Salahaddin University, Erbil
College of Agricultural Engineering Sciences

Data Analysis for MSc students

Department of Soil and Water and field Crops and Medical sciences

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Steps for Designing experiment :

: The experiment involves a number of steps or activities like:

1- Formulation of a statistical hypothesis (Null hypothesis or Alternative hypothesis)

2- Determination of independent variable (X) experimental conditions) to be used, the measurement (y) (dependent variable) to be record.

3- Specification of the required experimental units (limiting number of experimental units which equal to number of treatments multiply by number of replicates..

4- Selecting the suitable design for conducting the experiment.

5- Determination of statistical analysis that will be performed.

Definition of basic terms in experimental design:

1- Treatment: It is a condition under the control of the researcher like temp., moisture, amount of fertilizer.

2- Experimental unit: It is a smallest part in experiment which receives a treatment. Experimental unit may be human, small animal, large animal, pots, plant, Petri dish, tree……etc.

3- Simple experiment: It is an experiment which includes one factor like studying four levels of temp. on the number of bacteria the factor is temp.

4- Factorial experiment: It is an experiment which includes two factors or more.

5- Replicate: Each experiment unit per treatment is a replicate

6- Observation: The experiment unit may be includes one observation or more for example one experiment unit may be includes two or more observations.

Functions of randomization:

The most important functions of randomization are:

1- To eliminate إبعاد the effect of bias.تحيز

2- Protection from unusual events.

3- Error associate with adjacent experimental units are removed by randomization

Methods for reducing the variability:-

1- Selecting the more uniform or homogenous experimental units.

2- Stratification مجمع of experimental units or materials into homogenous subgroups.

3- Increasing the number of replication.

$$s\,\bar{x} = \sqrt{\frac{s}{r}}$$

It means increase in replication causes decrease in standard error.

classification of experimental designs:

In general the experimental designs can be divided in to two classes:

1- systematic nature designs as shown from the schemes

B	C	A
B	C	A
B	C	A
B	C	A
B	C	A
B	C	A

A	A	A	A
B	B	B	B
C	C	C	C

C	C	C	C	A	A	A	A	B	B	B	B

B	B	C	C	A	A
B	B	C	C	A	A

A,B,C= Treatments

2- Modern experimental design or (random nature designs) nature design: the following schemes represent some random design:

B	A	B
A	C	A
C	B	C
C	A	C
A	B	B
B	C	A

A	B	C	A
B	B	A	B
C	A	C	C

B	A	B	C	A	C
A	B	C	B	C	A

C	A	B	C	A	B	A	C	B	C	B	A

A,B,C= Treatments

Advantages of systematic design:

1-Variation may be arrange.

2-Layout of design is very simple.

3-The randomization is not included.

4- It can be use in case of equal and unequal replicates.

Disadvantages of systematic design:

1- There is no valid فعال estimate of variance.

2- The correlation between adjacent مجاور experimental units may causes systematic error.

Completely randomized design (CRD)

CRD: This Design can be use if environmental conditions are fairly uniform or experimental units are homogenous ,for this reason CRD can be use in :

1- Laboratory experiments.

2-Green house experiments.

3-Glass house experiments.

4-Pot experiments.

Advantages of CRD:-

1- It is very simple design

2- It is a flexible مرن design or there are no any restriction تقيد on the number of treatments or replication.

3- Statistical analysis is very easy.

4- It is used in case of equal or unequal replication

5- The missing value does not affect on the statistical analysis.

Disadvantages:

The disadvantage of CRD can be summarized as follows:

1- The experimental units must be homogenous.

2- It is used in laboratory experiment green house experiments and pot experiments.

3- It can not be used in field experiments.

4- It is less accurate than other designs.

• Split plot Design

- The Split- plot design should not be used when all factors comparisonsمقارنات must be made with equal precision, or it uses when the researcher is more interesting in one factor in comparing with the second factor ,or where the experiment can determine that the factors are not of equal importance, it is sometimes advantageous to use relatively large plots (main plots) for levels of a factor which needs less precisionالدقة or for levels of less interesting Factor (A) ,with a sub-division of these main plots into two or more sub-plots (sub-units)upon which is superimposed a levels of a second factor (more interesting factor or (B) Factor).
- This design uses in laboratory and field experiment or it uses with CRD, RCBD and LSD (Split CRD, Split RCBD, Split LSD). The sources of Variation and degree of freedom can be summarized as follow: