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International Soybean Program, INTSOY
University of Illinois at Urbana - Champaign
Universidad de Puerto Rico - Recinto de Mayaguez

TRIP REPORT/MEXICO

Date Submitted: 1 December, 1978

NAME: Michael E. Irwin, Assistant Professor, Agricultural Entomology
Robert M. Goodman, Associate Professor, Plant Pathology

ITINERARY:

Irwin:	October 22, 1978	San Salvador/Guatemala/Mexico, D.F. arriving 11:50 a.m.
	Ocotber 23	At Mexico, D.F.
Irwin and Goodman:	October 24	Irwin at Mexico, D.F.; Goodman, Champaign/Chicago/Mexico, D.F., arriving, 2:00p.m.
	October 25	Drive to Tampico, arriving at 7:00 a.m. At Tampico, to Altamira, Mantes, and Las Huastecas Experiment Station, overnight in Tampico.
	October 26	Tampico, Las Huastecas Experiment Station, Tancasneque Experiment Station, and Tampico. By air Tampico/Mexico, D.F.
	October 27	Mexico, D.F./Chicago/Champaign, leaving 1:10 p.m., arriving 9:00 p.m.

PURPOSE:

1. To review entomology and plant pathology programs on soybeans in the humid tropics of Mexico.

2. To give advice and counsel on diseases affecting large acreages of soybeans in the Huastecas area.

INSTITUTIONS AND PERSONS CONTACTED:

Instituto Nacional de Investigaciones Agricolas (INIA), Ministry of Agriculture

Mexico City, Headquarters

Dr. Alfonso Crispin M., Subdirector INIA, Program Planning, Plant Pathologist

Wetland Tropics Soybean Production

Dr. Jorge Nieto, Director, Soybean Program for Wetland Tropics, Weed Scientist

CIAGON, Northeastern Regional Division, INIA

Ing. Enrique Elias Calles, Director, Agronomist, Pomologist

Tampico, "Las Huastecas" Experiment Station

Ing. Clemente Mora P., Station Director, Plant Pathologist
Ing. Salvador de la Paz, Entomologist
Ing. Ricardo Lagarda Marrieta, Soil Scientist
Ing. Jesus Tijerina O., Plant Breeder
Biologo Maria Angeles Pena del Rio, Plant Pathologist
Ing. Miguel Ibarra, Soybean Production Specialist

"Rio Bravo" Experiment Station, visiting Tampico area

Ing. Fernando Galvan C., Station Director, Plant Breeder
Ing. Gerardo Longoria, Soil Scientist (iron chlorosis)

RESULTS/ACCOMPLISHMENTS:

1. We viewed the research and field facilities, were briefed on soybean production in Mexico and specifics of protection problems, were taken to the field to view these problems, were presented information on results of specific research conducted in the areas of entomology and plant pathology. Following is a brief account of our impressions:

Background information on soybean production in the Huastecas area. Soybeans were first grown in Mexico in 1958 when 200 ha were planted in the Yaqui Valley, Sonora. Sinaloa and Chihuahua followed suit, but it was not until the late 1960's that soybean production began in the Huastecas area of Mexico. Soybean production is currently concentrated in the northwest portion of Mexico under irrigation and in the east central portion under rainfed conditions. Under irrigation, soybeans are yielding about 2,400 kg/ha, while under rainfed conditions, yields are lower, about 1000 kg/ha. In 1977 Mexico had about 700,000 ha under cultivation with a cash value of 7.2 million pesos. The area in northwestern Mexico under irrigated cropping conditions will be converted from soybean to higher cash value crops and the wetland tropics will become the major area for soybean production in Mexico.

In 1968, 300 ha of soybeans were planted in the Huastecas area (this area, between 23-24°N latitude, 98-100°W longitude, includes the states of Tamaulipas, San Luis Potosi, and parts of Vera Cruz). By 1977 103,000 ha were under cultivation with a mean yeild of 800 kg/ha. This low yeild was caused by drought during pod fill. In 1978, 90,766 ha were planted in soybean in the Huastecas area distributed between Tamaulipas (78,286 ha), San Luis Potosi (7,350 ha), and Vera Cruz (5,130 ha). It is estimated that the potential of the Huastecas area includes 4 million ha of soybeans and this includes a projected goal of 500,000 tons of seed. The Huastecas area is in a subtropical climate with dry, semiwet to humid conditions and between 2000 mm rainfall in the northern area to 700 mm in the central areas. Rainfall is heaviest between June and September (80% of total),

with the other 20% distributed throughout the rest of the year; mean temperature is 22-26°C; with a mean maximum of 32-45°C, and a mean minimum of -3 to -10°C; soil is clayish, and about 13% of the land is currently under crop agriculture. The main crops in the Huastecas area are soybean, sorghum, and corn in the summer and safflower, sunflower and horticultural crops in winter.

