

## Lecture.18

### Factorial experiments – factor and levels – types – symmetrical and asymmetrical – simple, main and interaction effects – advantages and disadvantages

#### Factorial Experiments

When two or more number of factors are investigated simultaneously in a single experiment such experiments are called as factorial experiments.

#### Terminologies

1. **Factor:** Factor refers to a set of related treatments. We may apply of different doses of nitrogen to a crop. Hence nitrogen irrespective of doses is a factor.
2. **Levels of a factor:** Different states or components making up a factor are known as the levels of that factor. eg different doses of nitrogen.

#### Types of factorial Experiment

A factorial experiment is named based on the number of factors and levels of factors. For example, when there are 3 factors each at 2 levels the experiment is known as 2 X 2 X 2 or 2<sup>3</sup> factorial experiments.

If there are 2 factors each at 3 levels then it is known as 3 X 3 or 3<sup>2</sup> factorial experiment.

- In general if there are n factors each with p levels then it is known as p<sup>n</sup> factorial experiment.
- For varying number of levels the arrangement is described by the product. For example, an experiment with 3 factors each at 2 levels, 3 levels and 4 levels respectively then it is known as 2 X 3 X 4 factorial experiment.
- If all the factors have the same number of levels the experiment is known as symmetrical factorial otherwise it is called as mixed factorial.
- Factors are represented by capital letters. Treatment combinations are usually by small letters.
- For example, if there are 2 varieties v0 and v1 and 2 dates of sowing d0 and d1 the treatment combinations will be
- v0d0, v1d0, v1d0 and v1d1.

## Simple and Main Effects

**Simple effect** of a factor is the difference between its responses for a fixed level of other factors.

**Main effect** is defined as the average of the simple effects.

**Interaction** is defined as the dependence of factors in their responses. Interaction is measured as the mean of the differences between simple effects.

## Advantages

1. In such type of experiments we study the individual effects of each factor and their interactions.
2. In factorial experiments a wide range of factor combinations are used.
3. Factorial approach will result in considerable saving of the experimental resources, experimental material and time.

## Disadvantages

1. When number of factors or levels of factors or both are increased, the number of treatment combinations increases. Consequently block size increases. If block size increases it may be difficult to maintain homogeneity of experimental material. This will lead to increase in experimental error and loss of precision in the experiment.
2. All treatment combinations are to be included for the experiment irrespective of its importance and hence this results in wastage of experimental material and time.
3. When many treatment combinations are included the execution of the experiment and statistical analysis become difficult.

## Questions

1. In a factorial experiment the minimum number of factors will be  
a) One      b) two      c) three      d) none of the above

**Ans: two**

2. With factor A which has two levels and factor B which has three levels the number of combinations will be  
a) 5      b) 6      c) 2      d) 3

**Ans: 6**

3. In a factorial experiments Factor refers to a set of related treatments.

**Ans: True**

4. A three 3 x3 factorial experiment can also be written as  $3^2$  factorial experiment.

**Ans: True**

5. In a factorial experiment factors are always represented by small letters.

**Ans: False**

6. If all the factors have the same number of levels the experiment is known as symmetrical factorial.

**Ans: True**

7. What is a main effect?

8. What is an interaction effect?

9. What are the advantages and disadvantages of Factorial experiments?

10. Write down the treatment combinations for a factorial experiment with varieties as one factor and n levels as the second factor. The levels for the varieties are 4 ( $V_0, V_1, V_2$  &  $V_3$ ) for n levels 4 ( $n_0, n_1, n_2$  &  $n_3$ )