International Cooperation in Agricultural Research and Development

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I am deeply honored to present the sixth annual William A. (Tex) Frazier Lecture. My participation allows me to join ASHS in recognizing the outstanding contributions that Frazier made to the world of horticultural science. Everywhere Frazier worked during his long and remarkable career, he left a definite contribution to horticultural crop production technology. This includes the two years he spent in Arizona, where he helped establish a strong vegetable industry and gave Arizona potato production a boost.

I am proud to join the previous Frazier lecturers in calling attention to the important contribution that horticulture can make in improving the quantity and quality of food available to feed the world. In 1989 David Hopper defined the role of horticulture in the economy and food supply of developing countries. In 1990 Frank Salisbury took us on a trip to the moon to discover how to produce food in space. And last year, E.T. York discussed the importance of agricultural sustainability as farmers try to increase food production while maintaining natural resources and the quality of the environment.

THE CHALLENGE-THE CONQUEST OF HUNGER

I mention these timely contributions because they are directly related to one of the most critical challenges confronting the world today: Will the planet be able to feed a rapidly increasing world population? A positive answer is possible only if world population stabilizes by 2100 at about 12 billion. An equally challenging question is: Can we feed this growing population while establishing a sustainable agriculture that will preserve the quality of our environment? The answer depends on our ability and discipline as citizens of one world to: 1) define and accept realistic goals and priorities; 2) use or develop the needed technology; and 3) establish strategies and international cooperation to implement the program. During this decade and as we enter a new millennium, this campaign to feed the world and preserve the quality of our environment may be the most critical struggle for survival in the history of mankind.

GOALS AND PRIORITIES

The goal is simple, clear, and inspiring: end hunger and malnutrition in the world while preserving the quality of the environment and maintaining our natural resources. The priorities, more complicated and controversial, are to: 1) produce enough food; 2) distribute it equitably; and 3) establish a sustainable agriculture.

World food production

Obviously, the production of enough food is basic to any solution of hunger. Much has happened to increase world food production during the past 40 years. The Green Revolution in wheat and rice production in Asia and Latin America has been followed by significant breakthroughs in other food crops, such as sorghum and potatoes. By the 1980s nearly 4 billion tons of grain was produced worldwide, almost double the amount two decades ago. Today 2.3 kg of food is produced per person per day in the world. This increased production has allowed more grain to be stored, even in India and China, which have 40% of the world’s population. This is in great contrast to 30 to 40 years ago, when great famines occurred every 2 to 3 years in these countries. Despite these encouraging data, an alarming paradox is emerging: food surpluses have grown worldwide, but so has hunger. The United Nations Food and Agriculture Organization (FAO) reports that, today, more than 700 million people are classified as hungry. The figure for those that are undernourished is much higher.

Appropriately, adequate food production does not mean an automatic solution to hunger. Why? Food production in developing countries. Although world food production has increased, many developing countries do not produce enough food to feed their populations. For example, due to rapid population growth, annual per capita food production is decreasing in large regions of Africa and Latin America. The resulting economic burden of importing food contributes to hunger.

Feeding a world population of 12 billion in 2100, even if it has stabilized, will be a monumental task. Even more alarming is the fact that 90% of this total population will inhabit what are today the developing countries of the world. Thus, if we are to feed this expanding world population during the next century, it is imperative that more food be produced in the developing countries, and by higher productivity rather than simply by more area planted.

Private incentive and food production. Attempts to socialize agricultural production have been unsuccessful. The production of food crops is subject to too many unpredictable variables and individual, spontaneous decisions. Whenever the food producer (the farmer) is directly rewarded for higher yields—either in quantity, quality, or both—private incentive is stimulated and food production and productivity increase.

For example, during the past decade, the conversion of Chinese agricultural communes to groups of individual family holdings has sparked a spectacular rise in crop productivity. In Poland, more than 80% of the agricultural land has remained in small holdings in the private sector since 1945. Consequently, yields of important food and forage crops have been substantially higher in Poland than those in neighboring countries with state-controlled agricultural production systems.

