REPORT ON VII WORLD SOYBEAN RESEARCH CONFERENCE, IV INTERNATIONAL SOYBEAN PROCESSING AND UTILIZATION CONFERNCE AND III BRAZILIAN SOYBEAN CONGRESS FOZ DO IGUASSU, 29 FEBRUARY - 5 MARCH, 2004

by

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13th April, 2004

The VII World Soybean Research Conference (WSRC VII), the International Soybean Processing and Utilization Conference and the III Brazilian Soybean Congresses were held at Foz do Iguassu, Brazil from 29 February to 5 March, 2004. The congresses provided a wonderful venue for rich interaction of over 1750 scientists, professionals of the private sector, students, extension officers, farmers and others from around the world. The programme for the three events was prepared in such a way to provide participants exposure to the most advanced information regarding soybean production, processing and utilization. Some of the sessions (plenary, posters and exhibitions) were common to all three events. Concurrent sessions (up to eight) also took place every day, involving all three events.

The proceedings themselves offered participants a unique opportunity to become acquainted with the most up-to-date research related to soybean production, processing and utilisation, encompassing specific areas of each of these aspects. The papers presented in symposia from invited speakers alone covered 1344 pages of fine print, in addition to 128 oral and 544 poster abstracts. Many hundreds of useful references are also provided. Anyone wishing to study this up-to-date information is welcome.

The city of Foz do Iguassu, right on the border with Argentina and Paraguay, offers many attractions, the major one being the Iguassu Falls, one of the most spectacular natural wonders of the world. Other breathtaking attractions include many safaris and eco-tours and the magnificent Itaipu hydroelectric dam – the largest in the world. The animal, bird and insect life is beautiful and abundant.

Brazil has overtaken North America and become the world's largest exporter of soybeans. It has also become the world leader in export of beef and poultry. In the 1970s and 1980s the Brazilian government invested large amounts of money in training young, bright scientists by sending them to

foreign countries (mainly to North America, Canada, Scotland, England and Germany) to obtain their PhDs. These scientists returned to Brazil with a wealth of information, skills and new technologies. Many believe that this, together with plant breeding and Brazil's no-till farming strategy, has been the answer to the county's rising agricultural production and economy.

Southern African Congress Delegates

Dr Pat Caldwell (University of KwaZulu-Natal), Ms Eve du Preez (Department of Agriculture and Environmental Affairs, Cedara, KZN), Mr Kim Lawrence (Agricultural Research Council) and Mr Anthony Jarvie (PANNAR, Greytown, KZN) represented South Africa. Dr Clive Levy (Commercial Farmers Union, Zimbabwe) and Mr Jacob Tichagwa (SEEDCO, Zimbabwe) represented Zimbabwe. Dr Caldwell, Ms du Preez, Dr Levy and Mr Tichagwa were all invited speakers.

Papers Presented by Southern African Delegates:

Soybean rust research in South Africa (Pat Caldwell)
Chemical control of soybean rust in South Africa (Eve du Preez)
Zimbabwe – a country report on soybean rust control (Clive Levy)
Breeding for resistance to soybean rust in Zimbabwe (Jacob Tichagwa)

Press Conference

Dr Caldwell, Dr Levy, Ms du Preez and Mr Tichagwa attended a press conference with journalists from various newspapers, agricultural magazines and journals. An overview of the soybean rust problem in Southern Africa was presented and questions from the journalists answered.

International Working Group for Soybean Rust

Dr Caldwell and Dr Levy became members of the International Working Group on Soybean Rust. An international conference (probably in Argentina) is being planned for 2005. A membership list will be circulated in the next few months. Anyone wishing to join this working group should contact Dr Glen Hartman – ghartman@uiuc.edu.

Arrival of *P. pachyrhizi* in North America

Many American scientists feel that when the rust arrives in N. America farmers, fungicide producers and equipment manufacturers will not be ready. Present spray rigs are not adaptable for the tall soybean crop. They believe that in the first season of the appearance of the rust, farmers will be hit hard despite repeated warnings. They still turn a blind eye and deaf ear to the constant warnings to get ready. There is also concern as to the availability of enough fungicides on the market to control the rust. There are probably sufficient supplies for the first but not enough available for second applications. They predict that the first application will equal the total amount of fungicides presently used in the US for all crops including turf! They do no believe people are going to be prepared to give up their present quota of fungicides to soybean farmers. In addition, chemical companies are not

prepared for a massive outbreak of *P. pachyrhizi* and are not willing to invest in a large production of stock as they are still hoping the pathogen will not reach the US! The problem facing the government in North America is that the drought experienced this past year is going to result in low yields. The US is going to be forced to import soyas to meet demands. Imports will probably come from Brazil or Argentina but *P. pachyrhizi* is already present in both counties. There is grave concern about bringing the rust pathogen into N. America on imported soyas as there could be viable spores on debris, soil on beans etc. Scientists believe there is going to have to be a 'leapfrog in technology transfer' if the US is going to get US farmers ready for outbreak of rust.

