: Strip- Split - Plot Design :

Sometimes situations arises when two factors requiring large experimental units are to be tested in the same experiment. In these situations, we use strip-split-plot design.

The strip-split-plot design has an extensive application in the agricultural sciences, but it finds occasional use in industrial experimentation.

In the simplest case, we have two factors A and B. Factor A is applied to whole plots just as in the standard split-plot design. Then factor B is applied to strips (which are really just another set of whole plots) that are orthogonal to the original whole plots used for factor A.

Whole plot ↓

	A_3	A_1	A_2
B_1	A_3B_1	A_1B_1	A_2B_1
B_2	A_3B_2	A_1B_2	A_2B_2
B_3	A_3B_3	A_1B_3	A_2B_3

Strip plot ←

In figure both factors A and B have three levels. Note that the levels of factor A are confounded with the whole plots and the level of factor B are confounded with the strips (which can be thought of as a second set of whole plots).

Example:

Consider an example in which four levels of spacing and 3 levels of the method of plowing are to be tested in the same experiment. Here both the factors required large experimental units. If the combination of two factors at all possible levels are alloted

In a Randomize Complete Block design (RCBD) then in a normal way the experimental plot would be very large. It would bring heterogeneity along with the consumption of resourses. So it will not be appropriate to use this design. On the other hand if one factor (spacing) is taken in main plot and the other factor (method of plowing) is taken in sub-plot within the main plot then the sub-plot needs to be large enough that resulting in very big size of main plot. In such cases, the strip-split-Plot designs are adopted. Suppose in this experiment, experimenter wants to run two replication and each replication considered as a block then the layout of this design will be.

Block I

	A_1	A_3	A_4	A_2
B_2	A_1B_2	A_3B_2	A_4B_2	A_2B_2
B_1	A_1B_1	A_3B_1	A_4B_1	A_2B_1
B_3	A_1B_3	A_3B_3	A_4B_3	A_2B_3

Block II

	A_2	A_1	A_3	A_4
B_1	A_2B_1	A_1B_1	A_3B_1	A_4B_1
B_2	A_2B_2	A_1B_2	A_3B_2	A_4B_2
B_3	A_2B_3	A_1B_3	A_3B_3	A_4B_3

General ANOVA Table (Same as split-plot Design)

SOV	d.f	SS	MS	F_{cal}	F_{tab}
Blocks (R)	$r-1$	$\sum R_K^2 / ab - C.F$	$SSR / r-1$		
A	$a-1$	$\sum A_i^2 / rb - C.F$	$SSA / a-1$	$MSA / MS(W.P.E(A))$	$F_{\alpha}[(a-1), (r-1)(a-1)]$
RA (Whole-plot error A)	$(r-1)(a-1)$	$\sum (R_K A_i)^2 / b - C.F - SSR - SSA$	$SS(WPE(A)) / (r-1)(a-1)$		
B	$b-1$	$\sum B_j^2 / ra - C.F$	$SSB / b-1$	$MSB / MS(W.P.E(B))$	$F_{\alpha}[(b-1), (r-1)(b-1)]$
RB (Whole-plot error B)	$(r-1)(b-1)$	$\sum (R_K B_j)^2 / a - C.F - SSR - SSB$	$SS(WPE(B)) / (r-1)(b-1)$		
AB (Interaction)	$(a-1)(b-1)$	$\sum (A_i B_j)^2 / r - C.F - SSA - SSB$	$SS(AB) / (a-1)(b-1)$	$MS(AB) / MS(S.P.E)$	$F_{\alpha}[(a-1)(b-1), \text{SPE } d.f]$
Sub-plot error	By subtraction	By subtraction	$SS(SPE) / \text{its } d.f$		
Total	$rab-1$	$\sum (R_K A_i B_j)^2 - C.F$			

where $C.F = \dfrac{(T_{..})^2}{rab}$

Numerical:

Block I

	A_1	A_3	A_4	A_2
B_2	56	32	49	38
B_1	67	54	58	52
B_3	62	50	72	64

Block II

	A_2	A_1	A_3	A_4
B_1	54	44	51	50
B_2	63	54	68	64
B_3	38	62	52	72