Focus on…

The present situation with regard to black Sigatoka in Venezuela

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Bananas are important in many countries in the world and especially in Latin America and the Caribbean. In 1991, FAO estimated world production to be 74.5 million tonnes, including 20.5 million tonnes in Latin America. In Venezuela, the only banana cultivars grown are ‘Harton’ and ‘Cavendish’, forming 7% of Latin American production. However, these crops are currently suffering from both biotic and abiotic problems.

Among the fungal diseases that have an economic incidence, *Mycosphaerella musicola*, causing yellow Sigatoka, and *M. fijiensis*, causing black Sigatoka, have direct effects on production by causing a drastic reduction of the leaf area.

Black Sigatoka is much more aggressive than yellow Sigatoka. It is spreading rapidly across the Central American isthmus, Colombia and Venezuela and is a considerable cause for concern because of the socioeconomic implications that lead to an atmosphere of uncertainty among growers. Indeed, they can result in a disaster with unforeseen results because of the high cost of control (fungicides) that reduce the production capacity of small and medium-scale growers.

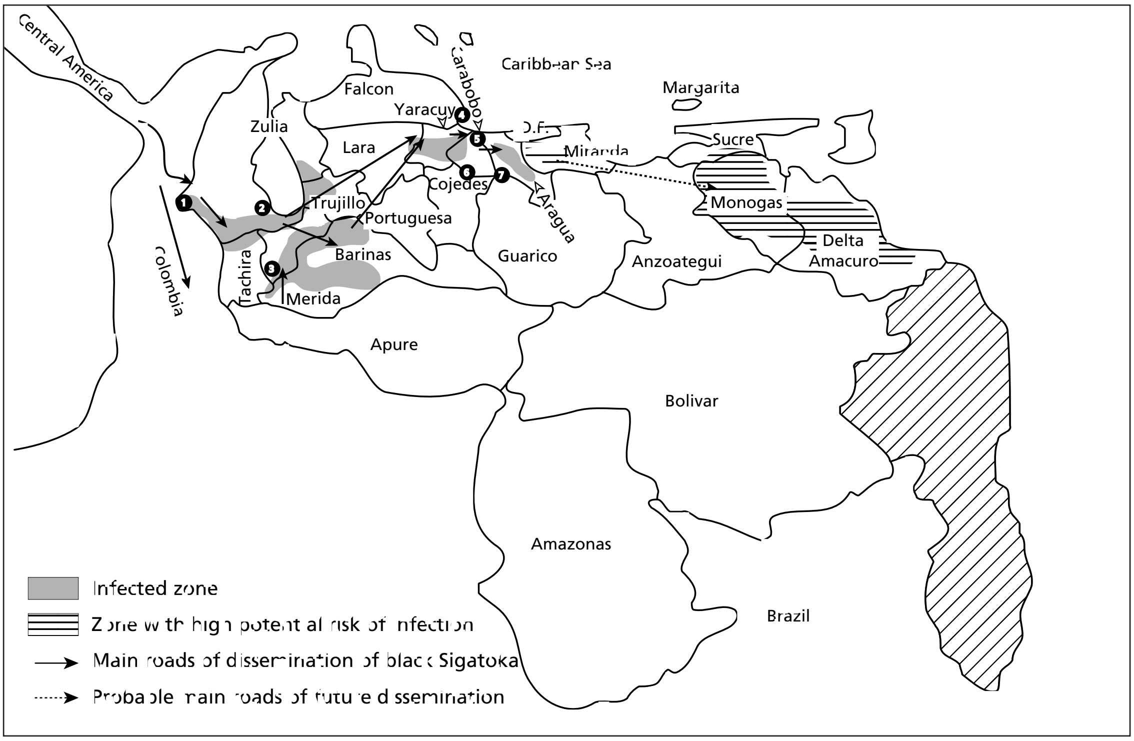
Black Sigatoka was observed for the first time in Venezuela in 1991 in Zulia state south of Lake Maracaibo (the Colombian frontier) in the western part of the country. Certain symptoms of the disease were observed and samples were taken for laboratory study. In 1992 and 1993, the disease gradually spread through the Andean piedmont regions (the lower zones in the states of Tachira, Mérida and Trujillo and in part of Barinas). It was severe and intense, especially on AAA genome plants (bananas), which are more susceptible (see map). Quarantine measures were therefore taken, such as the forbidding of transfer of germplasm for the multiplication of *Musaceae* and of the use of leaves for packaging purposes for example.

As black Sigatoka persisted in the west of the country, changes occurred in agricultural practices. Disease control by fungicide application is possible but expensive and with a risk of increasing the resistance of the fungus. Agricultural measures are required, such as an appropriate fertilisation programme, weed management, the removal of dry leaves and those at the base of stems in order to reduce inoculation pressure, good drainage and regular planting density, all accompanied by alternative use of fungicides of different chemical groups.

However, in spite of these measures, the disease spread to Yaracuy state in the central western part of the country in 1994. Infection reached the Urama region (at the boundary between Yaracuy and Carabobo states) at the end of that year. This forms a substantial threat to the banana plantations in Aragua state in the central region, which account for some 50 percent of total national production (see map).

Certain climatic conditions enhance the effect of the pathogen and the development of the disease. The regions in which black Sigatoka is found have relative humidity close to 80 percent, average temperature of 26 to 28°C and annual precipitation of 1,400 mm or more. The states of Monagas, Miranda and Delta Amacuro in the east of the country have similar climatic conditions although the disease has not yet been observed there.

