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What the Green Revolution Means to U.S. Agriculture*

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The dramatic upward sweep in Asian food grain production in recent years has been greeted enthusiastically by people of all nations. Because these advances in farm output are based largely on new varieties of seeds and new combinations of water, fertilizer, and other inputs, the whole process has been called the Green Revolution. Wheat is the commodity that has been most affected by the Green Revolution, but rice is not far behind. The promises of the Green Revolution give many less-developed nations the hope of becoming self-sufficient in vital food grains for the first time in decades.

These nations desire food grain self-sufficiency to reduce foreign exchange outlays and to lessen dependence on special food aid imports from wealthy nations like the United States. While most of the advanced nations of the world have supported and encouraged the development efforts underway in Asia, Africa, and Latin America, the results of the Green Revolution are beginning to bring the interests of the United States and other developed nations into direct clash with the goals of less-developed countries.¹

This article concerns the nature and extent of the emerging clash. The issue is complicated by concurrent agricultural policy developments in Canada, Australia, Japan, and the nations of the European Economic Community (EEC).² Knowledge of these policy developments

and of changes in world wheat markets provides a background for understanding what the Green Revolution means to U.S. agriculture.

WORLD WHEAT MARKETS

Production and Trade

World wheat output has climbed irregularly but persistently during the past 2 decades, especially since about 1961-62 (figure 1). When compared with the slow increase and recent fall in world exports, the conclusion of mounting self-sufficiency around the world is inescapable. Even noncommercial or concessional exports, which include food aid, barter sales, and long-term credit, have remained relatively stable or dwindled. Naturally, the pressure of these developments has not been shared equally by all nations. The burden has been borne especially by the United States, Canada, and Australia. These three countries together with the EEC account for about one-third of the world's wheat production but three-fourths or more of recent global exports. Less-developed countries have provided important outlets for excess supplies from these developed producers.

The trends for U.S. production and trade are shown in figure 2. Recent cuts in wheat acreage and output are substantial, though not unprecedented, and reflect tightened acreage controls and lower market prices. Observe the overall importance and recent decline in food aid shipments under U.S. government programs, mainly Public Law (P.L.) 480.

The decline in U.S. and world wheat exports since the mid-1960's resulted, in large measure, from cereal grain production growing more rapidly in the less-developed countries than in the developed ones: 37 and 19 percent, respectively, during the 1960-70 period. This production growth within less-developed nations has placed pressure on world markets in two ways; first, as traditional exporters lose former markets and these displaced supplies seek alternative outlets; and second, as previous importers become exporters when supplies exceed domestic demand or the domestic market's ability to distribute them internally.

Markets within the United States and other highly developed nations also are important outlets for wheat. But little or no growth in food use for wheat can be expected in these nations. Population growth only partly offsets the declining per capita consumption generally associated with rising incomes. Some expansion in feed use is possible at low prices, but such expansion adds economic and political pressure to domestic supply constraints in operation for feed grains. Consequently, stagnant or shrinking markets within advanced nations intensify the surplus problem already depicted in world wheat markets.

Concessional Exports

Several countries provide noncommercial exports to less-developed nations to advance their humanitarian and foreign policy goals as well as to gain access to markets where commercial transactions pose difficulties. These exports involve sales for nonconvertible currencies, long-term credit sales, gifts and donations, barter exchanges, bilateral arrangements, and government-to-government agreements. Since the mid-1950's, special transactions of this variety have account-



* A more detailed paper on this subject is available as Staff Paper 71-20 from the Department of Agricultural and Applied Economics, 212 Haacker Hall, University of Minnesota, St. Paul, Minnesota 55101.

¹ It is, of course, difficult to be precise about the distinction between developed and less-developed nations. Here, developed nations comprise the wealthy countries of western Europe, Canada, Japan, Australia, and the United States. The less-developed nations are noncommunist countries in Asia, Latin America, and Africa.

² Belgium, France, the Federal Republic of Germany, Italy, Luxembourg, and the Netherlands constitute the six-nation common market. Since the member nations now follow a common agricultural policy, we can view the community as a single nation for most purposes. The impending accession of the United Kingdom to membership in the community does not appreciably alter the arguments made here.

