

The Role of The American Phytopathological Society in International Food Production Programs¹

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It is more than coincidence that the theme of this annual meeting of the American Phytopathological Society is "international cooperation" and that we should be meeting together with our colleagues from the Caribbean Division of the APS. In October 1984, at its annual meeting in San Jose, Costa Rica, the members of the the Caribbean Division expressed their concern 1) that international food production programs be expanded and made more efficient and 2) that a vital relationship exist between success in food production and the level and date of population stabilization.

The Caribbean Division requested the International Cooperation Committee of The American Phytopathological Society to make recommendations for an APS policy on the food/population problem and to submit such a proposal to the APS Council for its consideration, which it did. The APS Council carefully studied this proposal and prepared a resolution for presentation to the APS membership at the 1985 annual meeting. Thus, after a decade of discussion and indecision, in 1985, The American Phytopathological Society adopted a resolution defining its policy on international cooperation and participation in food production programs, particularly in countries of the Third World.

By this resolution, APS members reaffirmed the commitment of the society to encourage plant health research and education, particularly in developing countries; urged APS members to make available their expertise in plant disease control to countries affected by food shortages; pledged the APS to provide technical guidance and rapid transfer of information to the international community and to support all efforts to increase food supplies in developing countries; and recognized that the earth has a finite carrying capacity for the human species and that the ultimate success of our efforts in food production will depend on the date and level of population stabilization.

The leadership of Dr. John Lockwood, then the APS president, and of Dr. Luis Sequeira, the current APS president, was vital to the successful preparation and acceptance of this important resolution. The continuing support of the councilors of the Caribbean Division and the guidance and hard work of the chairmen of the International Cooperation Committee provided the momentum as the resolution moved from a proposal to an adopted policy of the APS.

I will address the specific role that the APS and its members might play in this challenging campaign to feed the world, not only during the next few decades, but during the next century until population stabilization is achieved.

During the past year I have visited a number of departments of plant pathology in the United States and a few in other countries, and each visit provided an opportunity to discuss this expanding role of the APS in international cooperation.

In such a discussion, a common first reaction is one of surprise—"Aren't we already doing a good job?" And it is true. Plant pathologists have been deeply involved in international food production programs for decades. The careers of plant pathologists are eloquent testimony to the great contributions

made by our science in food production programs all over the world. It is no exaggeration to state that the APS has been in the forefront of all international societies in the individual involvement of its members in international food production programs.

It is in full recognition of the remarkable contributions made by plant pathologists that today—and here—we ask the question, "How can the APS, as an international scientific society, foster the efficiency and impact of these international, cooperative efforts to improve human nutrition throughout the world?"

Two years ago, at the plenary session of the annual meeting of the APS in Guelph, Dr. Arthur Kelman asked that question in his keynote address entitled "The APS at the Crossroads." Last year at Reno, the APS membership took a stand and declared its intention as an international society to expand its collaboration and participation in food production programs.

Current Projects

The APS is currently involved in numerous and varied international endeavors. Some of these international activities are as follows:

APS Endowment Fund. This fund was initiated by a \$5,000 contribution from the estate of E. C. Stakman. In 1984 it was proposed to use these funds for free APS group memberships in Third World countries. Also, the APS Books and Journals Committee has been using some of these funds to cover the costs of distributing books to other nations.

International Cooperation. The mandate for this standing committee of the APS is to develop programs of an international nature that will improve the dissemination of information of all aspects of phytopathology through teaching, research, and extension.

At the Diamond Jubilee Celebration of the APS in 1983, this Committee organized a forum on the "Challenges for the APS in International Cooperation." A number of the current international activities of the APS have been initiated or monitored by this Committee. During the past several years, under the leadership of Jose Amador, Arthur Lamey, Charles Chang, and Jack Schafer, the Committee has been assuming an even more active role in international cooperation.

Intersociety Consortium for Plant Protection. Membership in this consortium, backed by the U.S. Agency for International Development, provides the APS with an opportunity to collaborate with scientists in weed control, entomology, and nematology for promoting agricultural development in Third World countries.