The government has a guaranteed price for soybeans, but this guarantee is currently lower than the international price. The decision to plant is left up to the farmers.

The soybean research team. The team of researchers working on soybeans in the humid tropics of Mexico currently consists of a breeder (Jesus Tigerina O.), a plant pathologist (Maria de los Angeles), an entomologist (Salvador de la Paz), and a team director (Dr. Jorge Nieto H.) stationed at Las Huastecas. The team extends beyond the Huastecas region and Dr. Nieto has a staff of scientists working on soybean that currently numbers 14 specialists and covers the following parts of Mexico: Vera Cruz, Tampico, Rio Bravo, Santander de Jimenez, Apatzingan, Iguala, Tecomay, La Huerta, Tapachula, Villa Flores, Merida, and Campeche. At the 'Las Huastecas' station, Dr. Nieto feels he is in need of additional specialists in the fields of water management, soils, plant physiology, and weed science.

Entomology aspects of soybean team. There are several groups of pests attacking soybeans in the Huastecas area, but the most important to date has been the complex of defoliators. This complex includes several species but the most important are *Anticarsia gemmatalis* and *Pseudoplusia includens*. *Cerotoma ruficornis*, though present, has not yet become an important pest in the area. Seed feeders form a second potentially important complex. Presently, there are three species of stink bugs involved: *Nezara viridula*, *Euschistis servus* and *Piezodorus guildini*. To date, this complex has not surpassed levels of 2/m row and; therefore, research on the complex has been minimal.

A fungal pathogen, previously identified as *Metarhysia* sp, but confirmed at the University of Illinois by samples brought back as *Nomuraea rileyi*, has often controlled the lepidopterous defoliator complex before economic injury levels were reached. Also a polyembrionic parasite, *Copidosoma* sp., parasitizes *Trichoplusia ni* and *Pseudoplusia includens* larvae in soybean fields.

The insect pest management program has concentrated on the lepidopterous defoliator complex during the past 3 years. In 1976, sampling methods were developed. It was found that 5 ground cloth samples were accurate to within 20% either side of the mean if mean numbers of larvae were at 5 or more per meter row.

During the 1977 and 1978 seasons, this sampling method was used to monitor lepidopterous larvae in large field blocks of soybean.

These blocks were sprayed with insecticide if and when the numbers of larvae > 1.5 cm in length/m row surpassed the following limits: 5,10,15, or 20. There was an unsprayed check as well as a check that was sprayed weekly. The 1978 experiment has not been harvested yet, but data from the 1977 experiment strongly support the economic injury levels proposed by the University of Illinois and Illinois Natural History Survey entomologists: 20 larvae > 1.5 cm in length/m row. The table presented below is a rough approximation of the results obtained by Salvador de la Paz. It should not be reproduced without de la Paz's permission.

Treatment at x larvae > 1.5 cm/m row	Percent defoliation at R4-R5	Number Pesticide Applications	Yields[a/] kg/ha	Monetary gain (pesos) to farmer/ha
5	< 5	4	1,709 b	8,519
10	15	4	1,725 b	8,607
15	25	3	1,703 b	8,706
20	30-35	3	1,656 b	8,448
every week (0)	0	13	2,023 a	8,266
no treatment (90)	> 60	0	1,312 c	7,216

[a/] Figures followed by different letters are statistically significant

Plant Pathology Aspects. Two major diseases affect soybeans in this area of Mexico, bud blight caused by tobacco ringspot virus (see below) and another blight disease of unknown etiology thought to be caused by a fungus. In an impressive series of experiments, Maria de los Angeles has shown that tobacco ringspot virus (TRSV) is the cause of bud blight symptoms affecting some 4,000 ha in the area of Tamaulipas north of Tampico. Sra. de los Angeles had conducted host range tests that strongly indicated TRSV as the causal agent. Typical TRSV symptoms were obtained in soybean, tobacco, cowpea and *Datura stramonium* and reinoculation experiments in which healthy soybeans were inoculated in the field with inoculum from tobacco plants infected with TSRV confirmed the etiology of this disease. During our visit, R. M. Goodman and Sra. de los Angeles conducted serological tests for TRSV, soybean mosaic virus (SMV) cowpea severe mosaic virus (CPMV) and bean pod mottle virus (BPMV). Tests with field-collected soybean material and sap from TRSV infected tobacco plants further confirmed TRSV as the cause of bud blight and appeared to rule out the presence of SMV, BPMV or CPMV.

