Participation in Twelfth Biennial Meeting of FAO Plant Protection Committee for Southeast Asia and the Pacific

Michael E. Irwin

ISR-80-25

October 1980

International Soybean Program, INTSOY

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INTERNATIONAL SOYBEAN PROGRAM (INTSOY)
UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN
UNIVERSITY OF PUERTO RICO, MAYAGUEZ CAMPUS

TRIP REPORT -- THAILAND

NAME: Michael E. Irwin, Associate Professor
Agricultural Entomology, Plant Pathology and INTSOY

PERIOD OF TRAVEL: October 25 through November 3, 1980

ITINERARY:

October 25	Champaign, IL, leave 6 am
October 26	Bangkok, Thailand, arrive 10 pm
October 27	Bangkok to Chiang Mai, leave 8 pm, arrive 9 pm
October 28	Chiang Mai, Plant Protection Committee
October 29	Chiang Mai, Plant Protection Committee
October 30	Chiang Mai, Plant Protection Committee
	Chiang Mai to Bangkok, leave 8 pm arrive 9 pm
October 31	Bangkok to San Francisco, leave 12 noon, arrive 11:30 am
November 1	At Berkeley
November 2	At Berkeley
November 3	San Francisco, CA to Champaign, IL, leave 9 am, arrive 5 pm.

PURPOSE:

To present an invitational paper on INTSOY and soybean pest management to the Twelfth Biennual Meetings of the Plant Protection Committee for Southeast Asia and the Pacific.

ORGANIZATIONS AND PERSONS CONTACTED:

See Attachment A for list of persons and institutions present at the Twelfth Biennial Meeting of the Plant Protection Committee for Southeast Asia and the Pacific.

RESULTS/ACCOMPLISHMENTS:

1. An invitational paper on soybean pest management and the International Soybean Program (INTSOY) was presented at the Twelfth Biennial Meeting of the Plant Protection Committee for Southeast Asia and the Pacific (see Attachment B for a summary of the paper).

2. I was able to convey INTSOY and CICP goals and methods to the Committee and received considerable interest from members of the Committee for national programs in respective countries.

3. The Food and Agriculture Organization of the United Nations (FAO), one of the major sponsors of the meeting, expressed interest in working with INTSOY and CICP in the area of insuring safe entry of germplasm into countries, principally by coordinating quarantine procedures and by transporting clean seed.

4. Dr. Oka, Indonesia's delegate to the Plant Protection Committee, suggested to me that a major effort was now being initiated in Indonesia to bring soybeans and corn production to the standards of rice in that country. He hopes INTSOY and CICP will help. I suggested that Dr. W. N. Thompson might be able to stop by Indonesia on his way to or from Sri Lanka in January to discuss the possibilities further. Dr. Oka said he would set up a series of top-level conferences if he was told well in advance of such a visit.

COMMENTS:

Several members of the Plant Protection Committee for Southeast Asia and the Pacific expressed deep concern for the inadequate safeguard for transporting seed-borne pathogens and pests among member countries by the transportation of germplasm (seeds) through international variety experiments by several international organizations, including INTSOY.

I wish to thank FAO and especially Drs. Umali and Reddy for inviting me to attend the Committee meeting, the always hospitable Thai personnel that contributed to making the meeting a success, CICP for providing international travel funds, and INTSOY for covering in-country costs.

RECOMMENDATIONS:

1. That INTSOY either make a concerted effort to minimize pathogens and weed seed in seed sent through international trials to other countries, such an effort has been initiated by R. M. Goodman on the part of INTSOY and E. A. Kueneman on the part of IITA for soybean mosaic virus; or seed shipments should contain some sort of indication of what precautions were taken to reduce probability of seed-borne pathogens. Such efforts might be coordinated with FAO or other international organizations.

2. That W. N. Thompson, INTSOY Director, visit Indonesia to explore the potential of a country program on soybean production.

