Linear variance structures for spatial analysis of agricultural field trials

Hans-Peter Piepho

Universität Hohenheim, Bioinformatics Unit, 70593 Stuttgart, Germany

This paper reviews methods for spatial analysis of field trials in one and two dimensions with a particular emphasis on linear variance-covariance structures. Particular consideration is given to methods of first and second differences, emphasizing relationships with state-space models (Piepho and Ogutu, 2007) and the linear variance model of Williams (1986). We study the properties of the nearest neighbour methods proposed by Wilkinson et al. (1983) and Schwarzbach (1984), which are still quite popular among plant breeders and show how the methods may be easily enhanced within a mixed model framework (Piepho et al., 2008). Extension of linear variance models in two dimensions is also discussed (Lee and Piepho, 2007; Piepho and Williams, 2007). We study the performance of different methods using extensive datasets from plant breeding trials in Germany and other countries.

References

Lee, Y., Piepho, H.P. (2007). Ambiguity in random walks and implications for the analysis of field trials. *submitted*

Piepho, H.P., Richter, C. (2008). Nearest neighbour adjustment and linear variance models in plant breeding trials. *Biometrical Journal* (in press)

Piepho, H.P., Ogutu, J.O. (2007). Simple state-space models in a mixed model framework. *The American Statistician* **61**, 224-232.

Piepho, H.P., Williams, E.R. (2007). Two-dimensional linear variance structures for field trials. *submitted*.

Schwarzbach, E. (1984). A new approach in the evaluation of field trials. *Vorträge für Pflanzenzüchtung* **6**, 249-259.

Wilkinson, G. N., Eckert, S. R., Hancock, T. W., and Mayo, O. (1983). Nearest neighbour (NN) analysis of field experiments (with discussion). *Journal of the Royal Statistical Society B* **45,** 151-211.

Williams, E. R. (1986). A neighbour model for field experiments. Biometrika 73, 279-287.

Williams, E. R., John, J. A., and Whitaker, D. (2006). Construction of resolvable row-column designs. *Biometrics* **62**, 103-108.