in the coefficients of variation of world cereal production, 1960/61-1970/71 to 1971/72-1982/83^a

Cereal	Coefficient of Variation of Production		
	First Period	Second Period	Change
 (percent)		
Wheat	5.46	4.83	-11.5
Maize	3.29	4.41	34.0
Rice	3.97	3.80	-4.3
Barley	4.81	7.50	55.9
Millets	7.78	7.66	-1.5
Sorghum	4.75	5.70	20.0
Oats	11.30	5.35	-52.6
Other cereals	4.57	9.33	104.2
Total cereals	2.76	3.06	21.7

Source: Hazell (1988).

^a Does not include China.

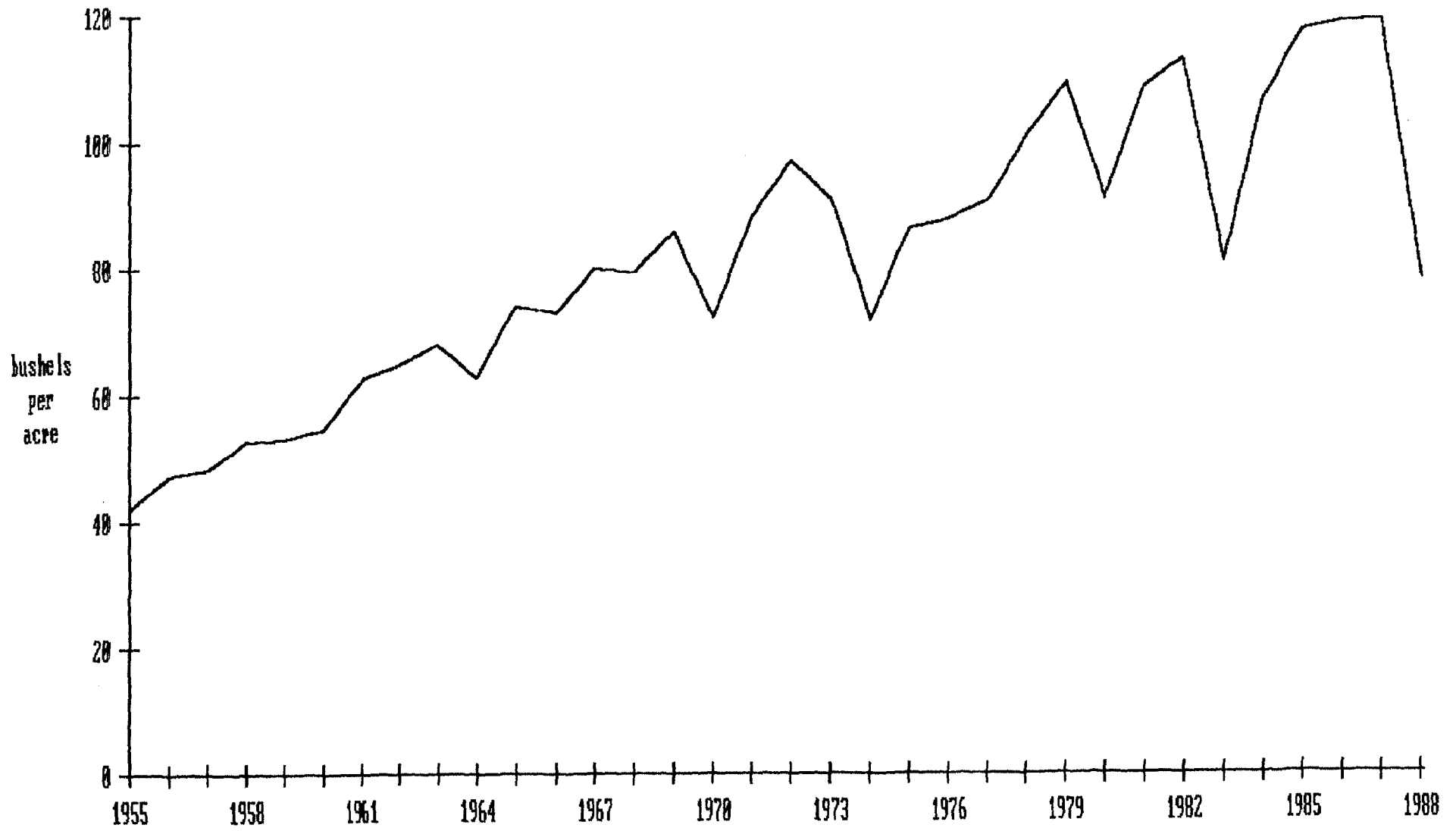
Table 6--Changes in the coefficients of variation of world and national cereal prices,^a 1961-71 to 1974-81

	Wheat		Rice		Maize	
	1961-71	1974-81	1961-71	1974-81	1961-71	1974-81
 (percent)					
World	4.05	20.50	17.76	28.16	7.37	12.35
France	3.02	2.41			2.51	4.27
United States	15.03	20.20	2.56	20.29	7.98	16.77
Mexico	2.92	5.47			7.60	10.03
India	9.89	7.20	22.36	11.10		
Japan	3.37	8.39	13.50	4.24		
Canada	7.37	20.06				
Turkey	2.67	25.48				
F.R. Germany	2.92	3.00				
United Kingdom	2.68	4.78				
Italy	2.53	3.43				
Pakistan	7.84	8.11				
Argentina	24.58	50.17			23.15	33.05
Brazil			13.75	18.69	5.04	26.07
Yugoslavia					18.07	14.00
Kenya					10.91	10.00
Burma			2.54	0.66		
Philippines			12.57	4.17		
Colombia			14.05	9.32		

Source: Hazell (1988).

