Lecture.23

Long term experiments – ANOVA table – guard rows – optimum plot size – determination methods.

Long Term Experiments

A long term experiment is an experimental procedure that runs through a long period of time, in order to test a hypothesis or observe a phenomenon that takes place at an extremely slow rate. Several agricultural field experiments have run for more than 100 years. Experiments that are conducted at several sites or repeated over different seasons can also be classified as long term experiments. Performance of crops varies considerably from location to location as well as season to season. This is because of the influence of environmental factors such as rainfall, temperature etc. In order to determine the effects, the experiments have to be repeated at different locations and seasons. With such repetition of experiments practical recommendations may be made with greater confidence especially with new crop varieties or new techniques are introduced. Here we discuss the experiments that are conducted over different locations or different seasons.

Layout of experiment

Once the locations or seasons are decided upon the next step is to select the appropriate design of experiment. The individual experiments may be designed as CRD, RBD, split plot etc. The same design is adopted for all the locations or seasons. However randomization of treatments should be done afresh for each experiment.

Analysis

The results of repeated experiments are analysed using combined analysis of variance method.

The combined analysis is aimed at

1. to test whether there are significant differences between the treatments at various environments or loc or seasons etc.

2. test the consistency of the treatment at different environments. i.e. to test the presence or absence of interaction of the treatment with environments.

The presence of interaction will indicate that the responses change with environment.

In the first stage of the combined analysis the results of the individual locations are analysed based on the basic experimental design tried. In the second stage of the analysis various SS are computed by combining all the data.

If the basic design adopted is RBD with t treatments and r replications and p locations the ANOVA table will be

Sources of Variation	Degrees of Freedom	Sum of Squares	Mean Squares	F-ratio
Replication within locations	p(r-1)	RSS	RMS	
Locations	p-1	LSS	LMS	
Treatments	t-1	TrSS	TrMS	TrMS / LXTMS
Location x Treatments	(p-1)(t-1)	LXTSS	LXTMS	LXTMS / EMS
Combined error	p(r-1)(t-1)	ESS	EMS	
Total	rtp-1	TSS		

But before proceeding with the combined analysis it is necessary to test whether the EMS of the individual experiments are homogenous and the heterogeneity of EMS can be tested by either Bartlett's test or Hartley's test.

When the EMS are homogenous the analysis is done as follows:

Rep within location SS = Sum of replication SS of all locations

Pooled error SS = sum of error SS of all locations

The treatment X location two-way table is formed. From this two way table treatment SS, locations SS and treatment X location SS are computed.

The significance of treatment X location interaction is tested and if it is found to be significant then the interaction mean square is used for calculating the F value for treatments.

Optimum plot size

Size and shape of experimental units will affect the accuracy of the experimental units. Select a plot with optimum plot size for this purpose. **Minimum size of experimental plot for a given degree of precision is known as optimum plot size.** Optimum plot size depends on crop, available land area, number of treatments etc.

To determine the optimum plot size two methods are available. They are (1) Maximum curvature method and (2) Fairfield Smith's variance law. For determining the optimum plot size in either method data are to be collected by conducting an Uniformity trial.

An uniformity trial is a trial conducted over an experimental material by selecting a particular variety of a crop and for the entire experimental unit uniform treatments are given. At harvest, the experimental unit is divided into small basic units (depending on the crop) and yield recorded. Then to find the optimum plot size, the basic units are combined by adding the basic units in rows or columns. But while combining rows or columns no row or column should be left out. Then for the new units formed we calculate coefficient of variation and based on the CV values the optimum plot size is determined.

Questions

1. A long term experiment is an experiment conducted in
a) one season b) more than one season c) more than one year d) **both b and c**

Ans: both b and c

2. The homogeneity of the error variances of the individual seasons or locations is tested by
a) t test b) F test c) Bartlett's test d) none of these

Ans: Bartlett's test

3. The significant interaction indicated that the responses change with the environment.
Ans: True

4. Minimum size of experimental plot for a given degree of precision is known as optimum plot size.
Ans: True

5. The designs adopted in two seasons for the same experiment need not be the same design.
Ans: False

6. The combined analysis is used to test whether there are significant differences between the treatments at various environments or loc or seasons etc.
Ans: True

7. What is a uniformity trail?

8. Mention the methods of determining the optimum plot size.

9. How to determine the optimum plot size?

10. Furnish the ANOVA table of an experiment conducted in RBD in s seasons.