ATTACHMENTS:

1. Persons and institutions contacted.

2. Paper presented to the Twelfth Meeting of the Plant Protection Committee for Southeast Asia and the Pacific.

ATTACHMENT A

LIST OF DELEGATES

Delegations of Participating Governments

Australia

Lance Smee

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Bangladesh

D.U. Khan

Member Director (Field)
Bangladesh Agricultural Development Corporation
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Krishikaj, Dacca

A. Sattar

Director (Plant Protection)
75, Kakrail, Dacca

India

S.P. Jakhanwal

Director
Ministry of Agriculture
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Indonesia

I.N. Oka

Director of Food Crops Protection
Direktorat Proteksi Tanaman Pangan
Jalan AUD
Pasarminggu, Jakarta Selatan

Lao

S.N. Banerjee

Project Manager (LAO/78/013)
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Malaysia

Ooi Soon Chye

Senior Agriculture Officer
Crop Protection Branch
Department of Agriculture
Jalan Gallagher, Kuala Lumpur

P.N. Rana	Director-General of Agriculture Department of Agriculture Harihar Bhawan Pulchok, Kathmandu
S.M. Shah	Chief Plant Pathologist Division of Plant Pathology Khumaltar, Lalitpur

Philippines

J.P. Sumangil	Research Chief Crop Protection Division Bureau of Plant Industry San Andres, Malate Manila
R. Otanes	Senior Plant Entomologist and Officer-in-Charge BPI Plant Quarantine Service Bureau of Plant Industry San Andres, Malate Manila

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Sri Lanka

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Thailand

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Narong Minanandana	Deputy Director-General Department of Agricultural Extension Bangkhen, Bangkok-9
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Prayong Jeungyusook	Chief, Plant Protection Subdivision Plant Protection Section Northern Agri-Extension Office Chiangmai
Jaap Hamelink	

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Observers

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FAO Staff

D.L. Umali — Assistant Director-General and Regional Representative, FAO Regional Office, Bangkok-2

D. Bap Reddy — Deputy Regional Representative, FAO Regional Office, Bangkok-2

Huang Ke-xun — Executive Secretary of the Plant Protection Committee, FAO Regional Office, Bangkok-2

J.F. Karpati — Plant Quarantine Officer, FAO, Rome

J.A. Lowe — FAO/IPC (Rice) Programme, FAO Regional Office, Bangkok-2

Lee Ling — FAO Consultant

ATTACHMENT B

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS

ORGANISATION DES NATIONS UNIES POUR L'ALIMENTATION ET L'AGRICULTURE

ORGANIZACION DE LAS NACIONES UNIDAS PARA LA AGRICULTURA Y LA ALIMENTACION

RAPA: FPC/SEAP/80/11/4

October 1980

TWELFTH SESSION OF THE
PLANT PROTECTION COMMITTEE FOR THE SOUTH EAST ASIA AND PACIFIC REGION
CHIANGMAI, THAILAND, 27 OCTOBER - 3 NOVEMBER 1980

Agenda Item 11: Development of Plant Protection Strategies and Programmes for Rainfed Field Crops and Flooded Rice

Soybean Pest Management and the International Soybean Program (INTSOY)

Michael E. Irwin

Soybeans account for a large percentage of worldwide human protein intake. The intake can be direct, as in many parts of Asia, or it can be indirect through the consumption of meats fattened on soy-rich diets, as in the industrialized West. However one views soybean, it must be with a sense of awe that one food can be so important. In the past much concern has been directed toward higher energy crops such as rice, corn, wheat, potato, and cassava because, on a per-hectar basis, these provide far more calories than do grain legumes. Lately, many countries have shown a positive and growing interest in grain legumes, particularly soybean, a crop, I feel, with a significant future. Administrators envision it as a means toward reducing malnutrition in their respective countries, and many countries that now import soybeans are interested in reducing their balance of payment deficits. In short, around the world, soybean is becoming a crop of the times.

To meet the increasing demands for soybean advice, since 1973 the Agency for International Development (USA) has supported a base program at the University of Illinois and the University of Puerto Rico, the International Soybean Program (INTSOY). INTSOY serves a leadership role in a network of organizations and individuals with interests in soybeans. The focus of INTSOY and others in this loose network is on all aspects of the crop -- production, protection, marketing, processing, and use. INTSOY realizes that the crop is rather special, that it must be fit into existing cropping patterns in the Western Hemisphere and that it often already forms an integral part of the existing patterns in Asia.