Sra. de los Angeles had also conducted an interesting experiment in which field-grown soybeans were inoculated with TRSV at various stages of plant development. The results showed convincingly that virus infection, to result in severe symptoms and failure of pod formation, had to occur prior to flower formation. Plants inoculated after flowering had few symptoms and appeared to grow more or less normally. The yield loss implications of inoculations at various stages will be obtained from this experiment which was at R7 when we saw it.

The prime suspect for transmitting TRSV in the field is thrips. M.E. Irwin brought back a sample of thrips that were on soybeans in the affected area and got the following identifications through the services of the International Reference Collection of Soybean-Associated Arthropods: most of the specimens were Caleothrips phaseoli, but there were a few specimens of Sericothrips geminus Hood as well. M. E. Irwin suspects C. phaseoli as the primary field vector.

Sra. de los Angeles reported obtaining evidence for the presence of Macrophomina phaseoli and species of Rhizoctonia and Fusarium from plants blighted by the unknown fungal pathogen. Symptoms seen and the prevailing conditions (an unusually dry season, scattered plants infected) were reminiscent of charcoal rot caused by M. phaseoli. Another possible cause that should be investigated is the fungus Phymatoptrichum omnivorum, southwestern U.S. and Mexico to cause a severe disease of soybeans.

Because of the manner in which soybean seeds are produced for seed use, the seed viability problem encountered in many tropical and subtropical locations does not appear to be a significant problem at the moment in the coastal areas of Mexico where soybeans are produced under rainfed conditions. The INIA soybean program staff are aware of this potential problem and will be attentive to possible problems in the future.

2. Procedures for controlling bud blight disease can be determined in part by the answers to the following questions: What is the vector? What is the primary inoculum source in the field? From what non-cultivated hosts does the virus spread to soybeans? Can virus spread be prevented or reduced by insecticide treatments or crop manipulations? If so, how should these be sequenced to maximize yield and minimize cost? Is there soybean germplasm available with resistance to the TRSV strain present in Tamaulipas? If so, how can this resistance be incorporated into agronomically acceptable cultivars?

We recommend that Sr. de la Paz and Sra. de los Angeles conduct studies during this winter to determine if the prevalent thrips species, Caleothrips phaseoli, can transmit TRSV. While at Tampico we made specific suggestions as to how this thrips species could be reared in the laboratory, and how the study might be conducted. We also pointed out numerous weeds in and around soybean fields that were suspect of harboring the virus. Maria de los Angeles knows how

to test these using antiserum supplied by INTSOY and host range tests that she has worked out already. In isolated cases where this disease occurs in the United States, the recommended control methods include removing broad leaf weeds near and within fields and planting a few rows of a trap crop at the edges of fields before soybeans are planted, followed by insecticide treatments on the trap crop rows only. We feel this procedure should be followed next season in at least one area in which problems with TRSV have occurred in 1978.

We also recommend joint experiments by Sra. de los Angeles and Sr. de la Paz to test the control of bud blight spread by use of timely insecticide treatments. This can be done even before the vector is known since recommended insecticides, like "carbaryl" (Sevin) are broad spectrum. We recommend experiments to test chemical application timing (emphasis on the time prior to flowering), frequency, and dosage. Furthermore, we highly recommend that de la Paz study the field biology, spatial and seasonal distribution and plant host range of the suspected vector, Caleothrips phaseoli. We have discussed methodolgies for such a study with him. A study on application of a systemic insecticide like "counter"or "carbofuran" at the time of planting would be worthwhile since numerous studies have shown that systemic insecticides limit the colonization of thrips early in the season.

We shall attempt to obtain information about TRSV-resistant soybean germplasm we believe is being tested by scientists at Purdue University. If possible, we shall obtain samples of lines that they find promising and send them to INIA for testing near Tampico.

Dr. Nieto asked for Dr. Goodman's opinion on the emphasis that should be given in the next season to work on the fungal disease in relation to work needed on the virus disease. We recommend that Maria de los Angeles should concentrate her efforts on identification of the pathogen causing the fungus disease while carrying on the investigations on spread and control of the virus jointly with Salvador de la Paz. We believe it would be unwise to abandon work on the virus disease now that the causal agent is identified because control methods are needed and a few experiments in the next season might well yield this information. On the other hand,the fungal disease seems important also, and it would be foolish to ignore it. From our brief inspection, we rate the diseases of about equal importance because either can substantially reduce yields.

Finally, we strongly urge that the pest management data of Sr. de la Paz and the bud blight epidemic studies by Sra. de los Angeles be prepared for publication in appropriate scientific journals.

DISTRIBUTION:

Dr. Crispin, INIA, Mexico City
Dr. Nieto, INIA, Tampico
Ing. Elias Calles, INIA, Tampico
Sra. de los Angeles, INIA, Tampico
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