^a Variation represented by fluctuations in prices around trend for the periods indicated.

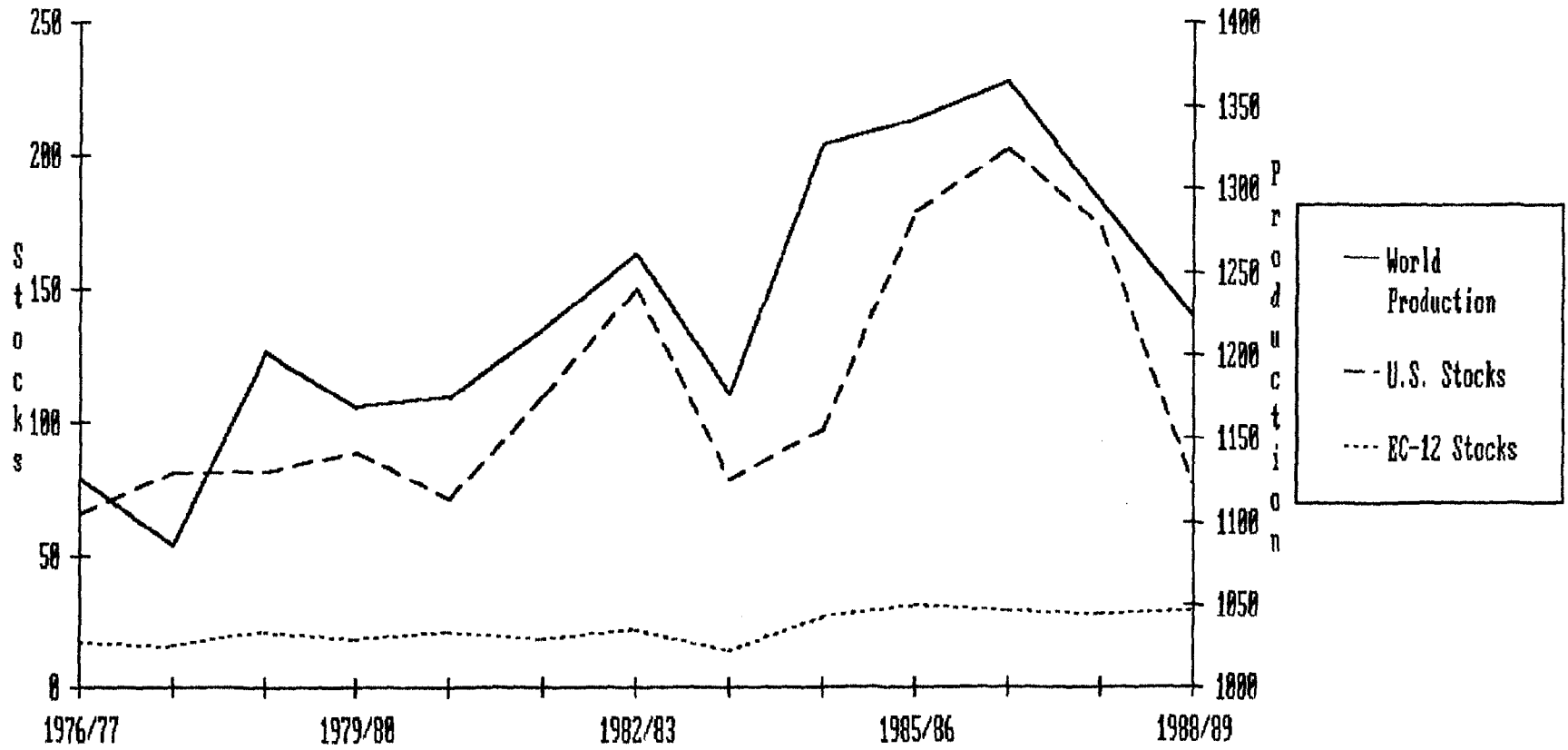
Figure 1. U.S. Corn Yields, 1955-88.



Source: USDA (1988).

Note: Downward fluctuations in corn yields in 1970 due primarily to widespread corn blight. Since then, most fluctuations can be attributed to severe weather conditions.

Figure 2. Responsiveness of U.S. and EC-12 Wheat and Coarse Grain Stocks to World Production, 1976/77 to 1988/89.
(million metric tons)



Source: USDA (1988).

Note: Data for 1988/89 based on USDA projections as of August 11, 1988.