

Supplementary material for:
Can knowledge of the spatial field trend
improve phenotypic prediction accuracy
through informed choice of experimental
design?

1. Field Layouts in simulation study

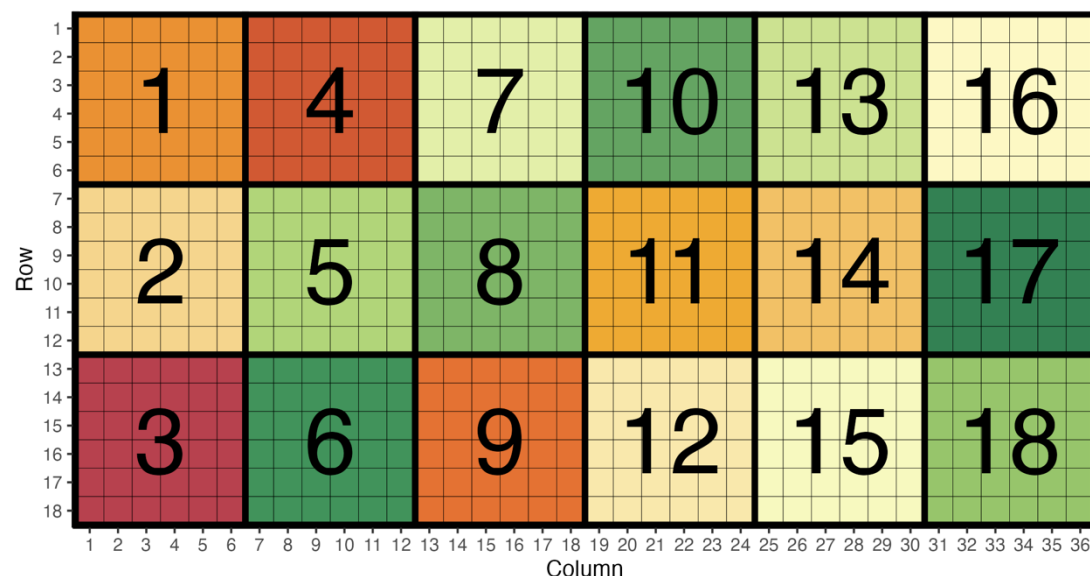


Fig. S1: Field layout with 18 individual experiments with 6 by 6 plots. Different colors represent different experiments. The numbers represent arbitrary experiment numbers.

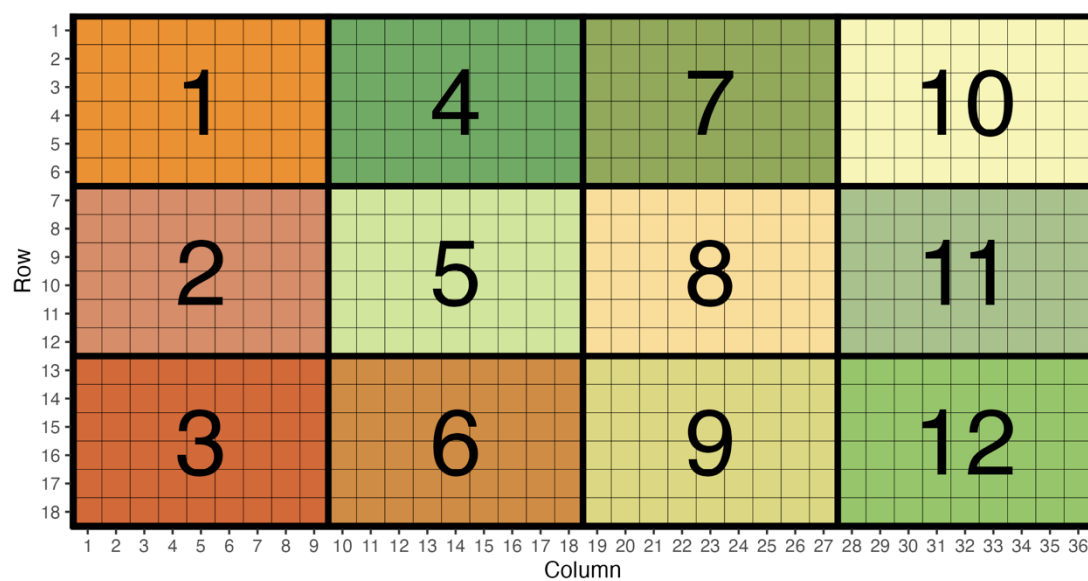


Fig. S2: Field layout with 12 individual experiments with 6 by 9 plots. Different colors represent different experiments. The numbers represent arbitrary experiment numbers.