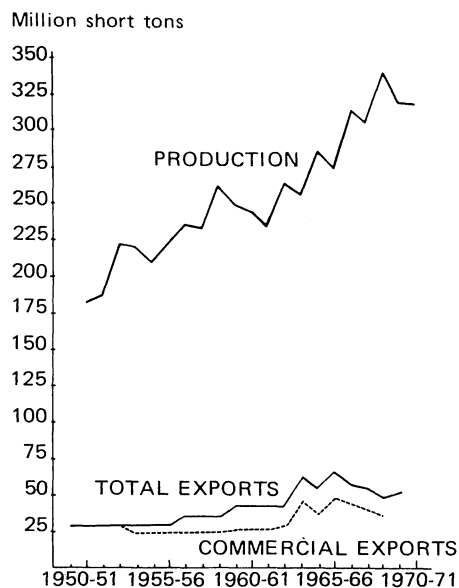


Figure 1. Wheat: world production and exports

ed for roughly one-fourth to one-third of total wheat exports annually.

Among wheat exporters, the United States has engaged most heavily in food aid sales and donations. Since 1954, when P.L. 480 was first passed, one-half to three-fourths of U.S. wheat exports have been in this category, mostly in the form of sales for foreign nonconvertible currency, long-term credit sales, and gifts. Canada began food aid exports in the early 1960's, with the annual amount reaching 10 percent of total Canadian shipments in 1966-67.

Large food aid shipments, especially foreign currency sales, to nations like India, Pakistan, and Turkey will be among the first casualties of the Green Revolution as these countries move toward food grain self-sufficiency.

AGRICULTURAL PROBLEMS AND POLICIES IN DEVELOPED NATIONS

Problems

The basic agricultural problems reflected in the food grain sectors of the United States, Canada, Australia, the European Economic Community, and, to a large extent, Japan, have many similarities. Among these problems are:

- excess production capacity (or supplies) at current internal price levels,
- constant political pressure to maintain or increase farm incomes, and
- pressure to maintain or expand export outlets (commercial and noncommercial) to alleviate domestic grain surpluses and earn foreign exchange.

Attempts to deal with these and other problems have produced a series of complex commodity programs for food grains and other agricultural products in these nations. Specific policy goals and program details differ from nation to nation

in accordance with national priorities and political pressures.

Policy Goals

In the United States, food grain policy goals involve supply restraint, farm income protection, export expansion, and government cost reduction. Both humanitarian and surplus disposal goals are evident in the establishment and operation of the P.L. 480 concessional export program in which food grains, mainly wheat, wheat flour, and rice, have formed the bulk of the shipments.

Wheat policy goals in Canada and Australia are alike. Both nations have been historic export producers at approximately world prices. Farm incomes traditionally have been reasonably comparable to nonfarm incomes in each country, so no strong pressures have developed to redistribute income to food grain producers from elsewhere in the economy. Both nations rely on agricultural exports to finance internal economic growth. Consequently, policy goals stress export expansion and development. Until recently, shielding producers from wide income fluctuations caused by weather and external price variation also was a major policy objective. But now supply control and farm income protection are emerging as major policy goals in both Canada and Australia in the face of wheat surpluses and low prices in world markets.

Apparent policy goals for rice in Japan and wheat in the EEC resemble one another. Income protection for farmers and food grain self-sufficiency predominate. Both the EEC and Japan have recently become surplus food grain producers and are now looking toward export outlets for excess supplies and are exploring methods of production restraint.

Policy Tools

Price supports or guarantees are common to each of the developed food grain producers under consideration here. Some form of production control is being practiced in the United States, Canada, Australia, and Japan. Until recently, the United States was the only major exporter to attempt output restraint through administrative mechanisms. All of these wealthier suppliers protect domestic markets by means of import controls and subsidize exports either directly or indirectly. All of them support wheat for food at higher internal prices than wheat for feed.

