HGCA

PROJECT REPORT No. 214

APPROPRIATE FUNGICIDE DOSES ON WINTER WHEAT: RESEARCH INFORMATION FOR GROWERS ON THE CONTROL OF POWDERY MILDEW, BROWN RUST AND *SEPTORIA NODORUM*

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APPROPRIATE FUNGICIDE DOSES ON WINTER WHEAT: RESEARCH INFORMATION FOR GROWERS ON THE CONTROL OF POWDERY MILDEW, BROWN RUST AND *SEPTORIA NODORUM*

Edited by

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This is the report of two HGCA-funded projects. Project no. 0029/1/96 (1297) started in October 1996, lasted 30 months and was funded by a grant of £184,820. The work was co-ordinated by Dr N D Paveley, ADAS High Mowthorpe in collaboration with Dr S Wale, SAC Aberdeen, Dr M Hims and Dr A Ainsley, CSL York, Mr D Stevens, Morley Research Centre and Mr W S Clark, ADAS Boxworth.

Project no. 0005/1/95 (2011) started in September 1995, lasted for 39 months and was funded by a grant of £68,515. The work was co-ordinated by Mr D Lockley, ADAS Mamhead Castle

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1.0 ABSTRACT

Growers bear the costs of protecting wheat against the effects of foliar pathogens. Despite an annual spend of approximately £100 million on fungicides for winter wheat, national survey data show annual losses to disease that fluctuate, according to disease pressure, around £40 million. There is still much that can be done to improve the efficiency of disease management, to the benefit of the unit cost of production.

Efficiency improvements depend on the ability to select the most cost-effective fungicide/s for the combination of pathogens which pose a threat to a particular crop, and apply a dose that is appropriate to the degree of disease risk. Product selection requires knowledge of comparative fungicide performance. Choice of dose depends on knowledge of the relationship between disease risk and the dose at which net economic output is maximised - by definition, the 'appropriate dose'.

The HGCA project 'Appropriate Fungicide Doses for Winter Wheat' began in 1994 and introduced the concept of appropriate fungicide doses. The first three harvest years focused on the control of *Septoria tritici* and yellow rust. This report covers appropriate dose experiments carried out since 1996.

Comparative dose-response curves are presented, summarising the performance of the major fungicide active ingredients against powdery mildew, brown rust and *Stagonospora* (previously *Septoria*) *nodorum* glume blotch. The products tested included a range of novel active ingredients, including strobilurins.

To be of enduring value to the industry, information on the performance of products needs to be kept current. In particular, novel fungicides will continue to enter the market and their performance relative to products in the existing data set will need to be assessed. It would be inefficient to re-run multi-site experiments with the entire range of existing fungicide active ingredients, each time a new fungicide appears, in order to allow a direct comparison. A statistical method has been developed, tested and reported here, which allows new fungicides to be assessed in relation to a small number of 'standards', which can then be used to relate performance of that product to others in the extant data set.

Resistance genes incorporated in wheat varieties by conventional breeding techniques marker assisted breeding or plant transformation are likely to be increase in their importance over the coming decade. Exploiting the potential benefits of these improvements depends on being able to assess the extent to which increases in resistance decrease the appropriate dose. Data are presented on the impact of varietal resistance on fungicide dose-response curves, as a step towards that goal.

The results presented in this report will be summarised and set into a practical crop management context in the HGCA Wheat Disease Management Guide, due for publication in 2000.

2.0 INTRODUCTION

The HGCA project 'Appropriate Fungicide Doses for Winter Wheat' (Project report No. 166, Paveley *et al.*,1998a) introduced the concept of minimising the unit cost of wheat production by selecting the most cost-effective fungicide/s for the combination of diseases which pose a threat to a particular crop, and applying a dose that is appropriate to the degree of disease risk. The principles underlying this approach were outlined in the introduction to Report No. 166 and are reproduced here, for reference, in Appendix 1.

Product selection depends on knowledge of comparative fungicide performance. Choice of dose depends on knowledge of the relationship between disease risk and the dose at which net economic output is maximised - by definition, the 'appropriate dose'.

The three seasons of field experiments in the original appropriate doses project provided robust comparative datasets on the control of *Septoria tritici* leaf blotch and yellow rust (Paveley *et al.*, 1998b), but coincided with low disease pressure for brown rust and powdery mildew. Recent seasons have seen a resurgence of the importance in *S. nodorum* glume blotch, particularly in the high rainfall regions of the South West, making the collection of data on this disease a higher priority.

The projects reported here used sites and varieties selected to maximise the likelihood of obtaining reliable comparative data on the control of brown rust, powdery mildew and *S. nodorum*. The experimental and statistical techniques used were consistent with the original project, to allow the data to be interrelated, and have been subject to peer review (Paveley *et al.*, in press). Guidance on the interpretation of dose-response curves was given in Report No. 166 and is reproduced here, for reference, in Appendix 2.

Two additional issues of practical importance were addressed by the work reported here. Firstly, when new fungicides appear on the market, growers will require an assessment of their performance, relative to the products in the existing dataset. Secondly, measuring fungicide performance is resource intensive, so levy payers should demand that the experimental and statistical techniques used provide the most reliable performance estimates with the minimum resource. Solutions to these requirements are presented.

3.0 OBJECTIVES

Overall objective

To reduce the unit cost of wheat production, by optimising fungicide inputs according to disease risk.

Constituent objectives

To define dose-response curves for the widely used conazole and morpholine fungicides, against the economically important powdery mildew, brown rust and *S. nodorum* diseases of winter wheat.

To measure the interaction of dose-response curves with the host partial resistance of winter wheat varieties, to enable resistance to be exploited through appropriate adjustment of fungicide dose.

To improve the determination of disease risk by providing data to enhance the Integrated Disease Risk system, which forms the basis of the DESSAC Wheat Disease Manager Module.

To support the interpretation of information from the HGCA Project 'Properties of new fungicides for winter wheat and winter barley', by aiding production of mathematical functions to predict intermediate dose points from untreated and label recommended dose points.