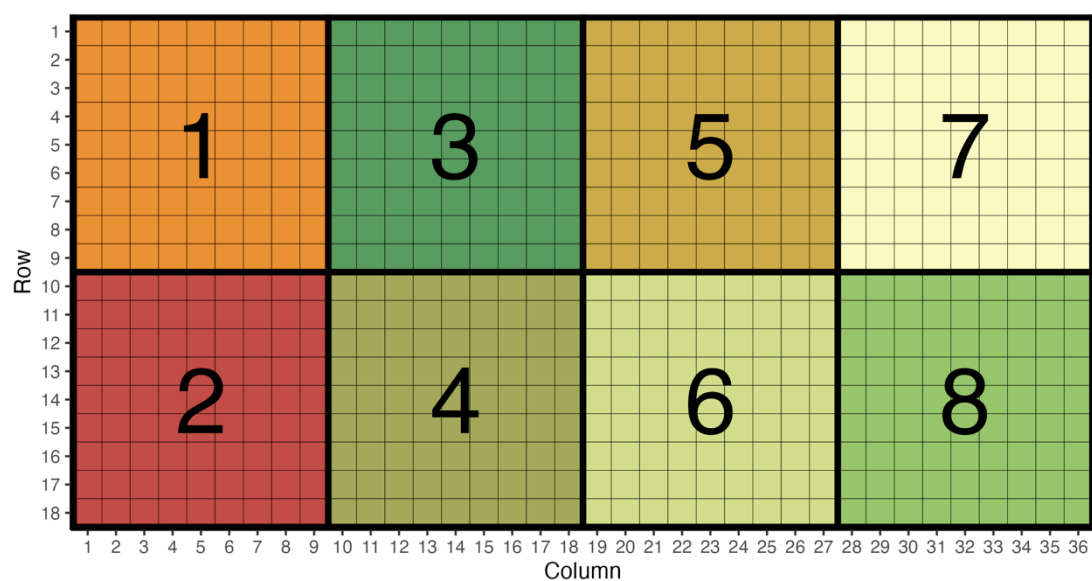


Fig. S3: Field layout with 8 individual experiments with 9 by 9 plots. Different colors represent different experiments. The numbers represent arbitrary experiment numbers.

2. Illustrations of single experiments for each design type and experiment size

RCBD design

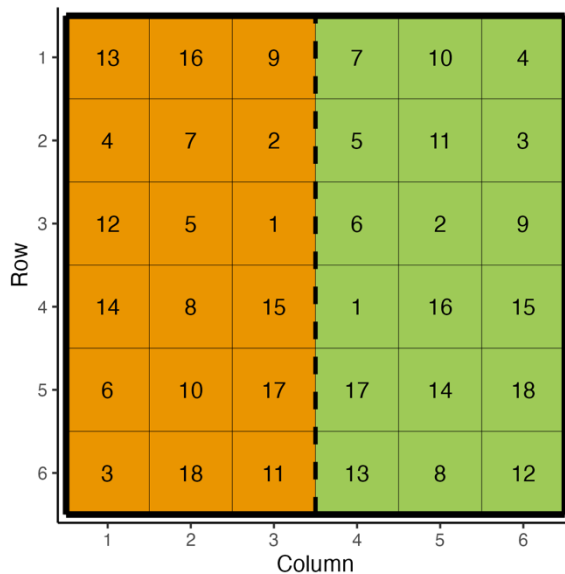


Fig. S4: Example of RCBD design in experiment with 6 by 6 plots and 2 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

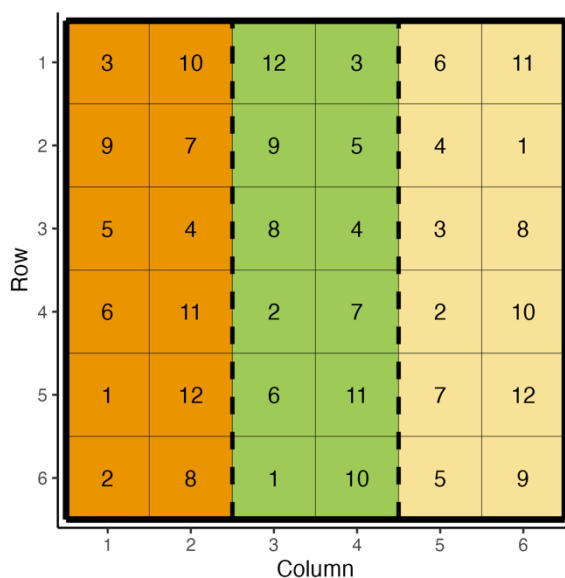


Fig. S5: Example of RCBD design in experiment with 6 by 6 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