Prices

Although international price comparisons are always risky, the following tabulation suggests the extent of protection by these wheat producers in a recent year. The Canadian price can be viewed as an approximation to the world price. Compare this with the prices offered to EEC and Japanese farmers. Also notice the middle range of protection offered U.S. wheat farmers via price support loans and the domestic marketing certificate payments. In this particular year, 1967-

Country	Producer prices for wheat, 1967-68, per bushel
Canada (final realized farm price, No. 1 Northern)	\$1.67
Australia (average return to grower)	\$1.68
United States (average farm price received, including direct payments)	\$1.87
EEC (weighted average producer price)	\$2.55
Japan (producer price, fixed by government, including bags)	\$3.96

68, only the United States was controlling production by direct policy.

HIGHLIGHTS

This summary of world wheat markets and agricultural policies in developed nations illuminates seven key points:

- The United States, Canada, and Australia rely heavily on export markets as outlets for their wheat production.
- None of the major exporters can depend on expansion of domestic food markets for wheat.
- The United States and the other major wheat exporters have excess capacity locked into their food grain sectors.
- This excess capacity is held as stocks or idled land or appears as subsidized commercial and concessional exports.
- The United States and other developed producers of food grains, for the near future at least, are committed to farm price and income guarantees based on multiple price mechanisms and/or direct payments to growers for land diversion.
- The costs of sustaining these price and farm income support programs in the face of this situation will grow.
- Much of the recent increase in world food grain production has come from Green Revolution advances in less-developed nations.

THE GREEN REVOLUTION IN LESS-DEVELOPED NATIONS

How the less-developed nations utilize their expanded output affects world trade and creates repercussions for the United States and other exporters of food grains. The likely policy and marketing developments are discussed below to show how Green Revolution changes can alter past trade patterns.

The leading policy goals adopted by less-developed nations with access to the technology of the Green Revolution include self-sufficiency in food grains and market stability. For example, India's fourth Five Year Plan (1969-74) sets out three main agricultural policy goals:

- To achieve production growth.
- To safeguard against fluctuations in agricultural production.
- To reduce foreign aid dependency.

Similar agricultural policy objectives are reflected explicitly or implicitly by many other governments. To the extent that these goals are achieved or approached, grain markets within less-developed nations will be subjected to unprecedented stress.

Over many years, complex and often sophisticated marketing systems have evolved to facilitate the handling and distribution of grain in relatively small lots and the movement of grain imports into consumption. The Green Revolution poses a set of opposite problems: namely, the handling and distribution of larger and increasing volumes in addition to the potential movement of domestic grain into exports channels and into channels normally served by imports. Consequently, one can expect traditional grain markets to face difficulty when called upon to handle, finance, store, and process large and increasing volumes of grain on a regular basis.

The following sequence of events illustrates the probable impacts of the high-yielding grains upon markets within less-developed nations.

1. Rising food grain production trends will create demand for more and better marketing facilities, institutions, and infrastructure.

2. These facilities will expand and improve but probably not as fast as needed.

3. The relatively slow growth of market capacity relative to production will be further aggravated by periodic bumper crops that will occur around a rising production trend.

4. The result will be occasional severe market gluts locally, regionally, and nationally. They will be rendered more acute because market facilities already will be overtaxed.

5. Consumption, even with rapidly rising incomes and population, cannot be expected to adjust to output fluctuations, especially if internal price changes are controlled or modified.

6. To the extent that the previous observations hold true, pressures will mount to move excess supplies into export channels. The lack of adequate local storage and other market facilities can cause this tendency to develop even when critical shortages are occurring elsewhere in the country. This is clearly possible in a large nation like India. The tendency to export also may be enhanced because foreign exchange is required for development and because the existing transportation infrastructure may be geared for primary product exports as a residue of an earlier colonial era.

7. These periodic exports, at least in the short run, will probably bring lower than average prices on world markets because of inherent uncertainties in location, volume, and quality.

