Lecture.16

Randomized blocks design – description – layout – analysis – advantages and disadvantages

Randomized Blocks Design (RBD)

When the experimental material is heterogeneous, the experimental material is grouped into homogenous sub-groups called blocks. As each block consists of the entire set of treatments a block is equivalent to a replication.

If the fertility gradient runs in one direction say from north to south or east to west then the blocks are formed in the opposite direction. Such an arrangement of grouping the heterogeneous units into homogenous blocks is known as randomized blocks design. Each block consists of as many experimental units as the number of treatments. The treatments are allocated randomly to the experimental units within each block independently such that each treatment occurs once. The number of blocks is chosen to be equal to the number of replications for the treatments.

The analysis of variance model for RBD is

$Yij = \mu + ti + rj + eij$

where

μ = the overall mean

t_i = the i^{th} treatment effect

r_j = the j^{th} replication effect

eij = the error term for i^{th} treatment and j^{th} replication

Analysis of RBD

The results of RBD can be arranged in a two way table according to the replications (blocks) and treatments.

There will be r x t observations in total where r stands for number of replications and t for number of treatments. .

The data are arranged in a two way table form by representing treatments in rows and replications in columns.

Treatment	Replication					Total
	1	2	3	……	r	
1	y11	y12	y13	……	y1r	T1
2	y21	y22	y23	……	y2r	T2
3	y31	y32	y33	……	y3r	T3
t	yt1	yt2	yt3	…….	ytr	Tt
Total	R1	R2	R3		Rr	G.T

In this design the total variance is divided into three sources of variation viz., between replications, between treatments and error

$$CF = \frac{(GT)^2}{rt}$$

Total SS=TSS=$\sum\sum y_{ij}^2 - CF$

Replication SS=RSS= = $\frac{1}{t}\sum Rj^2 - CF$

Treatments SS=T_rSS = $\frac{1}{r}\sum Ti^2$ - CF

Error SS=ESS = Total SS – Replication SS – Treatment SS

The skeleton ANOVA table for RBD with t treatments and r replications

Sources of variation	**d.f.**	**SS**	**MS**	**F Value**
Replication	r-1	RSS	RMS	RM S/ EM S
Treatment	t-1	TrSS	TrMS	TrMS/EMS
Error	(r-1) (t-1)	ESS	EMS	
Total	rt –1	TSS		

CD = SE(d) . t where S.E(d)= $\sqrt{\frac{2EMS}{r}}$

t = critical value of t for a specified level of significance and error degrees of freedom

Based on the CD value the bar chart can be drawn.

From the bar chart conclusion can be written.

Advantages of RBD

The precision is more in RBD. The amount of information obtained in RBD is more as compared to CRD. RBD is more flexible. Statistical analysis is simple and easy. Even if some values are missing, still the analysis can be done by using missing plot technique.

Disadvantages of RBD

When the number of treatments is increased, the block size will increase. If the block size is large maintaining homogeneity is difficult and hence when more number of treatments is present this design may not be suitable.

Questions

1. RBD can be used with

(a) Equal replication (b) unequal replication

(c)Equal and unequal replication (d) single replication

Ans: Equal replication

2. When there are 5 treatments each replicated 4 times the total number of experimental plots will be

(a) 5 (b) 4 (c) 9 (d) 20

Ans: 20

3. In RBD the error degrees of freedom is (r-1)(t-1).

Ans: True

4. RBD can be adopted when the experimental material is heterogeneous.

Ans: True

5. In RBD the blocking is done in one direction.

Ans: True

6. In RBD the total sum of squares is divided into treatment sum of squares, Replication sum of squares and error sum of squares.

Ans: True

7. Mention any two advantages of RBD?

8. Furnish the ANOVA model for RBD

9.Explain the Layout of the RBD?

10. Explain the computational procedure of RBD?