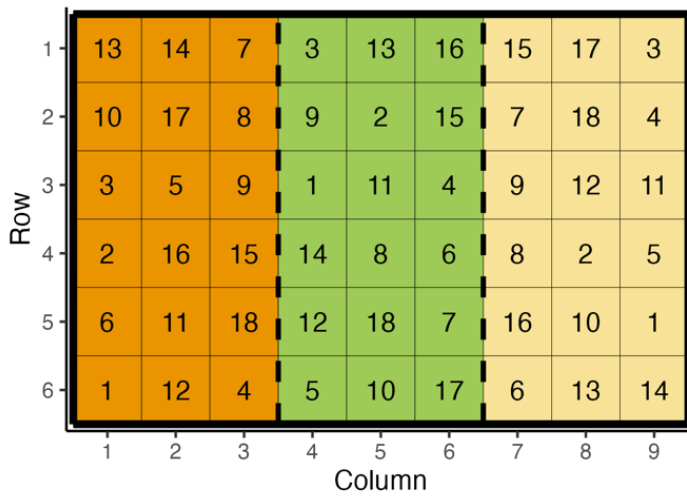


Fig. S6: Example of RCBD design in experiment with 6 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

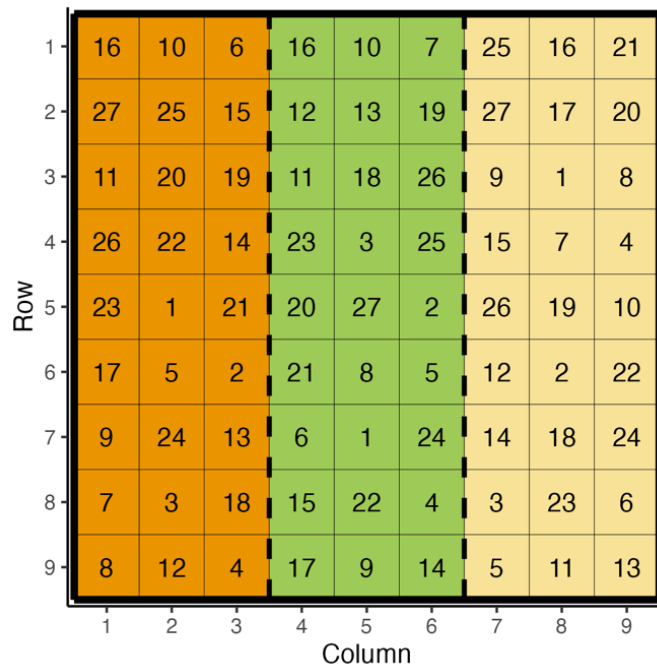


Fig. S7: Example of RCBD design in experiment with 9 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

Alpha designs

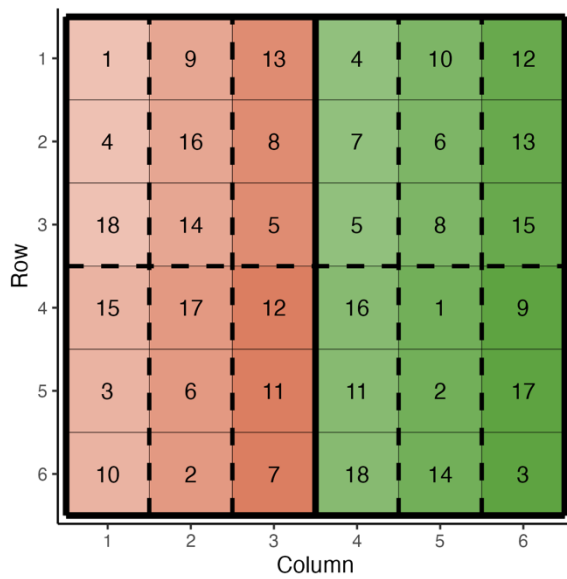


Fig. S8: Example of alpha design in experiment with 6 by 6 plots and 2 complete blocks, each divided in 6 incomplete blocks. The different colors each represent one repetition while the shades of each color represent the incomplete (mini) blocks surrounded by dashed lines. The numbers represent line names.