Short-Term Enrichment Program. This program, financed by a grant from the Institute of International Education, provides travel grants for foreign students studying in this country, allowing them to attend annual meetings and conferences.

List of APS members interested in international cooperation. Within the last year, the APS Council, acting on the initiative taken by President Luis Sequeira, assembled a list of more than 500 APS members who showed their interest in collaborating with scientists in developing countries in projects of mutual interest. This list will be made available to agencies active in international assistance programs.

International Society of Plant Pathology (ISPP). The APS is a member of the ISPP, and APS members have participated in

¹Presented August 11, 1986, at the Plenary Session of the Annual Meeting of The American Phytopathological Society in Kissimmee, FL.

activities sponsored by the ISPP, particularly in workshops, seminars, and lectures on tropical agriculture.

American Association for the Advancement of Science (AAAS) and the Association for the Advancement of Agricultural Sciences in Africa (AAASA). The AAAS has formed a Consortium for Affiliates for International Programs, and Dr. Lawrence Apple has served as the APS representative to this consortium. Quite recently, the AAAS responded to a request from its African counterpart (AAASA) to assist in the reorganization and revitalization of this association of African scientific societies. The APS is taking a leadership role in this intersociety effort. Lawrence Apple and Ray Tarleton are studying the best procedures for being of assistance to our African colleagues.

Sociedad Mexicana de Fitopatología. After the joint meeting of the Sociedad Mexicana de Fitopatología and the Caribbean Division of the APS in 1985, President Luis Sequeira and Dr. Roberto Garcia, president of the Mexican Phytopathological Society, initiated a dialogue on how cooperation between the two societies might be increased. Several specific proposals are being considered, including short-term exchanges of scientists, publishing Spanish versions of selected APS publications, and small grants and continuing collaboration with returning graduate students as they launch their careers.

All of these worthy activities are continuing evidence of an APS role in international cooperation. But aren't there even more active challenges to be accepted, as we identify new dimensions to the APS role in international cooperation in the developing world? I believe there are.

Suggestions for Research and Collaboration

Proposals for expanded APS participation in international cooperative food production programs can be identified in at least three distinct categories: 1) specific phytopathological research projects of mutual interest to the participants; 2) broader investigations, including basic research and production-oriented problems; and 3) collaboration with other scientific societies and institutions in specific areas of phytopathologic investigation, as a component of broad food-production programs. In each of these categories, the international cooperation should be of mutual interest to the participants. The scientific world today is far different from what it was three to four decades ago. No longer is international cooperation a "giving process." Today international cooperation is scientific collaboration among equal partners in projects of mutual interest and benefit. In today's small world, such projects of mutual interest are much more common than might appear to the casual observer.

Specific phytopathological problems. Numerous examples might be cited for consideration in an expanded international research effort by the APS. These diseases are important today, not only to specific regions of the developing world, but to the United States as well. They include citrus canker, karnal bunt of wheat, several cacao diseases (and movement of seed), coffee rust, black sigatoka of bananas, potato late blight, and *Pseudomonas solanacearum*. Each of these examples represents an important economic or limiting factor in the production of a crop in developing countries and is of direct or indirect interest to our own economy.

Although excellent research has provided much valuable data, the scientists involved recognize important areas where basic information is still lacking. In the examples cited, this information can be more reliably and efficiently obtained by an international cooperative project, bringing the appropriate scientists together in a united effort.

Broader research proposals. These projects need international dimensions to be truly successful. Here I am tempted to use the words "basic research." Although sometimes suspect, the words "basic research" do not bother me at all. As the great plant pathologist and international scientist, Dr. E. C. Stakman, once declared, "There is nothing wrong with basic research just because it happens to be useful!"

Following are some suggestions for these broader research

investigations best carried on through international cooperation:

Range and mechanisms of variability in plant pathogens. The historic research on asexual variability in plant pathogens (e.g., *Fusarium* and *Phytophthora*) serve only as examples for future pioneering and practical research using broader populations available through international cooperation. The success of our search for resistance to many diseases may well depend on better understanding of the genetics and range of variability in the pathogen—internationally and not just in the locality where scientists are fortunate enough to have financial support to work on it.

