Lecture.14

Design of experiments – basic concepts – treatment – experimental unit – experimental error - basic principle – replication, randomization and local control.

Design of Experiments

Choice of treatments, method of assigning treatments to experimental units and arrangement of experimental units in different patterns are known as designing an experiment. We study the effect of changes in one variable on another variable. For example how the application of various doses of fertilizer affects the grain yield. Variable whose change we wish to study is known as **response variable**. Variable whose effect on the response variable we wish to study is known as **factor**.

Treatment: Objects of comparison in an experiment are defined as treatments. Examples are Varieties tried in a trail and different chemicals.

Experimental unit: The object to which treatments are applied or basic objects on which the experiment is conducted is known as experimental unit.

Example: piece of land, an animal, etc

Experimental error: Response from all experimental units receiving the same treatment may not be same even under similar conditions. These variations in responses may be due to various reasons. Other factors like heterogeneity of soil, climatic factors and genetic differences, etc also may cause variations (known as extraneous factors). The variations in response caused by extraneous factors are known as **experimental error**.

Our aim of designing an experiment will be to minimize the experimental error.

Basic principles

To reduce the experimental error we adopt certain principles known as basic principles of experimental design.

The basic principles are 1) Replication, 2) Randomization and 3) Local control

Replication

Repeated application of the treatments is known as replication.

When the treatment is applied only once we have no means of knowing about the variation in the results of a treatment. Only when we repeat several times we can estimate the experimental error.

With the help of experimental error we can determine whether the obtained differences between treatment means are real or not. When the number of replications is increased, experimental error reduces.

Randomization

When all the treatments have equal chance of being allocated to different experimental units it is known as randomization.

If our conclusions are to be valid, treatment means and differences among treatment means should be estimated without any bias. For this purpose we use the technique of randomization.

Local Control

Experimental error is based on the variations from experimental unit to experimental unit. This suggests that if we group the homogenous experimental units into blocks, the experimental error will be reduced considerably. Grouping of homogenous experimental units into blocks is known as local control of error.

In order to have valid estimate of experimental error the principles of replication and randomization are used.

In order to reduce the experimental error, the principles of replication and local control are used.

In general to have precise, valid and accurate result we adopt the basic principles.

Questions

1. For valid conclusions we should have

(a) Unbiased estimate (b) biased estimate

(c) random estimate (d) none of these

Ans: Unbiased estimate

2. Response variable is also called as

(a) Independent variable (b) dependent variable

(c) treatment (d) error

Ans: dependent variable

3. The genetic differences of varieties are termed as extraneous factors.

Ans: True

4. Repetition of the treatment is known as replication.

Ans: True

5. Replicaion will increase the error.

Ans: False

6. Basic principles are adopted to reduce the experimental error.

Ans: True

7. What is experimental error?

8. Define treatment and experimental unit.

9. What is meant by designing an experiment?

10. Explain the basic principles and its uses?