DEVELOPING A CONTROLLED ENVIRONMENT METHOD TO SCREEN WHEAT FOR RESISTANCE TO COMMON ROOT ROT: A PROGRESS REPORT.

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INTRODUCTION

Common root rot (CRR; *Cochliobolus sativus*) occurs in all wheat growing regions of Australia and costs the wheat industry $30M annually with the potential to cause losses of up to $108M (1). Currently, resistance to CRR is assessed by visually estimating browning on the sub-crown internode (SCI) of field grown plants (2). The objective of this study is to develop a faster controlled environment (CE) method to evaluate resistance to CRR that is strongly correlated to existing field resistance classifications. The results presented in this abstract are a summary of three experiments completed to date.

MATERIALS AND METHODS

Exp 1 Four replicates of 10 wheat cultivars were grown in 7 cm square 15 cm high pots containing 330 g of pasteurised and air-dried Irving series Udic Pellusturt soil. Four seeds per pot were planted at depths of 2, 4, 6 or 8 cm and then the pots were transferred to a bench fitted with a self-regulating bottom watering system and under-bench heating that maintained the soil at 22ºC. Date of emergence of each plant was recorded. Seven weeks after planting, the soil was washed from the roots of each plant and SCI length (SCIL) and dry weight of plant tops (TDWT) were measured. Data were analysed using ANOVA in Genstat 11th edition.

Exp 2 used similar materials as Exp 1 except that the soil was oven-dried after pasteurisation. Ten seeds per pot of 11 wheat cultivars ranging from moderately resistant (MR) to susceptible (S) were planted on a 210 g soil base layer. The band treatment added a further 90 g of soil, 0.66 g of ground wheat inoculum containing the pathogen spread evenly across the soil surface and capped with 30 g of soil. The dispersed treatment added 120 g of soil mixed with 0.66 g of inoculum. All treatments gave a planting depth of 4 cm and were replicated three times. Seven wks after planting, the soil was washed from the roots of each plant and the SCI disease severity rated (2).

Exp 3 used similar methodologies as Exps 1 & 2. Nine wheat cultivars inoculated with a band of 0.33 g or 0.66 g and replicated four times were evaluated for SCI disease severity (2) at 3, 5, 7 and 16 wks after planting.

RESULTS

Exp 1 SCIL quadrupled to 23 mm when planting depth increased from 2 to 4 cm. Planting deeper than 4 cm significantly increased SCIL by 6-11%. However, each increase in planting depth significantly ($P < 0.001$) increased emergence time by up to 48%, reduced TDWT by up to 57% and reduced establishment by up to 20%.

Exp 2 There were significant ($P < 0.001$) variety and inoculum placement effects. Compared to banded inoculum, dispersed inoculum increased average disease severity from 43% to 76% and reduced establishment from 91% to 72%. Banded inoculum was more correlated with field disease severity data ($r = 0.90$, $P < 0.001$) than dispersed inoculum ($r = 0.66$, $P < 0.01$). A significant ($P < 0.001$) interaction between variety and inoculum placement was also identified. The increase of disease severity in the dispersed inoculum treatment was variety dependent with susceptible varieties increasing 6-12%, moderately resistant varieties increasing 15-23% and intermediate varieties increasing 27-63%.

Exp 3 There were significant ($P < 0.001$) variety and harvest time effects. Average disease severity increased significantly ($P < 0.05$) between each harvest. Peak correlation with field disease severity data occurred at the 5wk harvest (Fig. 1) but all harvests were significantly correlated (3 wk: $r = 0.85$, $P < 0.001$; 7 wk: $r = 0.88$, $P < 0.001$; 16 wk: $r = 0.80$, $P < 0.01$). A significant ($P < 0.001$) interaction between variety and harvest time was also identified with increasing disease severity with time on intermediate varieties but relatively stable severity on MR and S varieties.

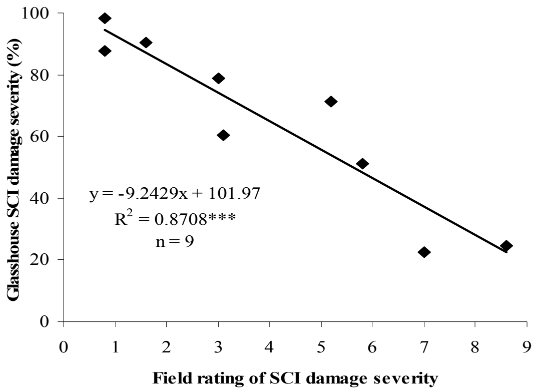

Figure 1. Relationship between common root rot disease severity ratings from existing field data (1 = susceptible, 9 = resistant) and glasshouse treatments 5 wks after planting (100% = susceptible, 0% = resistant).

DISCUSSION

These results have demonstrated that the development of a CE method to evaluate resistance to CRR that is correlated to existing field resistance classifications is feasible. The procedure identified in this study has the potential to improve the efficiency of CRR resistance screening by reducing the test period from >6 months to 5 wks, allowing faster delivery of results and increasing the number of lines that can be screened. Additional experiments will be conducted to verify these findings.

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