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## *Biotechnology-Global Interdependence*

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**M**ultiple interests and pressures on planet Earth today are moving us rapidly towards problems and progress. As major gains are made on some fronts, new problems emerge on others. No longer is there a cold war with the potential confrontation of super powers. However, unresolved religious, tribal and ethnic differences are causing confrontations which may be far more difficult to resolve than cold wars. The Green Revolution of the 1960s allowed food production to catch up temporarily with the food requirements of a growing population. However, the increases in cereal yields have slowed and decreases are now being reported in some areas highly dependent on these crops. Scientists at the International Rice Research Institute (IRRI) are attempting now to engineer a new rice to help keep yields abreast of population needs for the immediate future. Only through biotechnology does such a possibility exist.

Planet Earth has become a global village due to advances in the science of communications and travel. A problem of any kind/anywhere becomes the immediate concern of the whole global village. The same holds true for progress wherever it is made and for its potential application. Scientists from countries which were engaged in major conflict against each other forty years ago are now sharing the same spaceship in explorations beyond the global village. We have become one community with our problems and our scientific advances. The question is: which will win, the problems or the advances?

Most of the problems of today orient around the lack of knowledge and programs to adjust population to the levels that can be sustained adequately on a planet with finite resources. During this decade world population is increasing by 90 million people annually with no end in sight. Grain stocks which have provided food security to the planet are at their lowest level since 1972. No surpluses exist in North America or Europe today at a time when some communities in the global village are facing famine. Fish catches are diminishing and placing a greater dependency on land production. A number of countries with high population density have utilized all available good land without balancing food production with population requirements. Few countries have information about the numbers of people that might be maintained within their boundaries in a healthy condition and a sustainable environment.

Concern for the environment first highlighted by Rachel Carson in *Silent Spring* in 1962 was followed in the 1980s by the United Nations World Commission Report on Environment and Development, known as the Brundtland report. Agenda 21 provided a more recent global focus at the Earth Summit meeting held in Rio de Janeiro, Brazil, in 1992.

Unfortunately the recommendations coming from this meeting are more political than scientific and do not adequately link environment to agriculture. The problems of both the environment and agriculture are triggered by population levels being out of balance with what planet Earth can healthily sustain. For many communities in the global village, survival must continue to be at the expense of environment until economic development has eliminated the masses below the poverty line of existence. The key to economic development in almost all countries up until now has been through the improvement of agriculture. Thus the problems of environment and agriculture are intimately entwined across the global village and must be addressed together. In my opinion, biotechnology, with its new tools, is the single major force in sight to help provide solutions to the problems of food and environment until the population can be maintained at a level which planet Earth can healthily sustain.

Environmental problems do not stop at country boundaries; hungry people in any community have become a responsibility of the whole village. The great potential of biotechnology is needed across the whole planet. The tools, however, are expensive to develop and few can afford to produce them; once available, all countries need the ability to apply them. A new generation of young scientists is ready to utilize the new tools, but too frequently they return from training to institutions not concerned with practical applications, institutions far removed from conventional breeding approaches. Furthermore, the potential of biotechnology is very much limited by the low priority given to agriculture today by our political leaders.

Tremendous gaps exist along the agricultural production chain between the institutions in which the tools of biotechnology are developed and a farm level application providing visible economic and environmental benefits. Programs such as Agricultural Biotechnology for Sustainable Agriculture (ABSP) at Michigan State University, East Lansing, Michigan, USA; The International Service for the Acquisition of Agri-biotech Applications (ISAAA) headquartered at Cornell University, Ithaca, New York, USA; and the International Laboratory for Tropical Agricultural Biotechnology (ILTAB) at Scripps Research Institute, La Jolla, California, USA, are essential building blocks for the utilization of the potential of biotechnology. The differences in their objectives need to be adequately explained and linkages developed so that complementarity, and not competition, is evident to the decisionmakers controlling funds. Communication capabilities and a strategy must be in place which will orient political leaders to the potential which exists with biotechnology for programs aimed at a healthy global village.

Recently at a breakfast meeting with the administrator for the U.S. Agency for International Development (USAID) I voiced the concern many of us have about the low priority apparently given agriculture as available resources are reorganized to address the USAID's present priorities of environment, economic development, population and democracy. My question indicated that economic development and environment depended on agricultural improvement. Brian Atwood, Administrator, USAID, stated that many of the resources going for the environment and economic development would be earmarked for agriculture. In my opinion this answer was inadequate, making agriculture an indirect objective with little recognition that it is the fundamental building block for programs aimed at economic development and sustainable food production in a healthy environment.

We in agricultural science have not prepared the global village for what we have to offer to its communities. We have been poor sales people for our products. Space scientists have developed a protected existence as they look outward from the village. An exploratory rocket explodes on takeoff at a cost of a billion dollars, four times the annual budget of all the international agricultural research centers combined, and there is little reaction. In contrast, budgets for agricultural science nationally and internationally have been decreasing for a decade. Agricultural scientists have communicated well with each other but have not communicated well with the general public, the decisionmaker and the politician. In comparison, the environmentalists have been excellent salespeople for their ideas. Their support groups are many, as evidenced by the daily mail and well-organized requests for funds to attend their concerns. How can agriculture become organized and supported so that priority programs to address the problems of food and environment have a similar protected existence as space scientists have had for their work?

The global village badly needs the tools of biotechnology put to use in solving the problems of food and environment. We are globally interdependent with our problems, and we must be globally interdependent with solutions. We must utilize the comparative advantages already in place within institutions across the communities in the village and link them together. The biotechnologists must become joiners and offer their services to the conventional breeders as tools are put to practical use. Furthermore, the biotechnologist must learn to communicate in a language the average agricultural scientist and breeder understand. Even more important is the need for all scientists to communicate well with the general public, the politician and the decisionmaker. A global interdependence is necessary in biotechnology, but even more important is the interdependence of advances in science on the whole community. As long as scientists have mainly the ability to communicate their potential and their programs and progress to other scientists, they will be understood by scientists. Their funding support, however, will be lacking until they are understood by the rest of society.