INTSOY works cooperatively with international centers, regional centers, and national programs to help further production and utilization of soybeans. Currently, INTSOY has two major country programs, one in Peru, largely funded by the USAID mission in Peru, and one in Sri Lanka, funded by UNDP, FAO, UNICEF and CARE. The latest phase of the Sri Lanka program has been oriented mainly to the use side while the Peru program has maintained a balance, with significant advancements in utilization, marketing, production and protection.

Some four years ago, INTSOY, in cooperation with the Asian Vegetable Research and Development Center (AVRDC), and the Government of Thailand, Ministry of Agriculture, sponsored a conference on "Expanding the Use of Soybeans" held right here in Chiangmai, Thailand. Some 225 participants from 21 countries in Asia and the Pacific attended. That was the third such regional conference in three years. Since that time, conferences and workshops sponsored in part by INTSOY have been more specific in nature and have focused on problem areas in soybean production and protection. For instance, one dealt with soybean rust and was held in Manila, the Philippines, in February 1977. In January 1981 INTSOY will sponsor a conference on soybean seed quality and stand establishment in Colombo, Sri Lanka.

Training courses in soybean production (13 weeks) and in soybean utilization (6 weeks) have been offered during May through August of each year at the University of Illinois. Sponsored in part by the USDA, these courses have attracted a total of 150 participants from 55 different countries during the past six years. In-country training courses are also offered. For instance in one month, INTSOY in cooperation with the Instituto Colombiano Agropecuario (ICA), will present a three week soybean production course in Spanish in Palmira, Colombia.

INTSOY understands the great importance of pests in soybean production and gives considerable weight to pest management in terms of personnel, funding, and training emphasis. INTSOY cooperates closely with the Consortium for Integrated Crop Protection (CICP) headed by Dr. Ray F. Smith. CICP is a consortium of 9 U.S. universities and the USDA. It is also supported largely by USAID. It sponsors seminar-workshops and short courses in pest management and pesticide safety and operates mainly through USAID/country mission programs. It and INTSOY are both interested in working cooperatively with national programs. Many of you will recall the excellent short courses that CICP directed in Indonesia and the Philippines.

Of course, INTSOY will gladly provide assistance with arrangements for degree and non-degree training at the University of Illinois or at one of the INTSOY network universities in areas related to soybean production, protection, economics or utilization.

Memoranda of understanding exist between INTSOY, University of Illinois, and many national institutions including in this region, AVRDC, Philippine Council for Agriculture and Resource Research (PCARR), Office of Rural Development of Korea and international centres such as the International Institute of Tropical Agriculture (IITA), and development oriented institutions such as the International Agricultural Development Service (IADS).

INTSOY has linkages with 110 countries through the International Soybean Variety Experiment (ISVEX). Participating institutions receive a package containing all the items necessary to conduct such an experiment. The results are printed yearly in the INTSOY publication series. This trial allows researchers and soybean programs to test advanced lines and promising cultivars against already proven cultivars under local conditions. The trials take into consideration both altitude and latitude, and our breeding program is aimed at stable yields under a variety of adverse conditions, including pests.

INTSOY has strong research programs in plant protection. At the University of Puerto Rico, this research is concentrating on 1) the effect of weeds on soybean stand and yield; 2) soybean resistance to several species of nematodes; 3) fungal pathogens of soybean; and 4) seedborne micro-organisms to name a few. At the University of Illinois, plant protection research is focusing on seed pathology, virology, entomology, and integrated pest management. The recent INTSOY newsletters will inform you of the various research programs and their accomplishments. Here, I but have time to illustrate how we operate. Since I am in charge of the entomology aspects, I will focus heavily on these.

INTSOY's entomological program relies heavily on research input from several U.S. national programs. Paramount among them are the USDA supported southern regional program (S-74) and the Huffacker-Adkissen projects sponsored mainly by the Environmental Projection Agency, the National Science Foundation, and the USDA. The combined efforts have generated an astonishing amount of information as can be seen by the tremendous increase in publications dealing with arthropods associated with soybean.

Part of the reason for our existance is to make available this vast and expanding quantity of information to the developing world. Therefore, part of INTSOY's function is to organize and package technology. Some of that information is here and you are welcome to review it at your leisure. If some of it interests you, please write INTSOY for single copies at no cost to you or your institution.