This means that in time these states risk a high level of contamination, perhaps even higher than in Aragua state where the rainfall curve is irregular, with a total of 1100 mm per year, six months of drought and six months of rainfall and 74 percent average relative humidity. Even when the other climatic conditions coincide, allowance must also be made for the efficacy of the fumigation programmes performed to control the yellow Sigatoka found in the region. This treatment may limit the spread of black Sigatoka. This does not mean that Aragua state is protected



Map: Dissemination of black Sigatoka in Venezuela

❶ *1991: Point of entry*

❷ *1991-1992: Dissemination at the south of Lake Maracaibo*

❸ *1992-1993: Piedmont of Monte Andino*

❹ *1995: Yaracuy*

❺ *End 1994: Urama, Carabobo State*

❻ *1995: edge of Lake Valencia, Carabobo State*

❼ *End 1996: edge of Lake Valencia, Aragua State* from the arrival of the pathogen, but the losses would not be comparable with those in the states mentioned above. In fact, the first outbreak was observed in Aragua state on a plantation at the edge of Lake Valencia, near the village of Guigue (Carabobo State) in October 1996. Because of the proximity of the lake, relative humidity is 80 percent, rainfall is distributed throughout the year and considered to be atypical and errors are made in the plantation in the application of fungicides for the control of yellow Sigatoka.

Field trials are now in progress to evaluate the behaviour of the tetraploid hybrid 'FHIA-21' with regard to black Sigatoka. This hybrid was introduced into the country within the framework of the SASA-FAO agreement. Other appraisals of hybrids are planned with the same objectives within the framework of the FONAIAP-INIBAP agreement.

It is obvious that black Sigatoka is spreading in Venezuela and that this is enhanced by man, resulting in a distinct decrease in banana and plantain production because of the high cost of fungicides. This is leading to a decrease in the cultivated area, changes in orientation and an increase in the unemployment rate and the final production cost. In addition, one cannot hide the serious problem formed by the indiscriminate use of chemicals that cause a high level of pollution.

It is essential to make the persons concerned aware of the scale of the problem of black Sigatoka in the country and to find solutions for controlling the disease. This has already been started with a national information campaign organised by FONAIAP and based on discussion with growers, regional trials, etc.

Broader study of the biology of the fungus involved and its influence on the control of the disease is required. Better knowledge of the climate and its impact on the reproduction of the fungus and the development of the disease is required. It is also necessary to make recommendations based on epidemiological study covering all the countries in Central America. One might suggest that biological warning systems should be set up in regions where there is a high risk of infection, enabling the appropriate use of chemicals and hence the attaining of productivity levels that compensate production costs. ■

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A salinity and sodium toxicity forecasting model for banana plantation soils (*Musa* AAA) in central Venezuela

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For Belalcázar *et al*. (1994), the continued increase in population and food consumption requires the establishment of alternatives that both prevent the destruction of the natural environment and contribute to increased food production. In particular, it is recommended in some cases that water with high levels of salts and sodium should not be used for irrigation because of the resulting problems of saline and/or alkaline soils. On this subject, Szabolcs (1989) and Chapman (1996) report that the fall in productivity of soils results to a considerable extent from salt accumulation and that this global problem has reached alarming proportions in arid, semi-arid and sub-humid regions. Villafañe (1993) and Maffei (1993) reported that numerous factors influence the soil salinization process in agricultural development zones and that irrigation is one of the most determinant. It is considered that several million hectares of fertile land is affected by salinization as a result of poor irrigation management. With regard to Venezuela in particular, Zérega (1991) mentioned that this type of degradation had been detected in irrigated regions as a result of the ion composition and concentration of the water available, the water status of the soils and irrigation practices. However, according to Pla (1988) and Ayers and Westcot (1987), it is possible to evaluate the degree of soil salinization by comparison of the ion composition of irrigation water, the type of soil and the crops to be grown. This would make it possible to forecast the effect of use of irrigation water with a given ionic composition with regard to the accumulation of salts in the soil profile and according to the crop, when a degree of leaching is possible during the rainy season. The present work concerns the validation of a model for forecasting salinity and the influence of sodium on land used for growing bananas (*Musa* AAA), in central Venezuela.

Material and methods

Description and composition of the salinity model and the sodium content.

The Ayers and Westcot (1987) model for the study of irrigation water quality includes guidelines concerning the following aspects:

a) the salt concentration in the water and its effect on water availability for plants;
b) the influence of the sodium adsorption and electrical conductivity ratio on the infiltration of water in the soil;
c) the toxicity of specific ions such as chlorine, sodium and boron;
d) the problems resulting from high nitrogen and bicarbonate levels;
e) extreme pH values.

The guidelines can only be applied under the following conditions:

a) loam to loam-clay soils with good internal drainage;
b) arid or semi-arid climate in which precipitation has little effect on leaching;
c) soils with surface or sprinkler irrigation with a leaching fraction greater than 0.15;
d) ground water level sufficiently deep or well controlled by a drainage system;
e) plant water uptake of 40% in the first quarter of the depth, 30% in the second quarter, 20% in the third and 10% in the fourth. The proposals of the researchers mentioned above (Ayers & Westcot) are shown in Table 1.

The model makes it possible to characterise irrigation water by using the following procedure. First, the salinity and sodium content are evaluated by entering in Table 1 the electrical conductivity of the irrigation water (ECiw) and the total quantity of dissolved salts. The infiltration loss into the soil is then evaluated using the corrected sodium adsorption ratio (SAR° - Table 2) and electrical conductivity (ECiw). Sodium-induced toxicity is then determined using the SAR° (Table 2) and the sodi-