Biochemistry, genetics, and inheritance of horizontal resistance. So much of the research on resistance has dealt with pathogenicity and resistance controlled by single genes. Classic work in this field has revealed much about hypersensitivity, phytoalexins, etc. But today we are increasingly aware of the importance of the resistance we vaguely term horizontal (field, durable, or partial) resistance. We recognize the value of this type of resistance, particularly in integrated plant disease control programs, but we still know little about the nature and inheritance of this type of resistance. We have trouble measuring it and screening for it. Is it not time that a coordinated, international research effort began systematically exploring and analyzing this resistance in a wide range of international locations? The collaboration of scientists in the developing countries is needed. Their participation would provide the extra dimensions, environmental and biologic, that would make this resistance more understandable and useful for all.

Biotechnology. No discussion of research proposals today is complete unless the words "biotechnology" and "genetic engineering" are mentioned. Biotechnology and genetic engineering deserve more than a nod of recognition. Individual plant pathogens usually attack a limited number of plant species. For example, *Phytophthora infestans* attacks a few plants, mostly solanaceous. *Puccinia graminis* attacks a number of cereal grains and grasses (let's forget about barberries, for the moment). The rest of the plant species and genera are immune. With the splendid, mysterious tools now placed in our hands by the biotechnologists, can such an immunity, so prevalent in the great majority of plants, be transferred to a crop species—wheat or potato—from some not-too-distant resistant relative?

Estimation and prevention of postharvest losses. The loss of food, after its production and harvest, has attracted worldwide attention as the restraints of land, water, and fertilizer make expansion of food production more difficult. And to increase food supplies, doesn't it make more sense to preserve the harvested food and prevent losses in storage than to launch expensive, energy-intensive programs to increase food production? As plant scientists, we are proud of a new cultivar that will increase yields 10–15%. But compare this with the potential increase of food reaching the consumer if we could reduce postharvest losses, which in many countries are estimated at 30%, or even higher.

During the past decade there has been an accelerating interest in the prevention of postharvest losses. In 1975 the United Nations General Assembly passed a resolution calling for a 50% reduction of postharvest losses by 1985. In 1978 the U.N. Food and Agriculture Organization declared food loss prevention a priority area.

Several other initiatives have been declared but have lacked the resources or the focus, or both, for truly effective implementation. Experts recognize that some fundamental research information is still lacking, as well as the innovative, applied technology to make widespread impact on the conservation of harvested crops. Most postharvest losses are due to biologic agents—fungi, insects, rodents, etc. Their practical control is linked to, if not dependent upon, an innovative, new technology for simple, practical storage of harvested crops. Obviously, not only plant pathologists would be involved in such research and development programs; they would need to work in collaboration with entomologists, nematologists, engineers, physiologists, ecologists, etc. The proper mechanism for such a program, with the APS collaborating as a society, might be through a consortium representing the professional disciplines needed for a coordinated research

program.

Integrated pest management and disease control. Practical, integrated pest and disease control is urgently needed in developing countries. This is a complicated challenge and requires cooperation among societies. How can we share research responsibilities with our colleagues in developing countries? How can the APS help to organize and administer such a cooperative effort?

Institutional collaboration. A third area for a proposed APS role in international cooperation is through collaboration with established institutions, usually as a component of broad programs in research and development in developing countries.

Tropical institutes. The recent establishment of the Fundacion Hondurena de Investigacion Agricola—the Honduran Foundation for Agricultural Research—brought an exciting new opportunity for international cooperation. Established on the large and excellent facility built by the United Fruit Company on the northern coast of Honduras, this new Foundation will work with the export crops (banana, cacao, citrus) and also with vegetables, soybeans, and other food crops. Dr. Joseph Krausz, an APS member and a member of the International Cooperation Committee, was recently named head of the plant pathology department of this Foundation. This Foundation has declared its interest in international cooperation and would be an ideal partner for the APS in the launching of several cooperative basic and applied research projects of mutual interest.

