What can we learn from the study of the design of experiments?

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Background

Comparative experiments are of great importance:

- New plant varieties, fertilizer treatments
- Clinical trials of new drugs
- Pharmaceutical trials of proto-drugs
- Simulations of traffic management schemes (vehicles, airport check-ins, telephone traffic, …)
- New methods in analytical chemistry

Extensive literature, much stemming from Sir Ronald ('R.A.') Fisher in the 1920s and 1930s. The mathematical theory has been remembered, the principles often forgotten.

D.R. Cox (1958) *Planning of Experiments* is still one of the best sources (as Fisher is delphic).

Considerable literature on computer simulation in OR.

Points

- Set clear goal(s).

  Prediction / theory formulation / case study of methodology.

- Experimental conditions should be defined.

  Who are the future users? Level of expertise?
  Are the problems realistically representative of future applications?

- Blinding.

  Randomization is often useful here.
  Remember Mendel!

- Replication.

  Mendel again.

- Significance of differences.

  Almost all NN accounts are wrong at the level of a first-semester statistics course.
  Most such experiments are not analysed at all.

- Selection effects.

  'Bottom drawer' effects.
  Which methods are included?