The effect of inoculum pressure, fertiliser and component number on severity of mildew and scald, yield and malting quality in mixtures of barley cultivars

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1 Introduction

Mixtures of species and cultivars effectively control disease in practice but are not widely grown for the following reasons:

- Reduced efficacy against some major pathogens
- Perceived quality and agronomic problems
- Non-acceptance by the end user in high quality markets such as for malting

New factors which could make mixtures more attractive:

- Reduced profit margins encouraging lower inputs
- Restrictions on pesticide usage
- Molecular techniques for identification of component cultivars

2 Aims

In Poland spring barley malting quality mixtures are grown and accepted by maltsters. In the UK cultivar mixtures are used only in winter feed crops to improve specific weights.

Two areas are explored here:

- Genotype and environmental effects on yield and disease resistance in spring barley mixtures using Polish and UK cultivars
- The potential of producing winter barley mixtures with malting quality

3 Materials & Methods

Genotypes:

Spring barley: three-component equal proportion mixtures of:

- Polish cultivars: Orlik (*Mla13*), Mobek (*Mlg + MlLa)*, Rudzik (*Mlg + MlLa*), Maressi (*Mla12* + ?) and Polo (Spontaneum)
- UK cultivars: Prisma (*Mlg+Ml(CP)+Mla12+Ml(Ab)*), Brewster (*Ml(Ab)+Mla1*), Cooper (*MlLa+Mla1*), Camargue (*Mla13+Ml(Ab)*)

Winter barley: two to six-component equal proportion mixtures of:

- Halcyon (5), Igri (1), Manitou (8), Maris Otter (1), Pipkin (3), Fighter (6) and Puffin (6) (where 1 is susceptible and 9 is resistant)

Environments:

IHAR in Bakow, Poland and at SCRI near Dundee, Scotland

Treatments:

+/- fungicide, high and low fertiliser, high and low mildew inoculum pressure (applied by surrounding entry plots with either susceptible or resistant cultivars) in three or four replicate split-split plot design

Data:

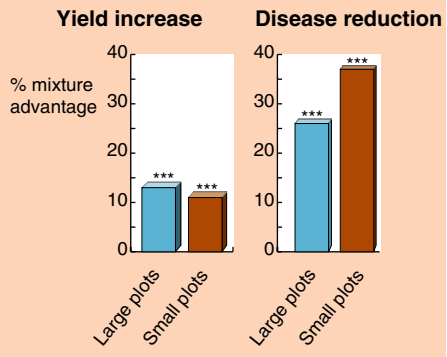
Disease assessed up to six times per season - area under the disease progress curve (AUDPC) calculated, and plot yield recorded

Malting quality assessments on some winter barley mixtures and their components

4 Spring Barley

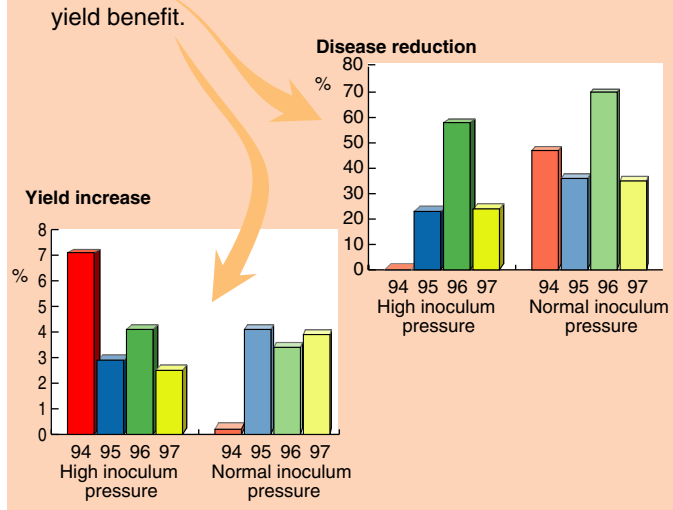
Plot size

Disease (*Erysiphe graminis* f.sp. *hordei*) (*Egh*) levels were higher in small plot than large plots in monocultures. Mixtures had less *Egh* compared with the mean of their monocultures but plot size did not affect them.