USDA Contacts

Dr Monty Miles (USDA - University of Illinois) and Dr Reid Frederick (USDA – Fort Deidrich) visited Zimbabwe and South Africa (Cedara, University of KwaZulu-Natal and PANNAR) in early April to investigate possibilities of further collaborative research programmes between Southern Africa and the USA.

Soybean Rust Bus Tour

After the congress Drs Caldwell and Levy joined a specially organized soybean rust tour of 3000km around eastern Paraguay and the Parana State of Brazil. There were 27 scientists on board the bus - 24 being plant pathologists with PhDs. Countries represented included Canada, North America, Columbia, Brazil, Zimbabwe and South Africa. The majority of the scientists were from North America mainly because they are expecting soybean rust to arrive in their country, if not during the 2004 growing season, then in the foreseeable future. As these scientists have no hands-on experience of the rust and had only seen photographs of the symptoms, they had been sent by their respective organisations to learn to identify early and late symptoms of the pathogen which would enable them to be alert to arrival of the rust in their respective states in North America.

Some Interesting Facts about Soybean Production in South America

- In Paraguay about 80% of cultivated land is planted to soybeans. Land that was previously regarded as unfit for agricultural production is now being planted to soybeans due to the no-till and plant breeding programmes. There are soybeans as far as the eye can see - intercropping between fruit and citrus trees and even the border areas between main roads and farmers' boundary fences are common sights.
- Soybeans are planted twice a year (August and December) in most areas and some farmers even try to plant a third crop in February hoping to harvest before the onset of the first winter frosts. Often no crop rotation is practised, and so there is concern that pathogens that are present, but not a problem at the moment, might become epidemic due to the demand farmers are placing on the land. Where maize is planted it was a common occurrence to see the newly cut maize stalks in the land with young soybean seedlings emerging in between.

- Many areas are under "Round-up Ready" soyas. However, some Co-operatives refuse to accept any genetically modified soyas and run tests on every load of soyas is tested before soyas offloaded. They test for GMO soyas – quick ELISA tests done and results are available within 15 minutes. If the test is positive the load is returned to the farmer. There are Co-ops. that accept GMO soyas.
- Fungicide applications are carried out using tractor rigs – very little aerial application of fungicides is practised. Where aerial applications are used, spray skips are often clearly visible in the soybean fields providing pockets of inoculum. 18m swaths are used for aerial application.
- Small-scale farms own in the region of 100-400ha. In the 1950s about 50% of Brazil's population was living in rural areas. Today this has been reduced to about 18% as most of the young people move into the cities, resulting in far fewer small-scale farmers.
- *Phakopsora pachyrhizi* – trap crops are not popular nor practised. Farmers spray for soybean rust at flowering whether or not the pathogen is present. Two fungicide applications usually give adequate control. Radio, extension officers and farmers' days are used to alert farmers to the arrival of the pathogen. Normal yields average 2.5 tons/ha with fungicides maintaining yields. South America experiences the same problems as Southern Africa – in a dry season very little rust is seen but in wetter environments it is a major problem.
- 1.8 million hectares are planted to soybeans in Brazil. However, the country has the potential to plant 7 million hectares to soybeans. Production potential is in the north-west with over 100 million ha of land still available for soybean production. However, this area often experiences heavy rainfalls causing severe outbreaks of *Sclerotinia* and also making harvesting very difficult. China is importing 30 million metric tonnes of soybeans per annum from Brazil. India and other Asian countries also demanding more soybean imports due to increase in economy of these countries. Brazil predicts a continuous increase of about 5 million tonnes of soybeans per year. If prices remain high, Brazil will increase production areas for soybeans.
- *Alternate hosts:* Kudzu vine (*Kudzu lobata*) is a most successful alternate host for *P. pachyzhizi.* This alien grows vigorously and everywhere – the story goes that if you go away on holiday you can come home to your house overgrown with this problem plant. It was brought into South America by the Japanese in 1920s for cattle fodder and is still used as cattle feed. Pustules on kudzu vine are numerous and large. Volunteer soyas are also a big problem providing host material during the winter months.
- *Other important agricultural crops:* Timber, cotton, maize and *Pyrethrum* (grown as an insect repellent)
- *Other common fungal diseases on soybeans*

  Charcoal rot, bacterial pustule, *Rhizoctonia*, *Colletotrichum* – a small problem unless very wet weather is experienced and then it can become epidemic; but a single late fungicide application late in the growing season has managed to control these pathogens in the past. 60-80% yield loss in unsprayed plants, *Cercospora kikuchii* (Frog eye), stem canker, *Alternaria*, powdery mildew, *Phomopsis*, *Septoria* and *Fusarium solani* f. sp. *glycine* - sudden death syndrome.