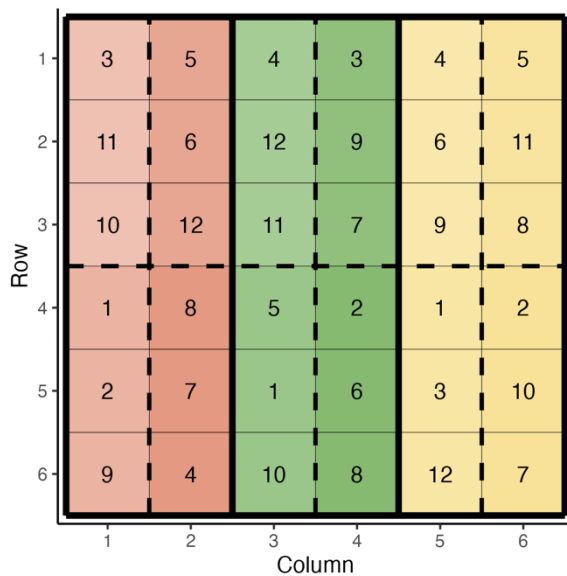


Fig. S9: Example of alpha design in experiment with 6 by 6 plots and 3 complete blocks, each divided in 4 incomplete blocks. The different colors each represent one repetition while the shades of each color represent the incomplete (mini) blocks surrounded by dashed lines. The numbers represent line names.

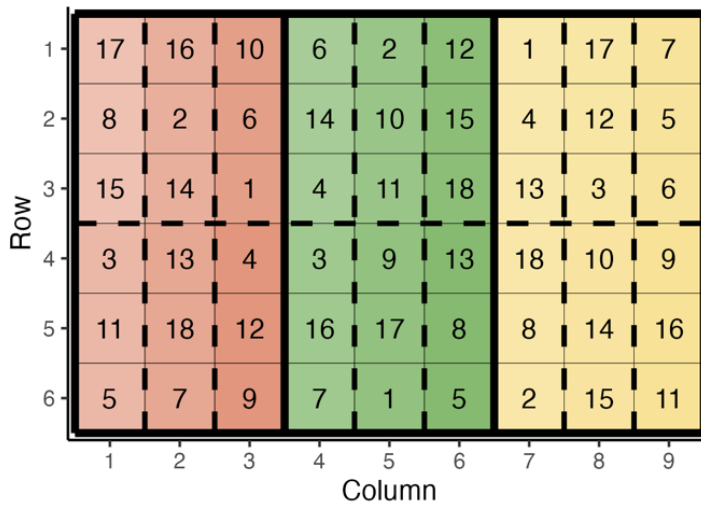


Fig. S10: Example of alpha design in experiment with 6 by 9 plots and 3 complete blocks, each divided in 6 incomplete blocks. The different colors each represent one repetition while the shades of each color represent the incomplete (mini) blocks surrounded by dashed lines. The numbers represent line names.

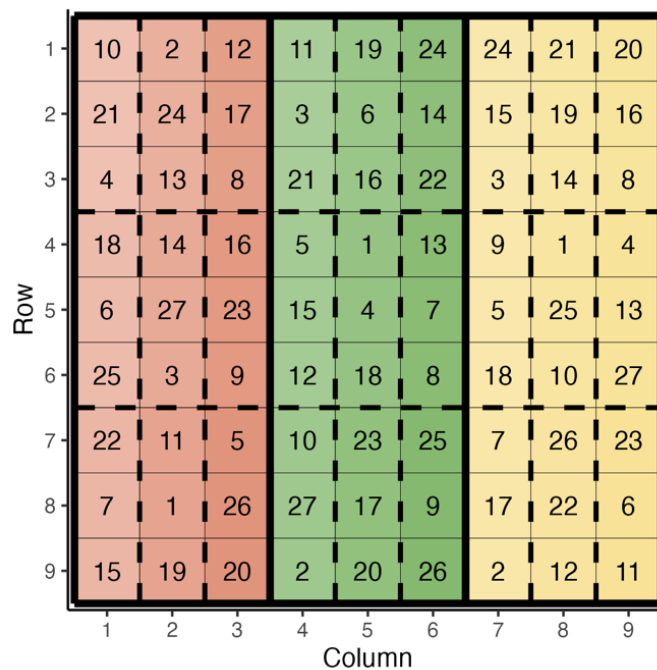


Fig. S11: Example of alpha design in experiment with 9 by 9 plots and 3 complete blocks, each divided in 9 incomplete blocks. The different colors each represent one repetition while the shades of each color represent the incomplete (mini) blocks surrounded by dashed lines. The numbers represent line names.