If a pest management program on soybeans is to be initiated, there are a series of questions that must be addressed. One of the first and most important deals with the ecosystem and the vast numbers of arthropods existing within it. Which of these many species are important as pests or natural enemies of these pests, and what are they? INTSOY and our soybean entomology program at Illinois have been successful in initiating the International Reference Collection of Soybean-Associated Arthropods (IRCSA), a world-wide collection of arthropods collected in soybean fields. The collection now contains over 200,000 specimens and about 2,500 taxa. Data from the collection are stored for computer retrieval. IRCSA acts in part as an identification service where specific host associated insects may be sent for identification.

Only if the arthropod's scientific name is known can one delve into the literature. And that, in our opinion, is the next thing to do to initiate a pest management program. INTSOY supports an ever expanding body of soybean-associated arthropod literature. The Soybean Insect Research Information Center (SIRIC) currently contains 18,000 documents, all computer coded and on file

for ready retrieval. If one wishes to know what literature exits that deals with the chemical control of Nevara viridula, a pod-sucking pest of soybean, a computer search will print out a list of citations that are relevant. SIRIC maintains hard copies of all documents and photocopies of articles not readily available in developing country institutions will be sent on request. In turn SIRIC would appreciate receiving all documents on soybean-associated arthropods from all countries so that these too may be made available to a larger user community. All costs for IRCSA and SIRIC services are borne by INTSOY.

The next step in putting together a pest management package is to make sure all available niches have been searched for pests and potential pests, not only spacially but also temporally. Sampling procedures must be established and standarized for the important species. Incidentally, a new book has just been released that gives detailed accounts of sampling procedures for soybean associated arthropods.

It is now time to put together a preliminary pest management package that consists of a crude chart listing the major pest species by common and scientific name, stages to be monitored, economic injury levels, and chemical control recommendations. Most of the information will have come from the literature, should be conservative, and should take into account current local control practices. Here I have emphasized arthropod pests but bear in mind that the design can be modified to include diseases, nematodes, vertebrates and weeds not only of soybeans but of other crops and even of cropping systems.

The next phase is the most difficult: implementation. How can the preliminary pest management package be put to use? Although many options for technology delivery exist, this phase must mesh with in-country delivery systems. In Peru, the delivery system, or extension, is within INIA, a semi-autonomous arm of the Ministry of Agriculture and Foods. To combat the propaganda delivered by chemical companies, we have envisioned using farm credit banks as buffers to the over use of pesticides.

Through the implementation of such a preliminary pest management package, surgences of secondary pests should be reduced. Chemical applications should be more timely and are usually fewer in number, and dosages are usually lighter.

The next phase is the systematic and frequent sampling of pest and beneficial population densities throughout the growing season. That will result in information as to when, relative to crop phenology, various arthropods are abundant. This will provide valuable information about when during the season certain pests need to be monitored by scouts in practical programs. It makes no sense to expend energy sampling for stink bugs early in the season. A series of experiments should also be initiated to adjust economic injury levels to local conditions and to crop phenology. Chemical compounds should also be tested and special attention must be given to low dosages, proper timing and efficacy on target organisms, secondary pests and beneficials.

The status of phytophagous species can also be investigated. For instance, a cerambycid stem borer (Grammopsoides rufipes) was found attacking soybean stems in ever increasing numbers in Peru. Through the efforts of a local researcher in collaboration with INTSOY, it was found that this species did not significantly reduce yields even when the crop was heavily attacked. The research was instrumental in relegating it to non-pest status.

A crucial point to remember in the formulation of a pest management program is feedback. Whatever information is gathered by scientists must be incorporated into the practical pest management package and whatever doesn't work well regarding the package should be brought to the attention of researchers. The idea is to continually improve the package. The few pests that habitually call for pesticide use need to be studied very thoroughly, especially their biologies and ecologies, looking for ways to implement alternate control tactics. One often very effective tactic is host plant resistance. Another is biological control. A key defoliating pest of soybeans in Latin America, Anticarsia gemmitalis, might easily be brought under control by helping a natural predator, Polistes sp. expand its search capacity by providing nesting sites close to soybean fields. Often, slight modifications of the habitat can directly or indirectly lower pest population densities enough to eliminate them as actual pests.

