

Optimal Design for Multi-Environment Crop Variety Testing

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New crop varieties are extensively tested in multi-environment trials in order to obtain a solid basis for recommendations to farmers. When the target population of environments is large, a division into sub-regions is often advantageous. If the same set of genotypes is tested in each of the sub-regions, a linear mixed model (LMM) may be fitted with random genotype-within-sub-region effects. The first analytical results to optimizing allocation of trials (designs) to sub-regions have been obtained in Prus and Piepho (2021). In that paper one-year experiments, in which the genotype effects for different genotypes were assumed to be uncorrelated with each other, were considered. Prus and Piepho (2024) extended the results from Prus and Piepho (2021) to multi-year experiments. In Prus (2025) a solution is proposed for one-year experiments with correlated genotype effects for small to moderate number of genotypes. Bodnar and Prus (2026) provided a dimension reduction approach for computing optimal designs in case of large number of genotypes. The present work generalizes the results obtained so far to multi-year experiments models with correlated genotype effects.

Bodnar, T. and Prus, M. (2026) Dimension reduction for optimal design problems with Kronecker-product structure. *Scandinavian Journal of Statistics*.

Prus, M. and Piepho, H.-P. (2021). Optimizing the allocation of trials to sub-regions in multi-environment crop variety testing. *Journal of Agricultural, Biological and Environmental Statistics*, 26, 267–288.

Prus, M. and Piepho, H.-P. (2024). Optimizing the allocation of trials to sub-regions in crop variety testing with multiple years and locations. *Journal of Agricultural, Biological and Environmental Statistics*.

Prus, M. (2025). Computing optimal allocation of trials to sub-regions in crop-variety testing in case of correlated genotype effects. *Statistica Neerlandica*