Cooperation with the International Agricultural Research Centers (IARCs). The worldwide network of the IARCs, with specific mandates for a given crop (CIMMYT, IRRI, CIP) or for a region (CIAT, IITA, ICRISAT), often need basic or applied research on plant diseases. The most practical, cost-effective way for these Centers to obtain this information is often through contract research with other research institutions.

Some of the most important plant diseases and pathogens, although we know them well after years of research, are still troublesome and limiting factors in the use of high-yielding varieties in many tropical regions. An excellent example is *Pseudomonas solanacearum*. Several IARCs have indicated an interest in collaboration with the APS. For example, CIMMYT is involved in the use of biotechnology in the search for disease resistance—to cereal rusts, downy mildew, and several viral diseases of maize.

National Science Foundation and assistance to returning scientists. Many agricultural scientists from developing countries, after terminating their graduate studies, are “under employed” after returning home and too frequently turn from scientific activity to other endeavors. Could the APS help in specific projects to provide some follow-up support for graduate students once more getting established in their countries? The National Science Foundation has indicated a definite interest in such a proposal. Such cooperative research could be sponsored through a U.S. institution, which could identify those in developing countries where need and opportunity are greatest. A small investment here could be very productive.

International Science Peace Corps. How could graduate students or recent Ph.D.s be provided opportunities to participate in agricultural field research programs in developing countries? An example of such a program has been cited by our colleague, Dr. Robert Fulton, in Costa Rica. A group of young German agricultural students worked on thesis problems in the disciplines of weed control, plant pathology, entomology, marketing, etc. Vehicles, housing, and laboratory and field equipment were supplied by the private sector (the German chemical industry). Projects were authorized by agreement with the Costa Rican Ministry of Agriculture, and all imported equipment became Costa Rican property when the project terminated. Some of the German scientists worked on the etiology and control of the black sigatoka disease of bananas; others discovered new problems for research, and some even found career opportunities. Could such a project be sponsored or conducted by the APS, with funding and cooperation from the private sector?

Several of the proposals mentioned here require or assume that a

consortium of scientific societies or institutions will participate in an interdisciplinary program. And I am not unaware of the problems inherent in the administration of such a coordinated effort.

Comparative Advantages of the APS in International Cooperation

As noted before, many APS members are currently involved in research with international dimensions, usually through grants to their university or institution. Certainly we do not wish to duplicate efforts and programs currently sponsored by government and international agencies. What is unique about the role proposed for the APS? What “comparative advantage” does the APS have that would justify an expanded role in international cooperation?

APS has several comparative advantages. First, the membership of the APS represents the largest manpower pool (more than 4,000 members) in the profession of plant pathology. Second, APS members have responded with enthusiasm to this proposed expansion in international cooperation. They have the talent, experience, and scientist-to-scientist contacts to implement such collaboration. Third, through the APS, a more direct working relationship between cooperating scientists would be fostered, with a minimum of administrative or bureaucratic problems. Such cooperation among scientists would favor continuity and efficiency and thus be more cost-effective. And fourth, a number of important plant disease problems remain almost untouched, because they don't happen to fit into the pattern of prevalent funding policy or sources. A proposal to provide agricultural assistance to a given country can easily overlook the need for international collaboration to solve a disease problem. The awareness and availability of research excellence in the APS could help avoid such lapses in integrated efforts to provide agricultural assistance to developing countries.

Strategy, Organization, and Administration

APS Foundation. How can the APS, as an international scientific society, establish a strategy and the organization to implement an expanding role in international cooperation? How can this be administered by an international scientific society such as the APS?

Early in the deliberations on how the APS might administer these new activities, it became apparent that a new mechanism must be established, perhaps in the form of an APS foundation. And thanks to a very fortunate coincidence, such a foundation has been created.

As the APS Foundation initiates its activities, few problems would be anticipated in the management of available grant funds for current activities and in the establishment of channels through which additional grant funds might be obtained for these activities. However, as the APS and the APS Foundation assume a more active and participating role in international cooperation, a strategy must be clearly defined. There are obvious alternatives. The APS Foundation could perform more as a catalyst and delegate the active participating role to an appropriate institution. Or the APS Foundation could actively administer and participate in a project.