Of course, results from these more long-term tactics should be incorporated into a much refined management system that provides the grower with wide options through time. The options must be based firmly on an understanding of crop/pest ecology. And this area, in my opinion, will shape the major efforts in pest control for this coming decade and well into the 1990's.

I would like to spend the rest of my time discussing an example of the way INTSOY approaches a research subject. The problem is soybean mosaic virus (SMV). Soybean mosaic virus is found wherever soybeans are grown because this virus is transmitted through the seed. INTSOY has a cooperative arrangement with IITA to eliminate seed borne viruses from material transported among countries in our ISVEX trials. SMV is also transmitted by carryover in the seed to volunteer plants, and, probably most importantly, by aphids in a non-persistent manner.

SMV can cause severe yield losses and the earlier in the season a plant is infected the more sever the losses. Also, seed transmission is greatest if parent plants are infected early. There are several strains of SMV and any single strain affects various soybean cultivars differently. So the yield loss and seed-transmission characteristics depend heavily on the cultivar used, the strain or strains of SMV, and the timing and quantity of movement in the field.

This programme is cooperative, between our INTSOY virologist, Dr. R.M. Goodman, the INTSOY entomologist, Dr. M.E. Irwin, and the INTSOY soybean breeder, currently Dr. Luis Camacho. Only by a collaborative effort did we feel we could solve this problem.

In the Western Hemisphere aphids usually do not colonize soybeans. Therefore, where our initial research was conducted, we were primarily interested in transient alate aphid flights. In the Orient and parts of the Pacific, certain species do colonize soybeans. Through a cooperative project with the People's Republic of China, a former student of mine, Dr. S.E. Halbert, will test some of our hypotheses of aphid vectors under conditions where aphids colonize the crop.

Dr. Halbert's work as a graduate student sponsored by INTSOY was to determine which of the more than 100 species of transient aphids are important field vectors. This was done by trapping alate aphids downwind of a heavily infected field and determining which of these are important.

The next item was to devise a trapping technique that would give a good approximation of the absolute landing rates of all species on the soybean canopy. We devised a water-filled pan trap with a green mosaic tile that mimiced the color and texture of a soybean canopy. With this trap we developed the following graphs that emphasize the fact that different species are abundant during different years. It also suggests that the same species are often abundant during different parts of the season from year to year and that the abundances differ among years. This means that the predictability of aphid populations is beyond our immediate grasp and that we will have to rely in terms of predication, more on the percentage seed transmission and assume a senario of worst-known-case of aphid flights for predicting SMV spread and effect on yield and end of season seed transmission. More will be said on this a little later.

Another set of experiments looked at resistance of soybean to SMV and to seed-transmission of SMV. This was done mainly by the virologist and plant breeder. Certain genotypes have been identified with good resistance to some, through not all, SMV strains, and a very promising area is that seed transmission varies greatly among soybean cultivars, some of which have less than 0.1% transmission under heavy infection.

How does SMV spread in the field? A series of experiments showed that the pattern of spread correlated with wind direction and that during a season it can move at least 50 meters. In a mixed planting, SMV can increase from 0.1% at planting to 100% at harvest under only moderately favourable circumstances.

Can SMV infection be delayed or reduced by altering aphid landing/probing behaviour? Several projects on this aspect were investigated, including one on canopy color. These tests showed positive correlation between canopy color, aphid landing rates, and spread of SMV. Furthermore, analysis by species showed that only some responded differently to different canopy colors.

Altering planting dates is another way to alter aphid landings and, at the same time reduce SMV transmission. Computer simulations of this confirm our observations. At 0.01% initial seed infection , the increase in sources plants over three growing seasons based on actual aphid landings is illustrated. The final yields and seed transmission is given. The same is computed for initial seed infection of 1%.

At the present time, what seems important is to concentrate on seed fields and to attempt to maintain seed quality high. A computer simulated graph based on our studies suggests that if carefully planned and if aphid population timing, abundance and species can be estimated, it should be possible to grow seed crops and maintain seed-transmission on a low and declining course.

This example is but one of several I could have presented. It is perhaps the most complicated case and for this reason I chose to present it. It should be stressed, however, that INTSOY is a flexible organization, one that exists to serve in any capacity it can the development of the soybean industry.

Thank you for your time and patience. I have enjoyed my time with this important and distinguished Committee. I hope you will call on us should our services be needed.