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GRADUATE TEACHING IN INTERNATIONAL AGRICULTURE

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(A paper presented at a session on "Education for International Agriculture" at the 66th Annual Meeting of the American Society of Agronomy, Chicago, Illinois, November 11, 1974.)

The immensity of the world food problem is known to all of us. Only by bold strategic approaches will it be alleviated. The land grant universities have been called upon many times to share their expertise in food production with the developing countries. But we have often been ill-prepared because our experiences in a temperate climate with a highly mechanized agriculture could not be transferred to the problems of the countries we were trying to help.

I believe that the land grant universities should be training some agronomists who are not only proficient in their discipline, but who, in addition, will have orientation toward the food production problems of the developing countries. This, I would call the International Agronomy dimension.

Let me make clear that I am discussing here primarily the training of the U. S. student who may be called upon, in the years ahead, to contribute toward increasing the food production in the developing countries, most of which lie in the tropical or subtropical areas.

I shall explain how we, at the University of Missouri, are attempting to build this dimension into a graduate student program.

With us, the key has been the use of the mungbean, a pulse crop, or food grain legume, widely grown in Southeast Asia and other areas, and using it as the research vehicle in a series of graduate student dissertation studies. The purpose is to provide a research problem that has relevance to the problems of the developing world rather than to the agriculture of the cornbelt.

Discussion here will be given to (1) events leading to the development of the UMC program, (2) nature of the research on the mungbean, and (3) the contribution of the mungbean research to the development of a graduate teaching program in plant breeding and international agriculture.

To those of you unacquainted with the mungbean let me briefly relate a few facts about it.

The mungbean is one of several species of pulses, or grain legumes, with seeds high in protein that are widely utilized for human food. Other important pulse species include the chick pea, pigeon pea, lentils, beans, peas, cowpeas, and in some cases, soybeans and peanuts.

Each of the pulse crops are important in particular geographic areas of the world, the mungbean in Southeast Asia, but it is also grown in many other areas, mostly tropical or subtropical. For millions of people who for cultural or economic reasons do not or cannot eat animal proteins, the mungbeans and other pulses provide high protein supplements to the cereal grains. Most Americans would recognize mungbeans as the bean sprouts in salads or Chinese-type foods.

In addition to substantial commercial production in Oklahoma, 70 to 90-thousand quintals (15 to 18-million pounds) are imported into the United States annually, coming mainly from Thailand and Peru, with lesser amounts from India, Taiwan, Colombia, S. A., and other countries.

Perhaps you are asking, "Why mungbean research?" How did the University of Missouri get involved with this crop?

After spending two years in India on a University Development project, I was searching for ways by which I might continue to make a contribution to the developing countries. The opportunity came when the University of Missouri received a USAID 211(d) Grant oriented toward training graduate students in Plant Breeding and International Agriculture, including support for thesis research overseas. We thought it important that the thesis research be relevant to the country where the student might study. Research on the pulse crops was a neglected area and the mungbean was a major food grain legume in the Southeast Asian area, and specifically in the state of Orissa, India, where the University of Missouri was assisting in the development of an agricultural university.

What is the nature of our research with the mungbean?

We began by evaluating the mungbean germplasm available to us. In 1970, we assembled 320 strains, mostly from the USDA Plant Introduction Station in Experiment, Georgia.

The germplasm collection has been built to more than 2,000 strains; 1,200 new strains were grown in 1974. The strains originated in many countries: India, Philippines, Taiwan, Australia, Papua-New Guinea, Nigeria, Peru and others. Many of the strains were collected through our efforts.

Mr. Earl Watt, while working on thesis research in Thailand, was able to collect more than 100 strains from mungbean fields and markets and add to the sparse USDA collection from that country.

As expected, a great diversity of plant types were observed--erect, spreading, viny, and other types.

There is also diversity in many other characteristics: yield, seed size and color, photoperiod response, disease resistance, etc. We are attempting to catalog the important economic characteristics and make this information available to plant breeders in other countries.

One of the early decisions confronting us was to determine what data to record. Being conditioned to thinking in terms of what information would be useful to the mechanized agriculture of a Missouri farmer, one was now forced to think of what would be useful to the cultivator in India, or Thailand, or Colombia, South America. This created a different thinking situation for the student.

Soon, requests were received for seed from mungbean research workers in many countries. How do you determine which strains to distribute? Specifically, how would a strain of mungbean perform in the photoperiod, or with the temperature regime, or in a multiple cropping sequence in locations as different as India, the Philippines, Canada (Manitoba), Peru, or Ethiopia--a few of the countries from which requests for seed have come.

To answer some of these questions, an International Mungbean Nursery was organized.

Planted at 10 locations in 1972, the IMN was grown at 18 locations in 1973 and has been distributed to 39 locations in 1974. Through the IMN problems with the mungbean in the developing countries that need to be researched have been identified and we have keyed into these problems for graduate student dissertations. May I emphasize again that this nursery is being conducted with graduate students so that they are involved in the problems and the discussions; hence it serves to broaden their knowledge and experience. These problems have included photoperiod response, interaction of photoperiod and temperature, seed quality, virus resistance, and others.

Let me illustrate with an example on photoperiod response. The First IMN contained 28 varieties which had a range in flowering date of 37 days at Columbia, Missouri, the earliest variety flowering in 42 days, the latest in 79 days.

When I visited the nursery at Thailand, all varieties were flowering within a 3-4 day period. Similar observations were made in the Philippines. The wide range in flowering observed at Columbia, Missouri, was not evident in the lower latitudes with shorter photoperiods and higher temperatures. The differential photoperiod response to a diverse group of mungbean strains has since been demonstrated in a growth chamber experiment as an M. S. thesis problem.

Data from the IMN indicated that temperature, too, may be a factor in differential flowering response. So a study of the temperature--photoperiod interaction is now in progress as a Ph. D. dissertation study. The information obtained will be useful for evaluating adaptation of specific strains.

What has been the contribution of the mungbean research to graduate teaching?

We have utilized the mungbean as the vehicle to develop some research problems relevant to food production in the developing countries which we could not have done by working with local crops. By working with the mungbean, the student develops a greater depth of understanding and a broader perspective of global agriculture.

The mungbean research has introduced the international dimension into our graduate teaching and has forced the student involved to think internationally. Plant Breeding may be taught using a locally grown crop, but then the student will tend to relate to local situations.

With the mungbean he has been forced to relate to diverse climatic zones, ecological conditions, cultural practices, and disease and insect problems. The broad benefits to the student of these experiences should be self-evident.

Sometimes the student learns the hard way, as when the bean shoot fly decimated the stand in the thesis research of both Earl Watt in Thailand and John Yohe in India.

We recognize that research of this nature cannot normally be done in a land grant university without some external financial support. We have been fortunate in receiving USAID support for the research, and for foreign travel. This support has enabled some students to obtain overseas experience where they could observe and study the food production problems in different countries.

At UMC we have utilized this support to generate much new information about the mungbean, and believe the research results more than justify the expenditures that have been made on this project. In addition, we are increasing the student's awareness and perspective of the food production problems of the developing countries. The program has the potential for building linkages between the land grant universities, the international research institutes, and research workers in many countries. We believe this kind of graduate teaching program may well serve as a model for preparing students to work the field of international agriculture.

SUMMARY

1. We have introduced an international dimension into our graduate teaching program.
2. The key has been use of the mungbean to provide dissertation research on problems that are relevant to the developing countries.
3. This has been designed primarily to broaden the training of U. S. students in Plant Breeding who wish to pursue a career in the international area.
4. It is appropriate for the foreign student who will be returning to his home country upon the completion of his training.