As a result of these developments, both commercial and concessional imports from the developed world will dwindle. These displaced shipments will seek other des-

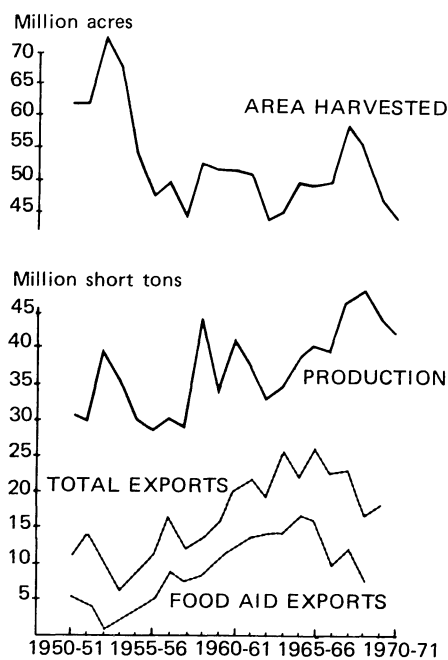


Figure 2. Wheat: U.S. area harvested, production, and gross exports

tinations in a shrinking or stagnant international market.

The great promise of the Green Revolution to help lift nations out of poverty depends heavily upon the ability of internal markets or other allocation systems to handle and distribute both outputs and inputs under great stress.

THE PROSPECTS

Synthesizing the analyses, a picture of the impact of the Green Revolution in the international marketplace begins to emerge. The exact details of this picture are unclear, especially the further we look into the future. In the boiling economic and political reality of today's world, great change can occur rapidly. However, the forces and trends that underpin these changes move more slowly and regularly. Let us turn first to the short-term prospects, between now and the mid- to late-1970's.

Short-Term Prospects

Barring a major natural or military catastrophe, a lower or only slowly growing volume of food grains, particularly wheat, will move internationally. This tendency will be a general one but will center on the trade between developed exporters and less-developed importers. This lower volume probably will be most pronounced in noncommercial markets but will also extend to commercial trade. Generally lower world prices will prevail, forced down by narrower markets on the import side and supply pressure and export subsidies on the export side. Short-term forces may cause prices to bounce up and down around this trend. In fact, a thinner world market might easily display more price fluctuation than in the past.

Self-sufficiency among less-developed nations will result in more intense competition for existing commercial markets. The possible intermittent exports from less-developed nations will be added to displaced commercial and concessional grain looking for markets. For a variety of reasons, including lower quality requirements, shorter shipping distances, and bilateral barter deals, regional trade in food grains among less-developed nations can be expected to increase.

It is clearly possible that domestic and international feed grain markets will be a release valve for low-priced, excess food grains. This can be expected to exert downward pressure on the generally buoyant demand for corn, sorghum, and other coarse grains in some years. Whether the short-run impact of the Green Revolution can be traced through to lower livestock and meat prices on world markets is difficult to say.

Taken together, these projected developments suggest that forces will be strong enough to continue and possibly increase levels of protection for agriculture within the United States and other developed grain exporting nations. The objectives will be to insulate domestic markets from imports and to combat increased competition for international sales. Measures will include continued quotas, minimum import prices, and variable levies, tariffs, and other mechanisms to control imports. Continued and possible expanded reliance on export subsidies, multiple pricing schemes, and special credit arrangements will take place as exporters attempt to maintain and promote trade. Thus the links among world prices, domestic market prices, and farm prices in the wealthier export nations could become weaker than ever. Even if farm support prices are simply maintained or even lowered slightly, larger decreases in international price levels will mean that relative levels of protection will have increased.

As less-developed nations eliminate regular reliance on food aid imports, this component of the international grain trade will shrink. As it shrinks, it may also become highly volatile and follow the unpredictable fluctuations in weather and natural calamities. Multinational programs going beyond current agreements will be needed to spread the costs of erratic food aid requirements.

It seems likely that production controls will be continued in some form or another in the United States, Canada, and Australia. If the U.S. experience is a guide, more expensive programs to hold acreage out of food grains or divert it to other uses will meet strong resistance from consumers, taxpayers, and fiscal agencies within governments. The potential entry of the United Kingdom into the

EEC may take some pressure off the food grain surplus problem inside the expanded community, but it will add to the problem of narrowing markets faced by the United States and other outsiders.