If the APS is to meet the broad challenge implicit in the resolution on international cooperation adopted last year, I would urge that the APS Foundation adopt the more aggressive, exciting role of a participant. But these are decisions to be made by the APS membership, the APS Council, and the newly created APS Foundation.

Sources of support. The search for financial support for worthy projects in international cooperation will bring the APS into a crowded arena. We have designated certain comparative advantages that must be exploited, in a constructive sense, to convince potential donors of the efficiency, objectivity, and impact of research projects done under the aegis of the APS Foundation.

We have identified both specific and general research proposals

that might serve to launch our new and more active role in international cooperation. To be funded, they must justify their priority as integral parts of international food production programs. Also, they should be research achievements of which an international scientific society could be proud. In my opinion, this can be done.

It would be premature here to attempt to identify or begin the search for sources of support. We must first define how we intend to implement our avowed policy and initiate our action with a few projects that most completely meet our criteria for international need, opportunity, and impact.

Some of the tentative proposals presented have already attracted the attention of potential donors. And perhaps, in the course of obtaining support, we will need to refine our plans and goals to adjust to the realities of funding possibilities. Undoubtedly, these are some of the topics that will be on the agenda for the Board of Directors of the APS Foundation.

How Do We Get Started?

What are some of the first steps that we might take to implement our new APS policy on participation in international cooperation? We should select at least two high priority, specific disease problems important in developing countries and also in the rest of the world. We should initiate direct communications with the international institutes and agencies with whom we share common interest and priority in these projects. These include the International Agricultural Research Centers, particularly CIMMYT, CIP, and CIAT, and the new Honduran Foundation.

The APS, acting from its large and talented manpower base, is uniquely qualified to collaborate with these international institutions in the solution of these specific phytopathological problems of high priority and mutual interest.

Because of the urgency and broad interest in the control of postharvest losses, I would urge that the expertise of the APS be coordinated with existing international initiatives and make our important contribution to the conquest of this worldwide problem. In this endeavor, the APS would collaborate as a member of an interdisciplinary team involving entomologists, agricultural engineers, marketing specialists, and others.

This project admirably meets the demanding criteria for high priority, as established by the Consortium of Affiliates for International Programs of the AAAS: an important global problem, high potential technological and scientific content, and involvement of a wide range of disciplines. The APS is a member of

the Consortium of Affiliates for International Programs, and perhaps through its representative, the APS could investigate how we might collaborate with this declared interest of the AAAS and the National Science Foundation in this project of such great importance to world food production.

And the APS, through the APS Council and the APS Foundation, should establish a procedure for reviewing and evaluating projects in international cooperation. Do they meet the goals and standards established? What modifications would increase efficiency and attainment of research objectives?

Conclusion

As members of the APS, we have dedicated ourselves to international cooperation in the worldwide campaign to produce enough food for an expanding population that may not stabilize until the end of the next century. This challenge can be successfully met only by a coordinated international effort, using all of the resources, technology, and talent that we can muster, within the restraints imposed by a rational protection of the environment. We plant pathologists have a unique opportunity to contribute to a positive and ultimate solution of the food/population crisis of global concern.

We have discussed and proposed here some forceful and specific projects that are needed to implement the APS policy and increased involvement in international cooperation. We are on the threshold of one of the most exciting and critical periods in the history of our society. We have reached this point because of the support, suggestions, and enthusiasm of so many. I would be remiss if I did not express the appreciation of all for the dedication and leadership of our APS officers and Council during these years. Although credit must be shared by many, special recognition and thanks must be given to Dr. John Lockwood and Dr. Luis Sequeira, our presidents during these past two years. I join my fellow members of the APS in looking forward with enthusiasm to the leadership of the new APS president, Dr. Anne Vidaver, and her colleagues on the APS Council, as we embark into this exciting new dimension of participation in international cooperative projects in plant disease control and food production.

We shall do our part, proud of our science and as citizens of one world. We shall support and join our fellow scientists in the disciplines of demography, medicine, nutrition, economics, environment, and agriculture in a coordinated, worldwide campaign for food and health for future generations.