2006-10-13: 16th Annual symposium of the soilborne plant diseases interest group of South Africa

MICRONUTRIENTS AND SOILBORNE PLANT DISEASES

The Soilborne Plant Diseases Unit of the Agricultural Research Council’s Plant Protection Research Institute hosted the 16th interdisciplinary symposium on soilborne plant diseases on 20 and 21 September 2006 at the Vredenburg Research Centre of the ARC-PPRI in Stellenbosch.

The topic for this year’s symposium was Micronutrients and Soilborne Plant Diseases. The event was attended by 61 representatives of Research Councils, National and Provincial Departments of Agriculture, private companies and universities. Participants represented a wide range of disciplines such as agronomy, botany, entomology, horticulture, microbiology, nematology, plant pathology, plant physiology and soil science.

The keynote address was delivered by Dr Mart Farina from Omnia Fertilizer in South Africa. Speakers at the symposium were: Front row, from left, Dr Mieke Daneel (ARC-Institute for Tropical and Subtropical Crops), Dr Rami Kfir (Research and Technology Manager, ARC- Plant Protection Research Institute), Dr S.C. Lamprecht (organiser, ARC-Plant Protection Research Institute), Dr Mart Farina (Omnia Fertilizer), Dr Joanne Dames (Rhodes University), Back row, from left, Dr Patrice Cadet (UMR Biologie et Gestion des Populations, France), Mr Theo Bekker (University of Pretoria), Prof. Neal Mc Laren (University of the Free State), Dr Shaun Berry (South African Sugarcane Research Institute), Dr A. Swanepoel (Department of Agriculture: Northern Cape), Mr Guy Thibaud (KZN Department of Agriculture and Environmental Affairs) and Dr Alex Valentine (Cape Peninsula University of Technology).

The following aspects were introduced and discussed in depth:
- Micronutrient problems of field crops in Southern Africa.
- Soil factors affecting micronutrient availability with special emphasis on molybdenum.
- Functions of micronutrients in plant production.
- Mycorrhizal fungi and micronutrients.
- The role of micronutrients in soilborne diseases of maize and sorghum.
- The role of micronutrients in soilborne diseases in the Northern Cape province.
- Nutrient management strategies under nematode infestations.
- The impact of silicon in crop and soil health.
- Effect of silicon on a sugarcane community in KwaZulu-Natal.
- Efficacy of water-soluble silicon against plant diseases with emphasis on Phytophthora root rot of avocado.

Conclusions reached by the delegates to this symposium can be summarized as follows:
- Interactions between micronutrients and soilborne plant diseases exist and there is a need to establish more precisely what micronutrient problems are likely to be encountered in southern Africa and their role in the incidence and severity of soilborne plant diseases.
- Problems are often encountered in separating disease symptoms, particularly virus diseases from those of nutritional deficiencies and excesses. An important contributory factor in this regard is the dearth of colour images in articles and books dealing with micronutrients. Since conceptualization of written descriptions is often difficult, it would be useful if the ensemble of field-derived colour images used in this symposium were to be expanded. This would benefit the region as a whole from both a plant disease and soil fertility perspective.
- Micronutrient withdrawals by the major field crops appear to comfortably exceed anthropogenic inputs, but this remains to be properly quantified.
- Numerous soil properties influence the plant-availability of micronutrients. While soil pH can be considered the “master variable” regulating micronutrient activity in soils – the availability of all micronutrients other than Mo being decreased by pH elevation – it is noteworthy that in the acidic, highly weathered soils so widespread in southern Africa, there are absolute deficiencies of elements such as Zn.
- The use of plant tissue analysis in conjunction with soil testing provides a powerful analytical tool for positively identifying micronutrient problems.

