

### Reference 23

Huang, C; Sun, ZY; Wang, HG; Luo, Y; Ma, ZH 2012 Effects of wheat cultivar mixtures on stripe rust: A meta-analysis on field trials *Crop Prot.* 33, 52-58  
10.1016/j.cropro.2011.11.020

### Background and objective

Using cultivar mixture with different resistance backgrounds is increasingly used to control wheat stripe rust. The objectives of the study were to 1) evaluate the overall effect of cultivar mixtures on wheat stripe rust control using metaanalysis and 2) determine the influence of some cultivar mixture characteristics and wheat growing conditions on the effect.

### Search strategy and selection criteria

The main criterion for inclusion of studies in the meta-analysis was from publications from peer-reviewed journals, spanning the period from 1950 to present. A search of this database was carried out using the keywords including stripe rust, *P. striiformis* and cultivar mixtures blend or diversity in titles and/or abstracts. Journals from which articles were selected included *Phytopathology*, *Plant Disease*, *Plant Pathology*, *European Journal of Plant Pathology*, *Crop Protection*, *Crop Fields Research* and other journals on plant diseases. A selected study needed to meet the following criteria: 1) it had a disease measure such as incidence, severity, disease index, or area under the disease progress curve, 2) contained replicated experiments or measurements, 3) contained pure cultivar stands, 4) was carried out focusing only on stripe rust and 5) the variance for the corresponding data measure was presented in the paper or could be calculated based on the results provided.

### Data and analysis

An independent meta-analysis was performed for relative mixing effect (esize) and for each moderator variable. To determine whether moderator variables significantly affected the overall relative cultivar mixing effect on disease, and estimate separate mixing effect for sub-groups, maximum-likelihood (ML) models were fitted using PROC MIXED of SAS using weights described above.

Number of papers	Population	Intervention	Comparator	Outcome	Quality score
11	Wheat	Cultivar mixtures	Pure stand	Metric: Wheat stripe rust intensity; Effect size: Relative difference of of the considered metrics between intervention and control	75

### Results

- Cultivar mixtures significantly reduced wheat stripe rust intensity by 28.0%.

### Factors influencing effect sizes

- Crop/cultivar combinations : Higher component disease diversity had a lower estimate of effect size, indicating that the more variation of disease between mixture and pure stands, higher the effect of cultivar mixtures on plant disease control.
- Sowing density : Cultivar mixtures performed better on control of wheat stripe rust when the planting density was appropriate (moderate sowing density, 200-400 seeds/m<sup>2</sup>) than either lower or higher planting density.
- Disease severity : Cultivar mixtures on disease reduction showed a better effect when disease occurred intensively.

### Conclusion

Using cultivar mixture with different resistance backgrounds is effective in controlling wheat stripe rust.