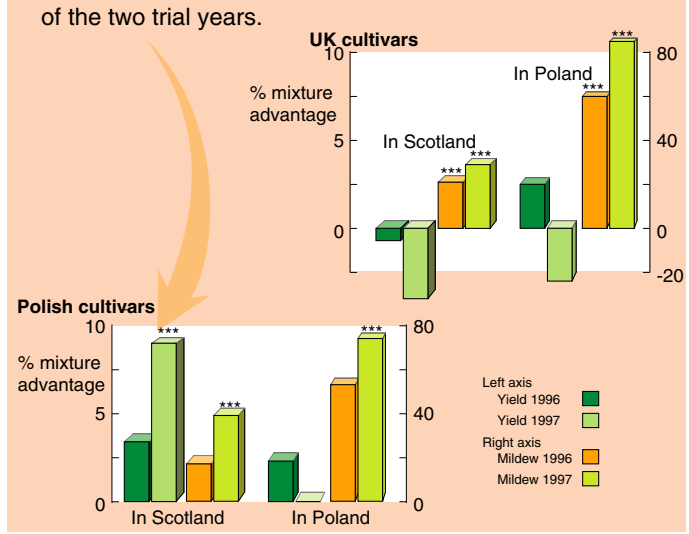
Inoculum pressure

Disease (*Egh*) reduction in the mixtures compared with the mean of their monocultures was always greater under 'normal' than high inoculum conditions. This was not always reflected in greater yield benefit.



Environment

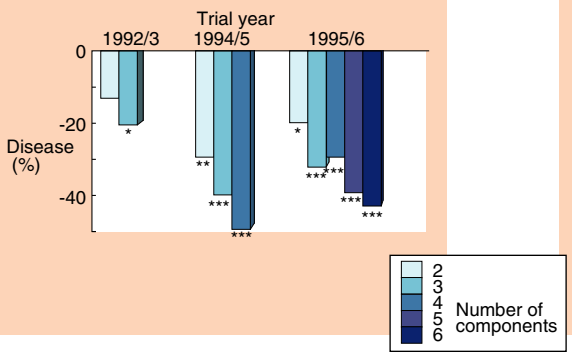
Polish and UK cultivars usually reduced mildew compared with the mean of their monocultures under both Polish and Scottish environments. Only Polish cultivars in Scotland increased yield significantly in one of the two trial years.



5 Winter Barley Mixtures

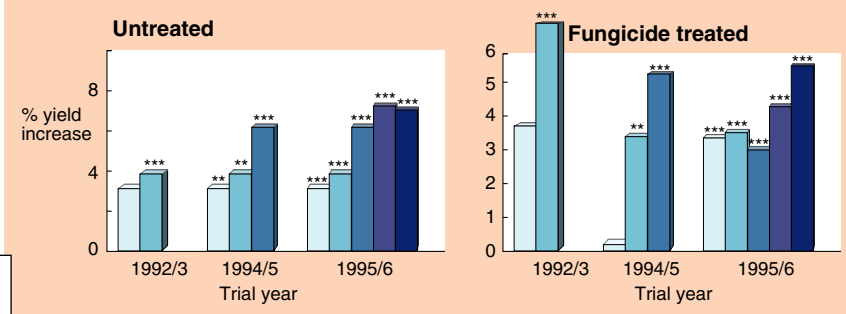
Disease control

Disease reduction (*Rhynchosporium secalis*) increased with the number of components of the mixture.



Yield

Yield increased in all mixtures with three or more components and the greater the number of components the greater the yield response in untreated plots.



Quality

- Malting quality parameters (percentage grain less than 2.5mm, milling energy, dry weight and hot water extract) = expected mean of monocultures.
- Small reduction in homogeneity of cell wall modification.
- Maris Otter+Halcyon+Pipkin BETTER than mean of components for: hot water extract, cell wall modification and homogeneity - similar lineages.

6 Conclusions

- Mixtures work better under lower inoculum pressure
- *Rhynchosporium secalis* reductions of up to 60%
- Malting quality can be equal to mean of components
- Potential for better malting quality than components

7 Future

- Application of molecular genotyping: optimising component selection (more informative than pedigree data)
- Verifying mixture composition: microsatelites (SSRs) particularly useful

8 Acknowledgements

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