Optimal design of experiments with very low average replication

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Abstract

Trials of new crop varieties usually have very low average replication. Thus one possibility is to have a single plot for each new variety and several plots for a control variety, with the latter well spread out over the field. A more recent proposal is to ignore the control, and instead have two plots for each of a small proportion of the new varieties.

Variation in the field may be accounted for by a polynomial trend, by spatial correlation, or by blocking. However, if the experiment has a second phase, such as making bread from flour milled from the grain produced in the first phase, then that second phase usually has blocks.

The optimality criterion used is usually the A criterion: the average variance of the pairwise differences between the new varieties.

I shall compare designs under the A criterion when the average replication is much less than two.