Technology. Many believe that a lack of technology is the limiting factor in agricultural production, resulting in hunger. This is rarely the case. We do have the technology to increase food production dramatically in most cases. The more critical factor is the fact that adequate food production does not, by itself, assure that food will be available or accessible to the people who need it.
parts of the world, but we lack the economic resources to use it efficiently in developing countries. We know how to put our farm lands on a sustainable base. However, a field-proven technology for increasing food productivity, while establishing and maintaining a sustainable agriculture, is still our greatest need and technological priority. This is true for all countries, developed and developing, but perhaps most critical in the latter.

Government policy. The use of available technologies is often made more difficult by contradictory government policies or the apathy of the decisionmakers. Inefficient coordination among official agencies and institutions can suppress or confuse the most worthy of production-oriented projects and prevent the wider use of new or established technologies. Again, this is true of both developed and developing countries. In affluent countries, for example, policymakers may decide they are not interested in disease-resistant cultivars or integrated pest management and may simply apply more chemicals to control pests. In poor countries with scarce resources, unstable governments and the lack of continuity in policies governing agricultural production and distribution can be potent contributors to hunger.

Distribution and availability of food

Poor distribution and reduced availability of food can result in hunger even when food is abundant. This is true of any country. Even in the United States, the largest food-exporting country in the world, about 12% of the people are hungry, and an even larger percentage is undernourished.

Any economic, political, or social factor that contributes to a lack of purchasing power in any sector of society is an important cause of hunger. These factors include poor marketing opportunities, postharvest losses, and inadequate transportation and storage facilities. Finally, and most importantly, an inescapable link exists between poverty and hunger.

Sustainable agriculture

We cannot continue to expand the area planted to food crops as a way to feed the increasing world population. The pressure on marginal lands is already at the danger point. The more pessimistic observers believe that we have already gone too far and that our planet is doomed.

If we merely continue to use more chemicals to fertilize our crops and control diseases and pests, the dangers to a sustainable agriculture are obvious. Any strategy to feed the world’s population during the coming century must maintain environmental quality and natural resources. And, as York stated in 1991, “A truly sustainable agriculture must also be productive, and profitable.”

CURRENT ROLE OF THE POTATO AS A WORLD FOOD CROP

In the remarkably short period of four centuries, the potato has emerged from the central Andean region of South America and become one of the four major food crops of the world, along with rice, wheat, and maize. Today the potato is a staple food in developed, industrialized countries and is becoming more important in developing countries.

Annual per capita consumption of potatoes in Europe, Russia, the United States, and Canada is several times higher than in the Third World countries of Asia and Africa. In Latin America, with the important exception of the Andean region where the cultivated potato originated, annual per capita consumption is also well below that of industrialized countries (Fig. 1).

Let us examine some of the recent trends in potato production and use, first in developed countries and then in developing countries.

Developed countries

Although the area planted to potatoes in developed countries has steadily declined during the past 40 years, productivity has significantly increased. As a result, total annual production has tended either to rise slowly or level off in these countries.

Canada and the United States are good examples of this trend. Annual potato production has been gradually rising during the past 20 years in both countries due to a steady increase in yield per hectare, while the area planted has remained fairly stable.

In several European countries, the potato is not only an important daily food for the people, but also a livestock fodder, particularly for swine; a source of starch; and a crop for processing. Any future decline in total potato consumption in Europe will probably be due, not to a reduction in human consumption, but to a shift from potatoes to cereal grains, both for starch production and livestock feed.

In Europe, the potential demand for processed potatoes has not been exploited; until recently, less than 20% was processed. In the United States, however, more than half the potato crop is processed and consumed as snack food.

Developing countries

During the past 45 years I have had the privilege of collaborating with colleagues in national potato programs in 78 countries, mostly in the developing world. In each country our main objectives were to 1) improve national potato production and productivity, thereby increasing per capita consumption of this valuable food crop; and 2) establish a strong national potato production program, with the resources and trained personnel to provide an operating base for continued contributions. These programs have been highly effective, and the potato has significantly increased in importance in many Third World countries. Potato production in these countries has been rising at a faster rate than that of any other food crop, due both to more hectares planted and higher yield per hectare.

Forty years ago the developing countries produced only 7% of the world’s potato crop; today they produce more than 25% (Table 1). This dramatic increase in potato production was the result of dedicated efforts by national potato program personnel, with the enlightened support of national decisionmakers who appreciated the potential contribution of the potato to the diet and economy of their people. These countries used their own resources to apply advanced, production-oriented technologies for the development of better seed, more