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Department of Agriculture and Food

GOVERNMENT OF WESTERN AUSTRALIA

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Identification and confirmation of disease suppressive soils in Western Australia

Introduction

Surveys of cereal root disease incidence and severity in Western Australia conducted in the early 1980's and 2006-2008 showed that there has not been a reduction during the past 25 years (Khangura *et al.,* 2013). Biological suppression of root diseases could be a valuable tool in their control.

Disease suppression is defined as the ability of soil to limit the development of disease incidence or severity, even though the pathogen is present with a susceptible host plant in a favourable environment. This study was carried out to identify fields which are suppressive for one or more wheat root diseases in Western Australia (WA). The suppressiveness of these fields was validated using a pot bioassay.

Methods

Screening for disease suppressive fields

In 2010 and 2011, 40 to 100 cereal plants were collected at anthesis from 146 fields across WA's cereal growing region and assessed for *Rhizoctonia solani* AG-8 (Rhizoctonia root rot), *Fusarium pseudograminearum* (Fusarium crown rot), *Gaeumannomyces graminis* var. *tritici* (take-all) and *Pratylenchus neglectus* (root lesion nematodes; RLN) disease incidence. Root disease incidence at anthesis was compared to levels of DNA of these diseases in the soil collected at pre-sowing. Fields which had low disease incidence, but high pathogen DNA in the soils were considered potentially suppressive (Fig. 1).

Disease suppressive bioassay

A bioassay was used to confirm the biological suppressiveness of the soils. Soil from each potentially suppressive field was amended with either 0, 0.5 or 1.0 g of sugar prior to seeding to activate the resident soil microbes (Roget *et al.*, 1999). Pots were inoculated with the pathogen being assessed (*R. solani* or *G. graminis* var. *tritici*) and placed in a growth cabinet for 2 weeks. Twenty fields identified in 2010 and 2011 as either suppressive or non-suppressive to *R. solani* and 12 fields to *G. graminis* var. *tritici* were bioassayed along with a known suppressive field (positive control). Pots were then sown with wheat seeds and harvested after 4 weeks of growth. Roots were assessed for disease. Fields were considered suppressive when disease incidence declined with amendment of sugar, while those with minimal or no decline in disease were considered non-suppressive.

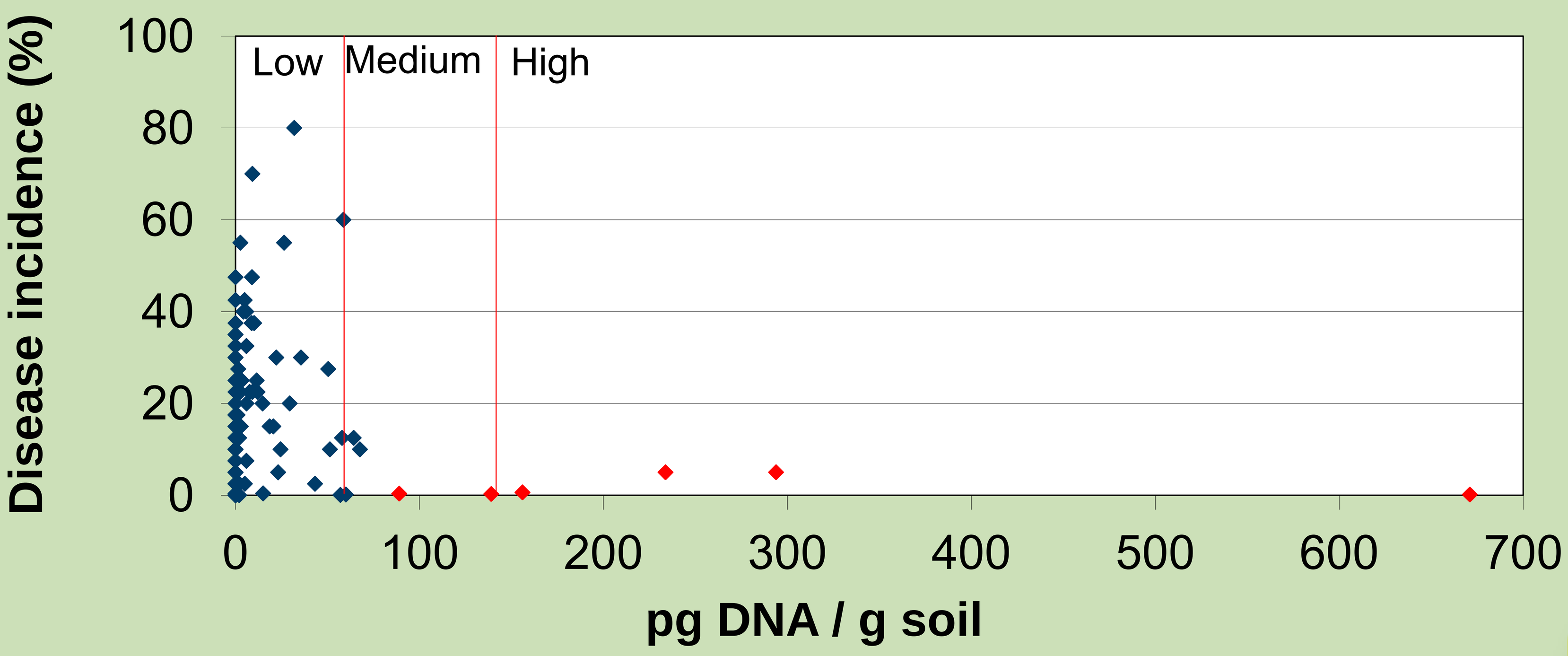

Figure 1. Selection for *Rhizoctonia solani* suppressive soils in 2010 on the basis of Rhizoctonia DNA in the soil at pre-sowing versus root disease incidence at anthesis. ◆potentially suppressive fields with high to medium level Rhizoctonia DNA in the soil and little or no root disease. Red lines are the boundaries between low, medium and high Rhizoctonia soil DNA.