Row-column designs

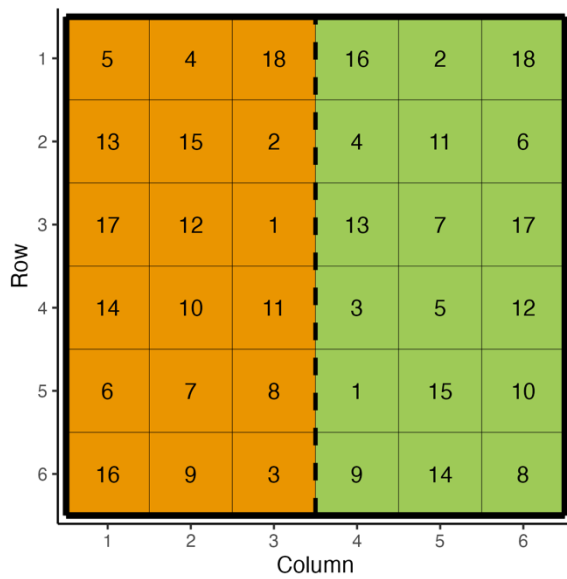


Fig. S12: Example of row-column design in experiment with 6 by 6 plots and 2 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

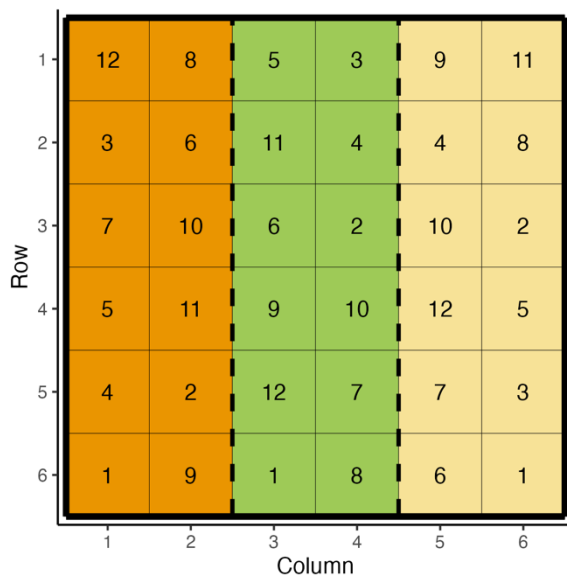


Fig. S13: Example of row-column design in experiment with 6 by 6 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	4	18	11	17	12	6	17	18	7
2	10	13	5	1	8	7	16	9	12
3	15	12	1	10	9	11	14	2	11
4	7	3	9	3	13	16	10	8	3
5	16	2	6	2	5	18	13	4	1
6	8	14	17	4	15	14	5	6	15
	1	2	3	4	5	6	7	8	9

Fig. S14: Example of row-column design in experiment with 6 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	1	19	21	6	14	8	20	7	13
2	17	20	2	24	15	16	3	6	16
3	23	12	4	22	1	3	24	23	18
4	15	25	27	19	20	11	8	11	15
5	24	3	9	13	10	4	19	25	2
6	18	13	6	5	21	18	9	10	26
7	5	11	10	26	12	17	1	14	17
8	7	22	8	27	2	7	21	22	12
9	14	16	26	23	25	9	5	4	27
	1	2	3	4	5	6	7	8	9

Fig. S15: Example of row-column design in experiment with 9 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

Augmented designs

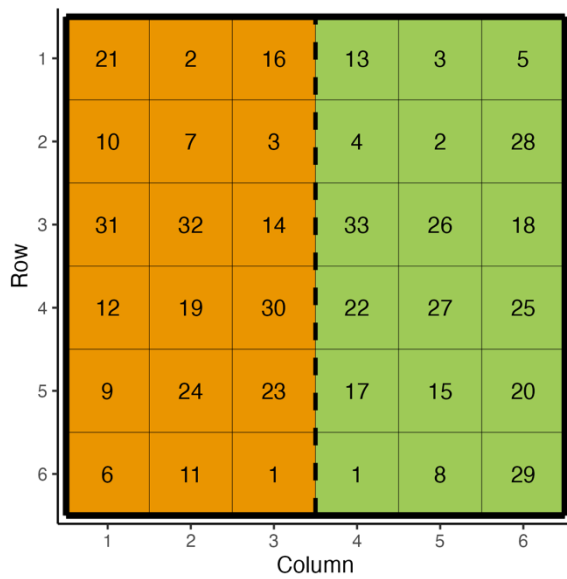


Fig. S16: Example of augmented design in experiment with 6 by 6 plots and 2 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

