

# I. EXECUTIVE SUMMARY

## Workshop on Soybean Rust

9-11 August 1995

This workshop was conducted in order to develop recommendations for action to deal with the possible introduction of soybean rust into the continental U.S. Scientific experts from varied research disciplines attended the workshop to discuss the disease and its casual agent, and potential threat to soybean production in the U.S.

### I. General conclusions:

A. Soybean rust is a potential threat to soybean production in the continental U.S. Soybean rust is caused by two described fungal species; *Phakopsora pachyrhizi*, which is predominantly in Australasia and Asia, and *Phakopsora meibomiaae*, in the New World (Latin America). The Australasia species is considered more aggressive than the New World species. An African species on soybeans has been reported but is undescribed at this time.

B. The introduction of soybean rust into the continental U.S. could come from either Australasia or the New World (or possibly Africa) at any point of entry, not necessarily from the direction of Hawaii.

C. Although it is not known how the pathogen was introduced into Hawaii, the detection of soybean rust in Hawaii suggests that the soybean rust organism can be transported over long distances and still remain in a viable or infective state.

D. Soybean producers in the U.S. are not prepared with any disease management options in the event that this disease becomes established. Specifically, there

are no fungicides currently registered for use on soybeans to control the disease. Also, there are no resistant nor disease tolerant cultivars available in the U.S.

E. Once the disease becomes established in an area, eradication is not practical. It would not be feasible to eradicate soybean rust in Hawaii or the New World due to the wide host range of the two soybean pathogens. If rust is detected early, however, chances for eradication improve considerably.

F. A recent pest-risk analysis indicated that under one scenario the Australasia species could cause yield losses of greater than 10% in any soybean-growing region of the U.S. Whereas in the southeastern U.S. where climatic conditions would favor the spread and development of disease, losses up to 50% have been predicted.

G. There is a lack of general information on the recognition and identification of the disease within the U.S. at the research, extension and industry levels. Early recognition is crucial if any eradication attempt is to be successful.

H. There is no research currently being done in the U.S. on soybean rust disease although there has been extensive research on soybean rust in Australasia and Latin America. For the past twenty years the national and international funding for research on this disease has been minimal.

I. There is no emergency action plan (Federal or State) which is specifically designed to deal with the possible introduction of soybean rust into the U.S.

## II Short-term research needs:

- A. Determine the natural host range of the soybean rust pathogen in Hawaii including wild and domesticated legumes on the three islands where it has been identified as well as other islands in the State.
- B. Determine whether the species that occurs in Hawaii is definitely the Australasian species and compare the pathogenicity of Hawaiian isolates to other Australasian isolates.
- C. Develop rapid morphological and molecular identification methods that would enable scientists to identify quickly and reliably which fungal species is present in a given area.
- D. Test available tolerance lines of soybeans for adaptability in the different soybean growing regions of the continental U.S.
- E. Prepare and distribute an outreach publication with photographs and a simple but brief description of the disease. This one- page leaflet would target soybean growers and extension specialists because early detection is the key to successful eradication.
- F. Request that USDA APHIS PPQ prepare an emergency action plan to deal with the possible introduction of soybean rust into the continental U.S.
- G. Request that effective fungicides be registered for use on soybeans to control the disease in the event it is accidentally introduced into the continental U.S.
- H. Establish an international collaborative research effort with countries such as Australia, Japan, Taiwan and those of the New World to study the disease and its control.

## III. Long-term research needs:

- A. Study the epidemiology of the disease in Hawaii to determine the spore dispersal pattern and the spatial distribution of the pathogen, and the development of the disease in relation to various environmental factors. This study would enhance current disease modeling systems for more accurate disease forecasting.
- B. Collaborate with international researchers to test crosses of desirable soybean lines with disease tolerant lines.
- C. Determine the genetic components of pathogen tolerance in soybeans, particularly those characteristics that could be screened for in the absence of the pathogen.
- D. Study the biology, including the life cycle, of the Australasian and Latin American pathogens including the relationship between the pathogens and their hosts. Study the African pathogen to determine its biology and relationship to the other two species.
- E. Develop a rapid method to evaluate soybean germ plasm for resistance that would correlate with field results and be used to evaluate sources of resistance and tolerance.
- F. Develop resistant breeding lines derived from crossing between soybean and wild relatives of the soybean.

## II. INTRODUCTION

Soybean rust was found and verified on soybeans collected from a farm in Mililani, Oahu, Hawaii on 4 May 1994. This was the first report from the State and thus, the first verified report in the U.S. The rust fungus somehow has bridged the Pacific Ocean gap between Asia and Hawaii. This discovery renewed concerns about the possibility of the fungus and disease coming to the continental U.S. and affecting the U.S. main land soybean production.

A workshop on soybean rust was held 9 to 11 August 1995 at the National Soybean Research Laboratory (NSRL), University of Illinois at Urbana-Champaign (UIUC). The workshop was sponsored, in part, by the United

Soybean Board, St. Louis; and the Office of Research, College of Agricultural, Consumer and Environmental Sciences, UIUC. The purpose of the workshop was to: (i) bring together nine scientists with expertise and knowledge about soybean rust and its casual agents; (ii) update current knowledge, published and unpublished; (iii) discuss the potential threat of the disease to U.S. soybean production; (iv) determine research needs and objectives; and (v) suggest management practices for controlling the disease and protecting U.S. soybean production, or other methods to minimize potential loss should the disease be introduced into the continental U.S.

## III. HISTORICAL BACKGROUND

Soybean rust has been known for some time to occur in Australia and Asia. A bibliography of soybean rust was published by the Asian Vegetable Research and Development Center in 1987 (5), which was superseded by an annotated bibliography in 1992 (4) (Appendix I-B). These publications provided a summary of most reported research on the disease through May 1991. A workshop on rust of soybeans, which was sponsored by the International Soybean Program (INTSOY) of the UIUC, was held in Manila in 1977 (3). This workshop stressed the problems and research needs in Australia and Asia. The potential threat to U.S. soybean production was acknowledged, but because of the distance between Asia and the U.S., it was considered a minor threat.

In 1976, a rust on soybeans was discovered in Puerto Rico. This was the first report of soybean rust occurring in the Western Hemisphere, although the fungus had been reported on other domesticated and wild legumes. A workshop on soybean rust in the Western Hemisphere,

sponsored by the USDA, ARS Mayaguez Institute of Tropical Agriculture, was held in Mayaguez, Puerto Rico in November 1976 (8). It was acknowledged at the time that the form of rust occurring in the Western Hemisphere was less virulent on soybeans than was the Asian form and thus, was less of a threat than the Asian form.

Research on soybean rust in the U.S. began in 1971 at the U.S. Department of Agriculture's containment facility at Fort Detrick, Frederick, Maryland (1) (Appendix I-A). The facility operates under the direction of the Foreign Disease-Weed Science Research Unit. The group associated with this laboratory has made comparative studies among selected isolates of the fungus and evaluated selected soybean cultivars and lines for resistance or tolerance to the casual agents.

With the discovery of rust on soybeans in the State of Hawaii, it was timely to revisit the question of the disease's threat to continental soybeans (Appendix I-E). This workshop was held at the National Soybean Research Laboratory, UIUC.