Results

- We identified 16 fields potentially suppressive for Rhizoctonia root rot, eight for take-all, 22 for Fusarium crown rot and four for RLN in 146 fields over 2 years.
- Only the positive control was recorded to be highly suppressive in the bioassay with disease incidence being significantly reduced when 0.5 and 1 g of sugar was added to the 2010 soil (Fig. 2). An additional two fields were identified as highly suppressive in the 2012 bioassay (not presented here).
- No fields were confirmed as being suppressive for take-all in the bioassay.

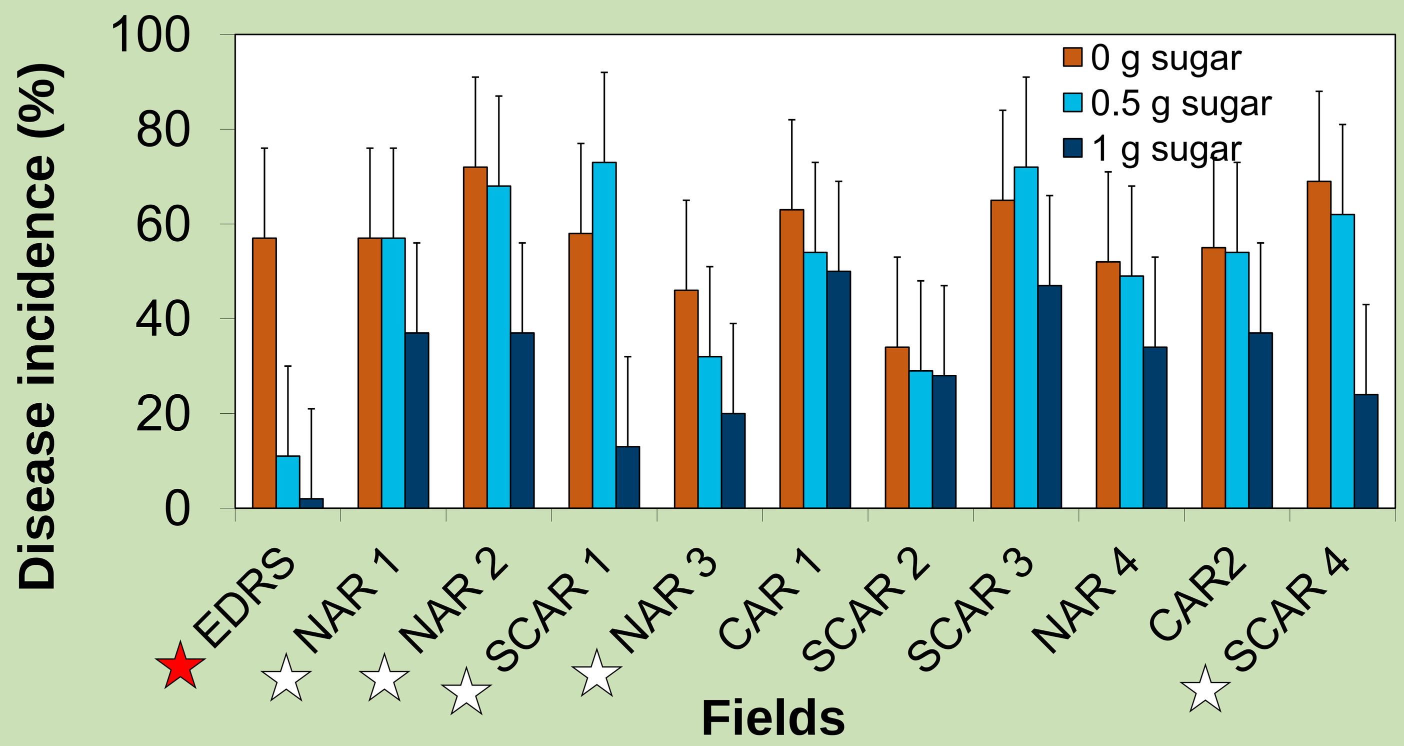

Figure 2. Rhizoctonia disease incidence (%) in a wheat seedling bioassay using potentially suppressive soils from 2010. Vertical bars are least significant difference (LSD). EDRS = positive control; NAR4 = non suppressive soil. ★highly suppressive field; ☆ moderately suppressive fields.

References

- Khangura, R *et al.* (2013). Current status of cereal root diseases in Western Australia under intensive cereal production and their comparison with the historical survey conducted during 1976-1982. *Journal of Phytopathology*, doi: 10.1111/jph.12144
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Conclusion

- Disease suppressive soils are present in WA, but are not common.
- In total, 18 fields were bioassayed to test for Rhizoctonia disease suppression, of these, only five fields showed moderate suppression and three fields were highly suppressive. No fields were confirmed as suppressive to take-all.
- The microbial communities will be profiled for two suppressive and non-suppressive fields for Rhizoctonia.

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