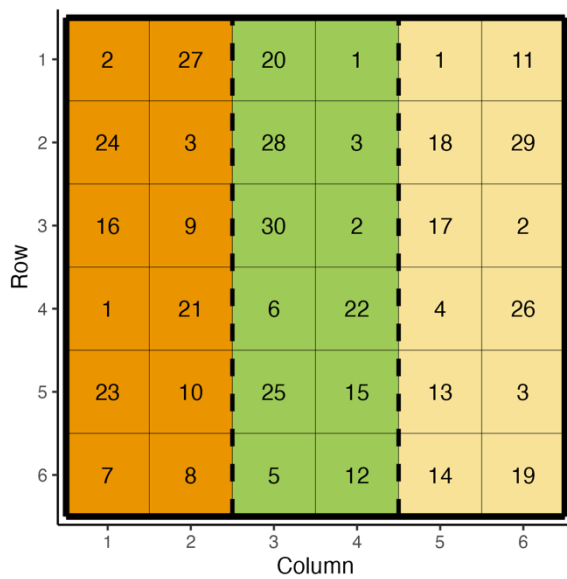


Fig. S17: Example of augmented design in experiment with 6 by 6 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	16	39	11	6	13	18	1	28	22
2	15	38	46	30	17	3	33	2	48
3	4	7	9	24	2	23	41	45	32
4	42	5	8	12	10	44	19	31	3
5	47	1	3	43	35	21	14	25	20
6	36	27	2	1	26	29	37	34	40
	1	2	3	4	5	6	7	8	9

Fig. S18: Example of augmented design in experiment with 6 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	59	32	28	3	47	36	60	66	14
2	51	54	11	68	22	8	27	1	44
3	1	71	2	61	49	64	7	21	37
4	39	58	52	23	56	17	31	26	18
5	46	57	73	16	13	42	25	63	35
6	30	10	3	45	50	1	3	5	15
7	48	69	53	72	9	19	75	67	34
8	4	43	38	33	74	2	70	24	20
9	6	12	40	65	62	41	2	55	29
	1	2	3	4	5	6	7	8	9

Fig. S19: Example of augmented design in experiment with 9 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

Augmented row-column designs

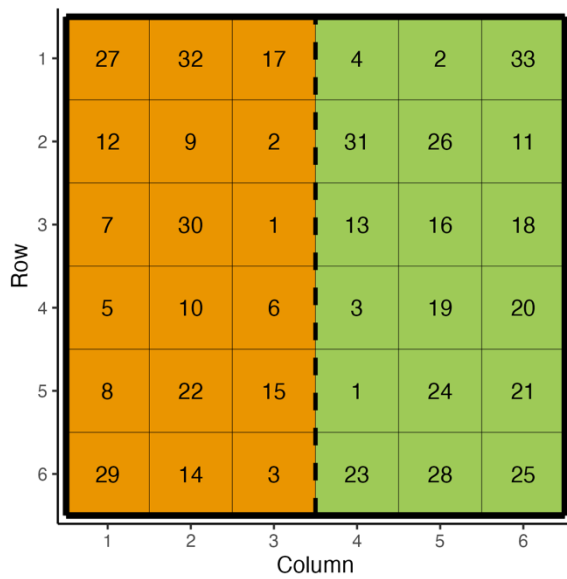


Fig. S20: Example of augmented row-column design in experiment with 6 by 6 plots and 2 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

