STRATEGIES FOR THE CONTROL OF THE
FOLIAR DISEASES OF OATS
IN SOUTH AUSTRALIA

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by

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GLOSSARY

ABBREVIATIONS
ABSTRACT

Three strategies for the control of stem rust (*Puccinia graminis* f. sp. *avenae*) and septoria leaf blotch (*Leptosphaeria avenaria*) in oats were examined.

Eleven fungicides were tested for their efficacy against stem rust, septoria and leaf rust (*Puccinia coronata*). Propiconazole, was effective rates of 62.5 - 125 g a.i. ha\(^{-1}\). In contrast, chlorothalonil and prochloraz were active on septoria but not rusts. A relatively new fungicide, tebuconazole, was as effective as propiconazole against stem rust in 1993. Responses in grain yield of 146%, 61% and 79% were measured for susceptible varieties infected with oat stem rust compared to responses of 29% and 14% for Echidna oats infected with septoria. Data from the fungicide experiments was used to develop a crop loss model for stem rust.

Little research on resistance to septoria has been published in Australia. Experiments conducted in 1986 and 1988 characterised over 200 lines selected by Australian oat breeding programs. Genotypes developed in N.S.W and Tasmania were the most resistant while those from W.A. were most susceptible with Victoria and S.A. intermediate. This was related to the gene pool used in each state, the relative priority placed on foliar disease resistance, the breeding methodology and the developmental pattern of varieties developed. Moderately resistant lines included MA4470, MA5005, MA3831, Blackbutt, AY1, Barmah and AX3. Resistance rating was generally higher in later maturing genotypes but resistant lines were found from all maturity groups. Resistance was not related to plant height. Later experiments detected a high level of resistance in five lines from the Quaker oat program for South America. Hence, the parental material, from both locally adapted and exotic origins, is available to initiate breeding high yielding, semi-dwarf lines with resistance for the septoria prone high rainfall districts of South Australia.

Experiments with variety mixtures were conducted with three pathosystems. The severity of disease in mixtures was decreased by increasing the complexity, or number of components, to less than either the arithmetic or geometric mean of the components grown as pure lines. Simple models predicted these findings as disease severity was
usually equal to or less than the geometric mean. The mixture effect was not influenced by the dispersal mechanism or degree of racial specialisation of the pathogen.

Fifteen experiments were conducted to test four experimental systems to partition the mixture effect into disease-related and other, mainly interplant competition, contributions. The preferred system included two pure lines and their binary mixture grown at a diseased site with a range from sub-optimal to super-optimal rates of fungicide applied to ensure a wide range of disease severities. A theoretical interpretation of the results from such experiments was presented.

Positive mixture effects were often recorded for observed disease severity but this was rarely reflected in final grain yield. Inter-genotypic competition was a powerful determinant of the mixture effect on yield compared to plant disease, although most experiments were not exposed to severe disease.

Strategies for the control of stem rust and septoria in South Australia were discussed based on the experimental results, model outcomes and the literature. It was concluded that well-supported breeding programs seeking multigenic resistance to stem and leaf rust combined with resistance to septoria offered the greatest prospects for long term control of the foliar diseases of oats. Fungicides could be recommended in severe epidemics on high value crops such as naked oats or export hay with variety mixtures possibly having a role in hay production.