Studies on common root rot
and Bipolaris sorokiniana
in wheat and barley
in South Australia

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ABSTRACT

Surveys of South Australian wheat and barley crops for common root rot were conducted in 1988 and 1989. The disease was present throughout the state’s cereal belt in many different environments. In 1988, the mean incidence of diseased plants in crops was 60% in wheat, and 77% in barley. The corresponding values in 1989 were 34% and 49%. Temperature during winter was probably an important determinant of annual variation in disease levels. Levels of common root rot in wheat crops corresponded with their variety resistance ratings.

Progress of common root rot through the growing season was followed in Machete wheat at six field sites in 1987. Percentage of plants with lesions ranged from 0 to 60% 83 days after sowing, and from 37 to 95% after 173 days. The differences between sites indicated that other factors besides temperature were important in determining disease development rate and final levels.

*Bipolaris sorokiniana*, the putative common root rot pathogen, was isolated from 105 out of 115 wheat crops in 1988, with a mean isolation frequency from lesioned subcrown internodes of 42%. In Machete wheat in the field in 1989, *B. sorokiniana* was isolated from 9% of unlesioned subcrown internodes and 43% of diseased ones. Two isolates were tested for pathogenicity on wheat and barley in field soil with a low background inoculum density of *B. sorokiniana*. Lesions on the sub-crown internode and roots, such as observed in field samples, were present in both inoculated and control treatments, but were more severe in the inoculated. *B. sorokiniana* was more frequently isolated from inoculated than control plants. There was a strong correlation (r = 0.81) between lesion severity and isolation frequency. Slightly diseased tissue gave rise to smaller colonies than did severely diseased tissue. Thus, through Koch’s Postulates, *B. sorokiniana* was demonstrated to be the probable cause of most, if not all, of the common root rot observed in the field. In this work, a plating method (“water agar/DR70 sandwich”) was developed for selective isolation of *B. sorokiniana*, using the selective medium of Döslman and Reinke (1982).
sandwich gave improved selectivity, was highly efficient, allowed accurate quantitation of disease severity and tissue colonisation, and allowed the association of these two variables to be investigated.

Field experiments were conducted on resistance to common root rot in wheat and barley. In both crops, there was variability in disease severity among genotypes, and ratings were quite consistent between sites, although the range and consistency was much greater in wheat than in barley. Genotype/site interactions were observed, but may have been statistical artefacts, rather than true interactions. Wheat varieties covering a large proportion of the state’s wheat area were rated susceptible. Others had much lower disease levels and were rated moderately resistant. These would be useful as resistance sources for breeding, without resorting to donors unadapted to South Australian conditions. Field screening could be used for resistance breeding in wheat. Without better resistance than available locally in barley, breeding for resistance using field screening would be difficult in that crop.

The fungicides fludioxonil and trifloxystrobin, which are used in South Australia to control foliar and floral diseases of cereals, were tested as seed-dressings and fertiliser-amendments for control of common root rot. Fludioxonil reduced symptoms by both treatment methods, in contrast to trifloxystrobin, which had no effect. A 25% reduction in disease incidence at anthesis and maturity resulted from fludioxonil at low rates (50 parts per million of seed-dressing or 50 grams of active ingredient per hectare of fertiliser-amendment). At higher rates, about 50% reduction was observed. The fungicides were phytotoxic, causing reduction in coleoptile length, delayed emergence or reduced establishment, thickened and shortened subcrown internodes, and delayed maturity. This was exacerbated by deep sowing, done deliberately to induce formation of long subcrown internodes for scoring common root rot. Mostly, yields were not affected, but were reduced in one case. Fludioxonil seed-dressing reduced the frequency of isolation of B. sorokiniana from subcrown internodes of barley, while trifloxystrobin did not. Applied as a fertiliser-amendment, fludioxonil reduced the
population density of *B. sorokiniana* in the soil by about 55%, to about 66 ppg in barley and 40 ppg in wheat.

Population densities of *B. sorokiniana* in the soil were studied in a field experiment with rotation, soil type and tillage system as factors. There were five rotations (continuous wheat, and wheat alternated with peas, oats, grassy pasture and medic), two soil types (sandy loam and clay loam) and two tillage systems (direct drilling and conventional cultivation). Among rotations, the highest mean inoculum density was after continuous wheat, with 168 propagules per gram of soil (ppg). Peas and oats in the rotation resulted in non-significant reductions to 146 and 137 ppg respectively. Population densities after grassy pasture and medic were 108 and 104 ppg, both significantly lower than in continuous wheat. Population density was significantly lower with direct drilling than with conventional cultivation (109 versus 144 ppg). Sandy loam had a significantly higher population density than clay loam (147 versus 117 ppg). It was concluded that none of the treatments were likely to greatly reduce common root rot levels, although they could be useful in an integrated control program.
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