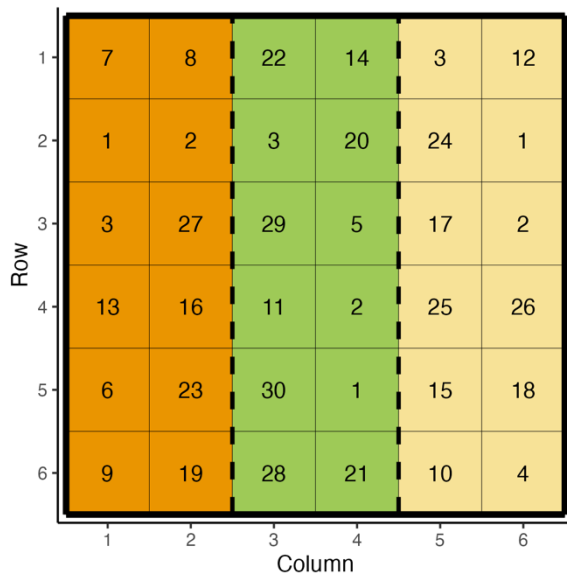


Fig. S21: Example of augmented row-column design in experiment with 6 by 6 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	19	25	22	30	46	10	6	2	45
2	9	41	31	15	2	29	34	14	36
3	5	20	16	39	37	21	4	23	1
4	24	26	2	11	1	38	12	40	7
5	8	33	17	35	48	18	32	43	27
6	1	3	13	42	3	44	28	3	47
	1	2	3	4	5	6	7	8	9

Fig. S22: Example of augmented row-column design in experiment with 6 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

1	27	30	14	15	37	31	24	63	53
2	35	3	32	42	2	73	1	20	51
3	22	75	47	55	68	26	3	2	19
4	74	29	6	18	9	12	36	58	65
5	4	69	43	59	64	57	46	34	54
6	10	52	1	40	25	8	60	13	45
7	2	39	70	7	1	21	17	23	66
8	44	33	61	50	56	16	49	48	62
9	41	11	5	71	28	3	38	72	67
	1	2	3	4	5	6	7	8	9

Fig. S23: Example of augmented row-column design in experiment with 9 by 9 plots and 3 complete blocks. The different colors each represent one repetition (complete block). The numbers represent line names.

3. Illustrations of entire field

Designs with 6 by 6 plots and two replicates per experiment

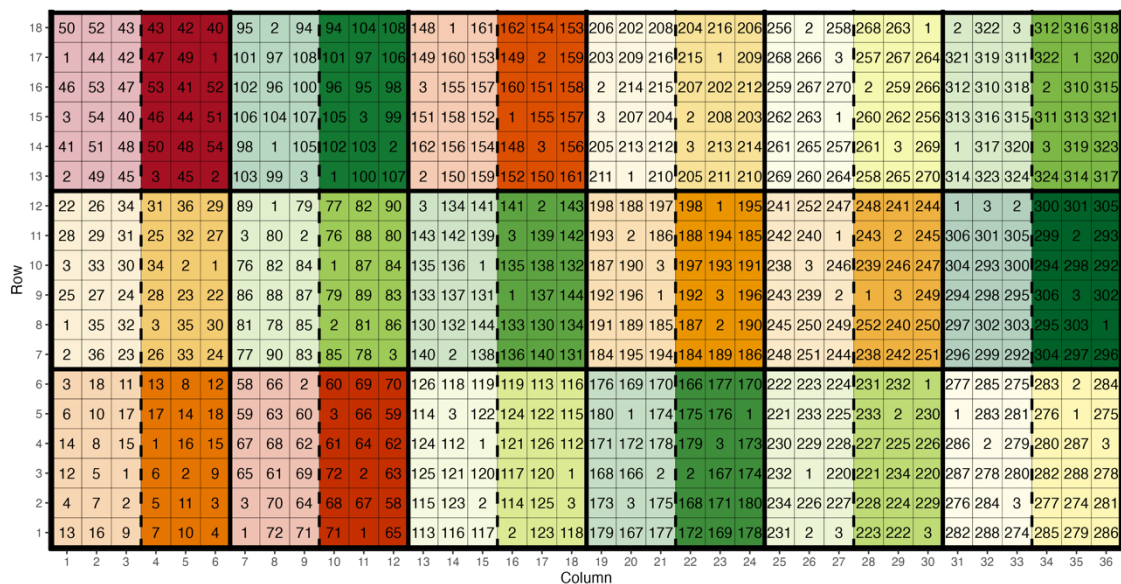


Fig. S24: Example of RCBD design with 18 treatments per experiment in two blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

