**STUDY MATERIAL ON STATISTICS (GENERAL), TDC 4TH SEMESTER, UNIT: 2**

**Topic: DESIGN OF EXPERIMENTS.**

*By D. N. Adhikary.*

By **Design of Experiments**, we mean the systematic procedure of planning and executing a comparative experiment and analyzing the results in an efficient, valid and economic manner. For example, a farmer may want to know which one of a number of varieties of a crop gives higher yield(production). Therefore, he may design a field experiment for comparing the varieties.

The subject matter of design of experiments are:

1. Planning of the experiment,
2. Collecting statistical data relevant to the hypothesis under study
3. Making a statistical analysis of the data.

Some terms used in design of experiments are as follows:

**Treatment**: The objects or methods under comparison in an experiment are called treatments. E.g. the varieties of a crop.

**Experimental units or plots**: The smallest division of the experimental area where a treatment is applied is called a plot.

**Yields**: The observations or measurements made on the plots are known as yields.

**Blocks**: Sometimes units or plots having common characteristics are grouped together. Such a homogeneous group is called a block.

**Experimental Error**: By experimental error, we mean the variation in the observations arising out of the random and unpredictable causes. Experimental errors are always present in an experiment. These do not imply mistake but may be due to the any or all of the following:

1. Natural variability of the experimental units,
2. Errors in measurements on the part of the experimenter,
3. Lack of representativeness of the sample to the population under study.

An experiment is designed with an aim to minimize the experimental error. However, an estimate of the experimental is necessary for valid analysis of the data.

BASIC PRINCIPLES OF DESIGN: There are three principles of experimental design. These are-

1. Replication
2. Randomisation and
3. Local control or error control.

**Replication**: By replication we mean repetition of treatments in the plots. A treatment is to be applied in two or more units or plots in the experiment. Replication is essential for getting an estimate of the error variation. Again, by increasing the number of replications we can reduce the experimental error.

**Randomisation**: Randomisation means random distribution of the treatments in to the plots. According to this principle, the treatments are to be assigned to the units or plots in such a way that each plot gets an equal or predetermined chance of receiving a treatment. Randomisation removes all kinds of subjective bias and enables us for obtaining a valid estimate of experimental error.

**Local control:** This is a desirable principle. According to this principle, randomization of treatments is to be done in such a manner that a part of the total variation can be separated which may be due to the variability of the plots. Usually it is done by forming homogeneous blocks and restricting randomization within the blocks. There are also other methods of error control e.g. analysis of co variance, confounding in factorial experiments etc.

The functions of the three principles of experimental design can be illustrated in the following diagram called Fisher’s diagram.

*I. REPLICATION*

*II.RANDOMISATION iii. LOCAL CONTROL*

Validity of estimate Diminution of experimental error

of experimental error

Fisher’s Diagram.

Questions:

1. What is design of experiment? Explain with the help of example.
2. Explain the principles of experimental design.
3. Explain the term “experimental error” in design of experiment.

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