

Control treatments in split plot experiments

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Abstract

Let us consider a two-factor experiment carried out in a split plot design. Moreover, let us assume that the levels of factor A represent the whole plot treatments, while the levels of factor B represent the subplot treatments. In addition to the whole plot and subplot treatments, so-called control (standard) treatments often occur in the experiment as well. Then we are usually interested in comparing the control treatment effect with other treatment effects with as great a precision as possible. An open question is how to introduce the control treatments into the experiment. One way is to treat the control treatment as one of the factor levels occurring in the experiment. Of course the control treatment may be one of the whole plot or subplot treatments. Then there is no problem with performing proper randomization in the experiment. Additionally, we can fulfill all the experimenter's requirements concerning statistical properties of the design.

In the above case only one of the whole plot \times subplot treatment combinations is really a control. It is free (independent) of both factor levels. Such a control treatment (individual) should be specially introduced into the experiment. In the paper we consider incomplete split plot designs. In these designs not all whole plot treatments occur within blocks, and not all subplot treatments occur within all whole plots. Then the introduction of an individual control treatment into the design leads to many problems, connected especially with the proper performance of randomization.

In this paper we propose new incomplete split plot designs with a control fulfilling all generally accepted methodological requirements, with special reference to the problems of randomization. Moreover, tools are described which allow checking of the general balance or efficiency of the design. Additionally, some statistical consequences of assigning the control treatment in the considered experiment will be studied.