That these pressures for heightened protection should be developing at the same time that significant movements toward preferential agreements favoring less-developed nations are occurring is indeed ironic. Despite political rhetoric and speeches by government officials idealizing trade liberalization, potential preferential agreements probably will involve exclusions on many agricultural products, particularly food grains.

Long-Term Prospects

Speculation on long-term prospects can be wide-ranging and, depending upon the assumptions, gloomy or optimistic. Let us assume that in the less-developed nations of Asia (1) the fruits of the Green Revolution are distributed fairly widely among people during the eighties and beyond, (2) population growth is not stimulated, and (3) per capita incomes continue to grow.

In this setting, the rather pessimistic outlook for the seventies gives way to some optimism. As per capita incomes grow, the demand for food grains and feed grains will grow. Since the demand for livestock products, hence feed grains, probably will respond strongly to income growth, productive resources in the less-developed nations can be diverted into feed production, livestock production, and other activities. With growing in-

comes and more opportunities for agricultural diversification, the self-sufficiency objectives with respect to food grains probably will weaken.

The developed nations still will have nagging excess capacity problems in food grains, especially those countries with strong protective policies, but the long-term developments suggested in the previous paragraph for less-developed nations will assist and stimulate the movement of resources into feed grains, high protein feeds, and livestock production in the developed nations. Export opportunities will remain and grow, slowly perhaps, for high-protein hard bread wheats. Much of the adjustment burden will fall upon the producers of soft wheats and other lower quality food grains all over the world.

POLICY IMPLICATIONS

Given political realities, it is difficult to suggest specific policies that the United States might reasonably be expected to adopt in dealing with the issues raised here. We will be torn between policies to foster and promote the promise of the Green Revolution on one hand and the claims of our own farmers and grain dealers for price and income protection on the other. Limited funds available for foreign aid and agricultural support will preclude massive programs in either direction.

Perhaps the one policy direction that emerges is to devote more of our limited foreign aid and technical assistance to the establishment of stronger, more flexible markets and market institutions in nations experiencing major grain production advances. This applies to markets for products and for critical new inputs. Smoothly operating markets and allocative institutions will be able to distribute increased volumes more efficiently over time, over space, and among alternative outlets. Success in this policy direction will have the dual advantage of helping to secure the benefits of the Green Revolution for both farm and nonfarm people in the less-developed nations, and helping to avoid intermittent disturbances in international markets caused by excess supplies surging out of less-developed

nations because local markets cannot handle them.

At home, our most feasible short-run policy probably is to continue to restrain production of food grains, especially low-quality wheats, within the limits of politically acceptable budget expenditures. Equity and fairness suggest that production restraint is an obligation of any developed nation that chooses to operate a comprehensive price or income support scheme for its domestic wheat farmers. In the long run, additional movement of resources out of food grains and into other activities should be a prime policy objective, difficult as this may be.

Consider one final suggestion on the food grain policy of developed nations. As less-developed nations approach self-sufficiency, their noncommercial or food aid requirements will dwindle. Facing shrinking commercial markets, the temptation will be strong for the United States, Canada, and the EEC to press these noncommercial supplies onto other poor nations where the Green Revolution has not yet begun. These other nations are concentrated in Africa and Latin America. Where food deficits and foreign exchange shortages are critical, there are surely legitimate opportunities for food aid, preferably on a multilateral basis. But if the objective of surplus disposal dominates and highly attractive terms of exchange are offered, then the progress of agricultural development may be further impeded in those nations where it will be most critical in the coming years. This can occur if prices of food grains are held at very low levels with concessional imports and if the easy availability of these imports diverts the attention of development officials away from the difficult questions of agricultural progress.

Some might argue that the international costs and consequences of the Green Revolution are falling largely and inequitably upon the United States and other major grain producing and trading nations. Generally speaking, they are correct. But these are costs we are well-advised to pay in order to foster agricultural and human development among the less fortunate occupants of this globe.



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