Pests: Stinkbugs and root mealie bugs are a big problem. Cyst nematodes also a problem.

- *EMBRAPA*

  Embrapa was created in 1974 so celebrating 40 years of research in 2004. The are currently involved in 40 research programmes. They plant 350ha to soybeans, sunflowers and wheat to produce new, disease resistant, high yielding cultivars for different latitudes. 70% of the staff have PhDs and 30% MSc degrees. No technical staff are employed with straight BSc degrees. Soybeans is the only crop in which EMBRAPA is are making big changes. Embrapa in Londrina achieve 800 seeds per plant. This research station is situated at a latitude of 23° providing an excellent place for soybean breeding because they can test breeding programmes at latitudes to the north and south. Use lights and irrigation in fields so able to grow soyas in winter – get better seed production than in greenhouses. No differential series available – virulence is diverse and complex.

- There has been an increase in soybean production in Brazil from 1.5–18.5 million ha from 1970--2004. Corn has not shown such dramatic increases in production. Originally Brazil produced 1.5-2 tons soybeans/ha. Today they harvest up to 4 tons/ha. Scientists believe this increase in production has been possible because of crop rotation, increased nitrogen fixation and most importantly no till practices, new varieties, seed quality and better fungal and insect control. 1996-2003 i.e. in seven years there has been an increase in grain soybean from 69-122 million metric tons/year due to the above reasons.
- However, because of high prices for soybeans many farmers are not practising rotational cropping and are trying to plant three crops of soybeans per year. They try to get the additional crop in immediately after harvesting first summer crop, taking a risk by hoping to avoid frost before harvest. With almost 12 months of soybean production scientists believe this is why inoculum levels are so high. Steps are being taken for government enforcement laws to stop farmers planting soybeans all year round because of the problem of inoculum build up. Many farmers also irrigate their soybean crop at certain times of the year exacerbating the problem of inoculum build up.
- Brazil consumes 33% of soybean produced in the country – 77% exported. About 55-60 million tonnes of soybeans produced annually. In 2004 they expect a reduced crop of about 50-55 million tonnes because there has been too much rain in the north-west and too little in the south. They believe they are losing yield more through drought than through the effect of the rust in 2004. Environmental conditions have not been favourable for severe rust outbreaks in many of the soybean production areas. Rust stresses plants – in dry areas charcoal rot becomes a problem and in wet areas *Sclerotinia* becomes epidemic.
- Harvest when moisture level of soyas is between 11-14% and then dry down to 10% moisture.
- In 1992 soya cyst nematodes became a problem in many areas. Then in 2001 soybean rust arrived.

- In State of Parana – very high rainfall in 4-6 days followed by high temperatures so rust never developed.
- *Arrival of P. pachyrhizi in South America* – In March 2001 first reports from Paraguay and in May 2001 it arrived in the Parana State of Brazil. Losses of 48% experienced in unsprayed areas = 1.5 million US$
- 2003 – rust was severe in areas where it had not appeared before, probably because of optimum environmental conditions. All cultivars used in these areas that were susceptible to rust are no longer commercialised. In 2003 rust spread to almost all areas of Brazil but a few areas in the north have not yet been effected. 80% of soybean production area of Brazil affected by rust. 733 million tonnes lost. In 2004 estimate 1billion US$ loss.
- In 2004 they have had fungicide application problems – shortage of fungicides and a lack of spray equipment to carry out spraying operations. Many farmers sprayed early but now fungicides are not available for further applications.
- 'No see – no believe' attitude among farmers so by the time they notice the appearance of the rust it has spread throughout their fields. Also farmers tend to survey their fields from their trucks. Top leaves still appear green and so they take it that rust has not yet arrived. However, if they get out of their trucks and open the canopy they would see that the bottom leaves are severely infected.
- No resistance found as yet so scientists are trying to find tolerance and reduce the number of sprays to lower production costs. Brazil is currently spending about $758 million on fungicides to control soybean rust.
- Bolivia – in July 2003 Bolivia planted a winter crop of soybeans for grain seed production. Scientists believe this caused a big source of inoculum for Brazil.
- 1969 coffee rust hit Brazil and spread through Central and South America. Scientist believe soybean rust will probably follow the same route. So farmers must be alert to rust arriving if not in 2004 then any time afterwards.
- Plant breeders believe they have a long way to go to find resistance. Meanwhile they are trying to breed for stability and tolerance so that only one fungicide application will be necessary to control the rust.
- Bayer feel that in their breeding programmes they cannot just breed for rust resistance (which is linked to the gene for lodging). So only 20% of their research breeding programme is targeted for rust resistance.
- Father of soybean breeding is Romeu Kiihl. One of the top three soybean breeders in the world. He has retired from Embrapa and is now working for Bayer in Londrina.
- Spraying recommendations – good spraying at R1 and R3 stage with a triazole/strobilurin e.g. Opera.