- The most widespread micronutrient problem in southern Africa is Zn deficiency. The introduction of zincated fertilizers has alleviated this problem in South Africa and Zimbabwe, but it remains a common problem in Zambia, Malawi, Tanzania and Madagascar. In all probability, it also occurs commonly in Mozambique and Angola.
- There are appreciable differences both within and across plant species with respect to the manner in which micronutrient deficiencies and toxicities present themselves. This can be confusing particularly where differences exist within species.
- Although micronutrients are required in low concentrations they serve a vital role in fine-tuning plant metabolic responses. The fact that they are required in such low concentrations makes it very easy for micronutrients to skirt on the border of being deficient or toxic. Application of small doses of micronutrients is relatively uncomplicated and in the majority of cases will yield gratifying noticeable results in particular with soilborne plant diseases.
- Although copper, zinc, iron, manganese, boron and molybdenum are the most important micronutrients, lesser known elements such as cobalt, chlorine and nickel have in some cases been shown to have a beneficial effect on plant growth. Ongoing research may in future elucidate some of the obscurities with certain of the “micro” microelements such as nickel and others.
- The importance of micronutrients in suppression of soilborne plant diseases cannot be ignored. Although there are only a few diseases that can be controlled by the application of fertilizers, many can be alleviated by the proper application and management of plant nutrient elements. The eventual effectiveness of the manipulation of soil nutrient status also depends on the other components of the integrated disease management system in use.
- It is evident that mycorrhizal fungi can enhance the plants ability to access and take up nutrients which impact on plant growth and health. Cognizance must also be taken of the interactions of mycorrhizal fungi with other soil microorganisms which could assist in the uptake of micronutrients. This aspect warrants further research.
- Determining fertilizer uptake efficiency can greatly assist in the most appropriate use of fertilizers to reduce damage caused by nematode infestations.
- Silicon applications can contribute significantly to reduce damage from a range of plant diseases. Whether the defensive mechanism of silicon is active, passive or both, there appears to be a correlation between the resistance of some plant species against fungal infection and the concentration of accumulated silicon in the tissue of these plants. Further research is, however, needed before general conclusions can be drawn about the effect of silicon on the individual components of host plant resistance.
- Changes in soil induced by silicon carriers when brought into the field are very likely to influence the nematode community by reducing the number of nematodes in the soil. However, accumulation of silicon in the root epidermis could select for nematode species with long stylets or nematodes that feed deeper in the root tissues. This could favour the long-term build-up of a more pathogenic community in such silicon rich environments.
- The manipulation of micronutrients can be an important component of integrated management strategies against soilborne plant diseases. The adage that a healthy plant is a more resistant plant still remains valid. Information on the use of micronutrients in managing soilborne plant diseases in South Africa is currently very limited and should be addressed in future research.
- The importance of a multidisciplinary approach to research on soilborne plant diseases was again emphasized. Not only scientists, but decision makers and particularly funders must take cognizance.

Participants in the Symposium of the Soilborne Plant Diseases Interest Group included: front row, from left, N.W. Mc Laren, J.F. Dames, R. Carlson, M.B. Hardy, A.R. Kfir, S.C. Lamprecht, M.P.W. Farina, G.R. Thibaud, M. Griesel, C.P. de L. Beyers, J.F. Bloem, A. Steyn; second row, E.E. Bunting, N.N. Nxumalo, M.W. Venter, C. Botha, R. Sutherland, J.P. Fouche, A. Swanepoel, T.A.S. Aveling, M. Truter, E.R. van Biljon, E. Smit, C.M. Lubbe, M. Groenewald, S. Tweer, M. Daneel; third row, J.H. Habig, J.J. van der Merwe, C. Millard, W. Fourie, Z. C. de Beer, G. Thomas, O.H.J. Rhode, M.C. Pretorius, P. Cadet, V.W. Spaull, S.G. Storey, F.G.H. van Zyl, H.J. Hugo, J.A. Brand; fourth row, G. Smit, T.F. Bekker, J.M. van Heerden, M.J. Southwood, Y. T. Tewoldemedhin, C.F.J. Spies, G.J. van Coller, S.D. Berry, F.W. van Wyk, W.J. Swart, J.L. Staphorst, J.C. Janse van Rensburg.