Strip plot design – layout – ANOVA Table
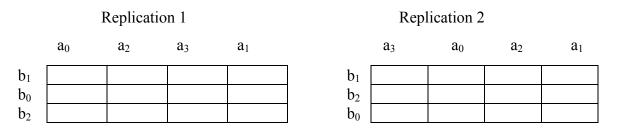
Strip Plot Design

This design is also known as **split block design.** When there are two factors in an experiment and both the factors require large plot sizes it is difficult to carryout the experiment in split plot design. Also the precision for measuring the interaction effect between the two factors is higher than that for measuring the main effect of either one of the two factors. Strip plot design is suitable for such experiments.

In strip plot design each block or replication is divided into number of vertical and horizontal strips depending on the levels of the respective factors.

	Replication 1						Replication 2			
	a_0	a_2	a_3	a_1			a_3	a_0	a_2	a_1
b_1						b_1				
b_0						b_2				
b_2						b_0				

In this design there are plot sizes.

1. Vertical strip plot for the first factor – vertical factor
2. Horizontal strip plot for the second factor – horizontal factor
3. Interaction plot for the interaction between 2 factors

The vertical strip and the horizontal strip are always perpendicular to each other. The interaction plot is the smallest and provides information on the interaction of the 2 factors. Thus we say that interaction is tested with more precision in strip plot design.

Analysis

The analysis is carried out in 3 parts.
1. Vertical strip analysis
2. Horizontal strip analysis

3. Interaction analysis

Suppose that A and B are the vertical and horizontal strips respectively. The following two way tables, viz., A X Rep table, B X Rep table and A X B table are formed. From A X Rep table, SS for Rep, A and Error (a) are computed. From B X Rep table, SS for B and Error (b) are computed. From A X B table, A X B SS is calculated.

When there are r replications, a levels for factor A and b levels for factor B, then the ANOVA table is

X	d.f.	SS	MS	F
Replication	(r-1)	RSS	RMS	RMS/EMS (a)
A	(a-1)	ASS	AMS	AMS/EMS (a)
Error (a)	(r-1) (a-1)	ESS (a)	EMS (a)	
B	(b-1)	BSS	BMS	BMS/EMS (b)
Error (b)	(r-1) (b-1)	ESS (b)	EMS (b)	
AB	(a-1) (b-1)	ABSS	ABMS	ABMS/EMS (c)
Error (c)	(r-1) (a-1) (b-1)	E SS (c)	EMS (c)	
Total	(rab – 1)	TSS		

Analysis

Arrange the results as follows:

Treatment Combination	Replication				Total
	R1	R2	R3	...	
A0B0	a0b0	a0b0	a0b0	…	T00
A0B1	a0b1	a0b1	a0b1	…	T01
A0B2	a0b2	a0b2	a0b2	…	T02
Sub Total	A01	A02	A03	…	T0
A1B0	a1b0	a1b0	a1b0	…	T10
A1B1	a1b1	a1b1	a1b1	…	T11
A1B2	a1b2	a1b2	a1b2	…	T12
Sub Total	A11	A12	A13	…	T1
. . .	. . .	. . .	. . .	. . .	. . .
Total	R1	R2	R3	…	G.T

Compute CF $= \dfrac{(G\,T)^2}{r \times m \times s}$

TSS = [$(a0b0)^2 +$

Treatment	Replication				Total
	R1	**R2**	**R3**	**...**	
B0	B01	B02	B03	…	T0
B1	B11	B12	B13	…	T1
B2	B21	B22	B23	…	T2
. . .	. . .	. . .	. . .	. . .	. . .
Total	R1	R2	R3	…	GT

$(a0b1)^2 + (a0b2)^2 + …]-CF$

1)   Vertical Strip Analysis

Form A x R Table and calculate RSS, ASS and Error(a) SS

Treatment	Replication				Total
	R1	**R2**	**R3**	**...**	
A0	A01	A02	A03	…	T0
A1	A11	A12	A13	…	T1
A2	A21	A22	A23	…	T2
. . .	. . .	. . .	. . .	. . .	. . .
Total	R1	R2	R3	…	GT

$$RSS = \left(\frac{R1^2 + R2^2 + R3^2 + ...}{m.\ s} \right) - CF$$

$$ASS = \left(\frac{T0^2 + T1^2 + T3^2 + ...}{r.\ s} \right) - CF$$

$$\text{A x R table SS} = \left(\frac{A01^2 + A02^2 + A03^2 + ...}{b} \right) - CF$$

Error (a) SS= A x R TSS-RASS-ASS.

2) Horizontal Strip Analysis

 Form B x R Table and calculate RSS, BSS and Error(b) SS

3

3) $BSS = \left(\dfrac{T0^2 + T1^2 + T3^2 + \ldots}{r.\ s} \right) - CF$

4) $B \times R \text{ table } SS = \left(\dfrac{B01^2 + B02^2 + B03^2 + \ldots}{a} \right) - CF$

5) Error (b) SS= B x R TSS-RSS-BSS

3) Interaction Analysis

Form A xB Table and calculate BSS, Ax B SSS and Error (b) SS

Treatment	Replication				Total
	B0	**B1**	**B2**	**…**	
A0	T00	T01	T02	…	T0
A1	T10	T11	T12	…	T1
A2	T20	T21	T22	…	T2
.	.	.	.	.	.
.	.	.	.	.	.
.	.	.	.	.	.
Total	C0	C1	C2	…	GT

$A \times B \text{ table } SS = \left(\dfrac{T0o^2 + T01^2 + T03^2 + \ldots}{r} \right) - CF$

ABSS= A x B Table SS – ASS- ABSS

Error (c) SS= TSS-ASS-BSS-ABSS –Error (a) SS.- –Error (a) SS

Then complete the ANOVA table.

Questions

1. To accommodate factors which require different sizes of experimental plots in the

same experiment_____ design has been evolved

a) Strip plot   b) CRD   c) RBD   d) LSD
Ans: Strip plot

2. The number of error terms in a strip plot design is

a) One   b) two   c) three   d) none of these
Ans: three

4. The plot size for the treatments allotted in vertical strips will not be equal when compared to the treatments allotted in horizontal strips.
Ans: True

5. The degrees of freedom for Error (b) in a strip plot design is (r-1) (a-1).
Ans: False

6. The analysis of a strip plot design is carried out in three stages, viz, horizontal strip analysis, vertical strip analysis and interaction analysis.
Ans: True

7. When will you adopt strip plot design?

8. What is error (c) in a strip plot design?

9. Furnish the skeleton ANOVA table with 3 replications, 3 treatments in horizontal strip

and 3 treatments in vertical strip.

10. Furnish the layout of a strip plot design.