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Interference between plots

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7.1 INTRODUCTION

Previous chapters have dealt with methods of statistical design and analysis for improving the precision of genotype comparison by controlling sources of environmental variation, particularly those due to soil heterogeneity. Plot interference is another potential source of experimental error which occurs when plot yield is affected not only by the genotype grown in the plot, but also by the particular genotypes in neighbouring plots. Interference is most likely to occur when the plots are small and unbordered, as in the early stages of a plant selection programme. In contrast to plot errors arising from underlying field variation, interference error can lead to a systematic bias in genotype effects that persists across trials and is not reduced by randomization and replication.

Interference frequently arises from competition for resources, such as light, nutrients or moisture. Figure 7.1 shows the effect of interference on the yields of six field bean genotypes with widely differing heights in single-row plots, compared with the centre rows of four-row plots. In single-row plots, yields of taller genotypes are enhanced and shorter genotypes reduced, which leads to a change in genotype ranking compared with the larger plots.

Interference may also be caused by the differential spread of plant pests or pathogens between plots. Thus in a disease screening trial, a highly susceptible genotype may act as a secondary source of infection for other genotypes in the trial so that the effectiveness of more resistant genotypes is underestimated (Parlevliet and van Ommeren, 1984). Figure 7.2 illustrates this for blight scores for four potato genotypes when grown in pure and mixed stands. Although the ordering of the genotypes is the same in both cases, the difference between resistant and susceptible genotypes is much reduced in the mixture. Van der Plank (1963), in his book *Plant Diseases*, called the bias arising from interference ‘representational error’ as the experimental conditions under which genotypes are assessed are not representative of farming practice.

Fig. 7.1. Yields of six field bean genotypes in unguarded single-row plots and the centre rows of four-row plots relative to trial means (= 100) (Kempton and Lockwood, 1984). Figures in brackets are the effective genotype heights in cm.

Spitters (1979) suggested that interference bias is one reason for the poor response to yield selection generally found in early generation trials with small plots. He proposed several methods for reducing the effects of interference: (i) using larger plots and only recording on inner rows; (ii) using wider spacing between plots or separating plots with rows of a standard genotype; (iii) grouping similar genotypes in the field; (iv) applying indirect selection using a character less affected by interference; and (v) applying a mathematical correction for interference. The first three approaches aim to control interference through plot or treatment design. We first consider this aspect in more detail.

7.2 REDUCING INTERFERENCE THROUGH DESIGN

7.2.1 Plot size and borders

Interference can be reduced by increasing plot size or including border plants as guards. In plant breeding trials, however, the scope for increasing plot size