Soya bean rust and Sclerotinia stem rot in the spotlight

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Sclerotinia stem rot, caused by *Sclerotinia sclerotiorum*, is increasing in importance locally and globally, and the wide host range challenges disease management strategies. Soya bean rust, caused by *Phakopsora pachyrhizi*, is a serious yield limiting foliar disease that has rapidly spread over large geographic areas. The absence of disease resistant cultivars has necessitated extensive fungicide control to ensure acceptable yields.

Stems infected with Sclerotinia sclerotiorum and covered in mycelium take on a white, bleached appearance.

Symptoms of leaves infected with Phakopsora pachyrhizi include development of chlorotic spots that gradually develop into coloured lesions.

Soya bean rust

A study was conducted to compare the reaction of experimental soya bean lines to soya bean rust in the greenhouse, and to evaluate epidemiological factors.

Greenhouse trials indicated significant differences in rust severity between lines, while field data illustrated the importance of differences in relative lifetime at disease onset, apparent infection rate, area under disease progress curve (AUDPC), and relative lifetime at which 100% disease severity was reached.

Although lines differed in disease severity, only Selection 43 showed late disease onset and slow apparent infection rate, and hence a significant level of rust resistance.

Yield losses associated with soya bean rust in varieties from three maturity groups, as well as the effects of row spacing and fungicide application on disease development were evaluated. Fungicides had little effect on delaying disease onset, which was closely related to host growth stage.

The apparent infection rate was higher in 45cm, compared with 90cm, row widths in the absence of fungicide applications, while greater reductions in apparent infection rate due to fungicide applications were recorded in the wider rows.

Differences in these variables between sprayed and unsprayed plots were more pronounced in the long-maturity cultivar compared to the shorter maturity cultivars, but the extent of these differences is dependent on spray efficiency. Differences in cultivar responses to the disease and row spacing do not provide adequate control, and fungicide applications remain the primary disease control strategy against soya bean rust.

Physiological changes associated with soya bean growth stage in field trials indicated that soya bean rust onset and development are determined by the activity of key pathogenesis-related enzymes. Environmental effects on disease severity were relatively small, once infection was initiated.

Host responses to rust infection were directly related to the decline in chitinase and β-1,3-glucanase, which coincided with flowering and pod formation, and the subsequent rapid increase in rust severity. Plots treated with fertiliser indicated that chitinase, β-1,3-glucanase, peroxidase and phenol content were related to the form of nitrogen received. Higher chitinase activity was associated with lower disease severity.

Sclerotinia stem rot

Evaluation of cultivars for resistance to Sclerotinia stem rot in the greenhouse and field failed to identify sources of resistance, although lower risk cultivars were observed in field trials. Most cultivars were susceptible to Sclerotinia stem rot, even when disease conditions were sub-optimal. A poor correlation between greenhouse and field data was observed.

Field trials indicated that cultivars react differently to changing environmental conditions and disease potentials, and high genotype x environment interactions were recorded. Data indicates that local cultivars still lack the desired level of resistance to Sclerotinia stem rot or stability to changing disease potentials.

In vitro studies indicated that *S. sclerotiorum* is favoured by cool to moderate temperatures (20°C to 25°C), while extreme cold or hot temperatures impair growth. Molecular characterisation of isolates using amplified fragment length polymorphism (AFLP) analysis revealed a relatively uniform distribution with evidence of genetic diversity within and among isolates across the five provinces evaluated.

A low recombination frequency suggests that the population is in a developing stage, which is emphasised by isolates found on the end of the minimal spanning network. No correlation between host plant or locality and genetic similarity was observed, but AFLP proved to be a valuable tool to characterise *S. sclerotiorum* isolates.

This excerpt was originally published as part of Dr Chrisna Steyn's PhD in plant pathology titled *Soya bean response to rust and Sclerotinia stem rot under different biotic and abiotic conditions*. For more information, contact her on 051 401 9378.