

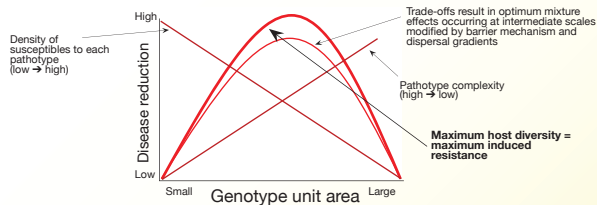
The effects of spatial scaling in host heterogeneity on epidemics of a plant pathogen

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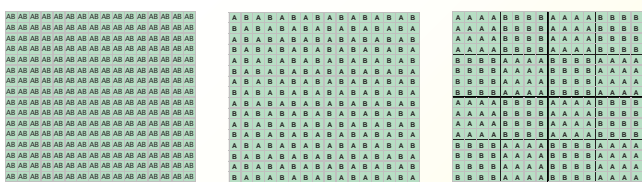
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Disease reduction trade-offs with scale

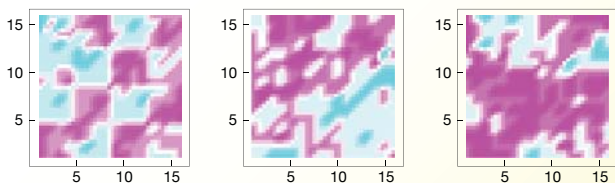


Spatial deployment in the field



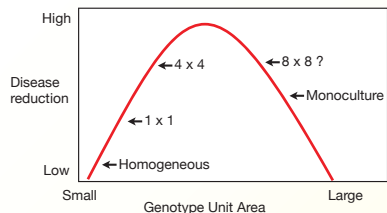
Random mix 0.4 m² plots, *R. secalis* infection 1 x 1 (also 0.01 m² (1 plant) and 2.25 m² plots in barley - mildew) 4 x 4

Disease progression (4x4)

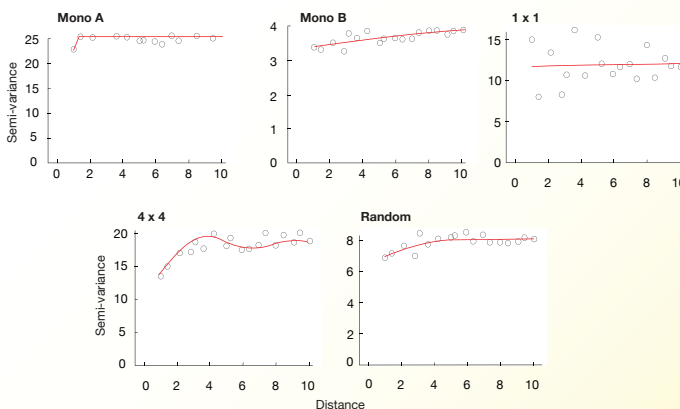


Spatial correlation

- The variogram describes the spatial correlation of the observed *Rhynchosporium* scores by plotting the mean-squared difference (semi-variance) between observed scores as a function of the distance between plots.
- The strength of the spatial structure present within the distribution of *Rhynchosporium* over the observed scale is quantified by the variogram sill.
- Comparison of the sill estimates showed a significant effect of scale (including monocultures) (trial 1-3: $F_{4,30} = 4.68$, $P = 0.0047$; trial 4: $F_{4,2} = 20.82$, $P = 0.0463$) with the 4x4 having a significantly greater sill than monoculture treatments.
- The flat variograms associated with the 1x1 scale deployments indicate that there is little or no spatial correlation across the observed separation distances when mixtures were deployed at this scale, however the alternation between high and low semi-variance values is consistent with patchiness at the scale of the 1 x 1 plots.
- Spatial correlation in *Rhynchosporium* scores was most evident at the 4 x 4 scale. The oscillating variogram is consistent with a chequer board pattern in *Rhynchosporium* scores at the 4x4 scale.



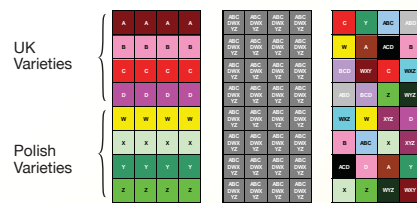
Spatial analysis using variograms



Structuring resistance gene deployment

2.1 1.8*** 1.8***
14.1 5.1*** 5.1***
12.9 12.0 8.0***

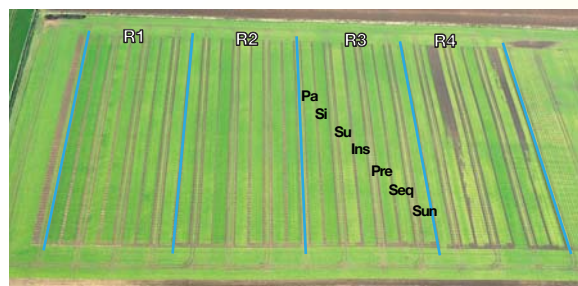
Mildew 03
Rhynchosporium
Mildew



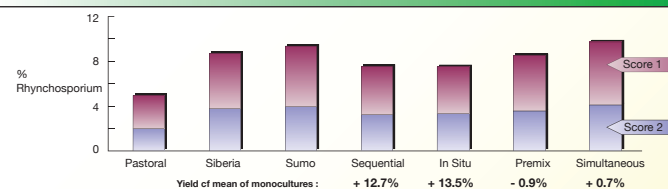
- Selection for:
- Simple
 - Complex
 - Simple and complex and groups

a) Monoculture b) Homogeneous c) Structured

Winter barley variable homogeneity mixes



Rhynchosporium



Conclusions

- Optimum scale of spatial distribution of mixture components depends on pathogen dispersal characteristics
- Spatial deployment parameters will also affect resource capture
- Yield will be dependent on compromises between different pathogen control and resource capture scale and distribution characteristics and parameters
- Patchy distribution of mixture components may be a practical compromise on-farm
- It is unnecessary and undesirable for mixtures to be homogeneously mixed

Acknowledgements:

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