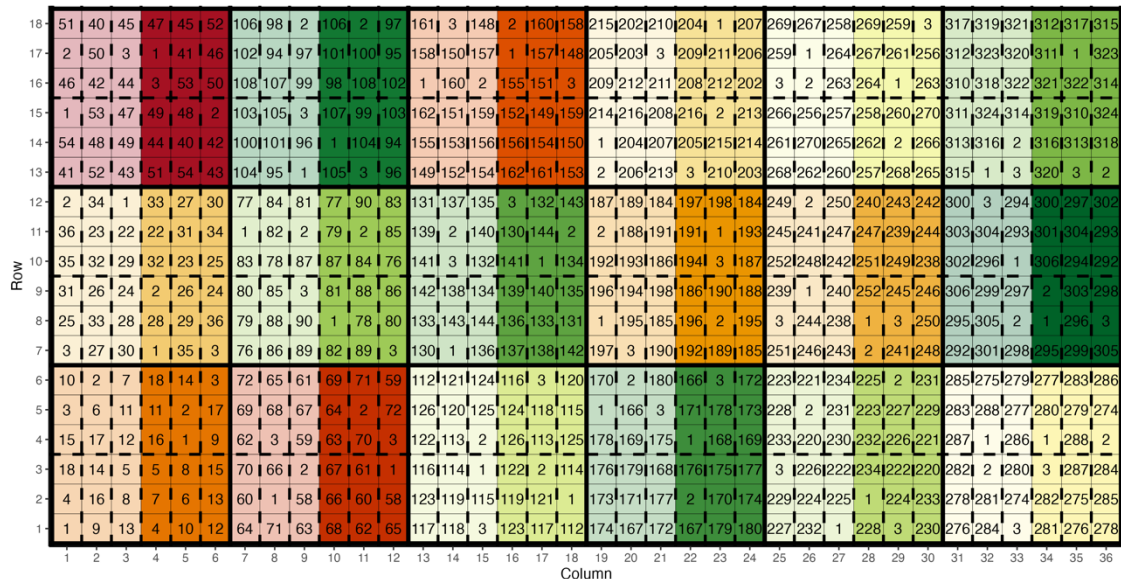


Fig. S25: Example of alpha design with 18 treatments per experiment in two blocks, each divided in 6 incomplete mini blocks. There are 3 check lines across the entire field. Each color represents a repetition within one experiment surrounded by bold black lines. Incomplete (mini) blocks are surrounded by dashed lines. The numbers represent line names.

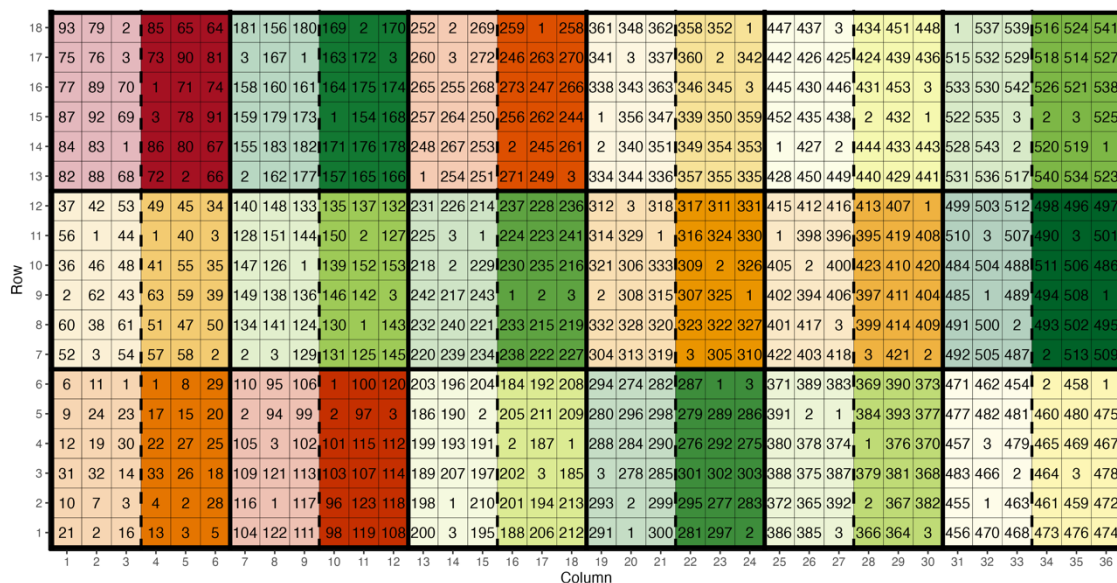


Fig. S26: Example of augmented design with 33 treatments per experiment in two blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

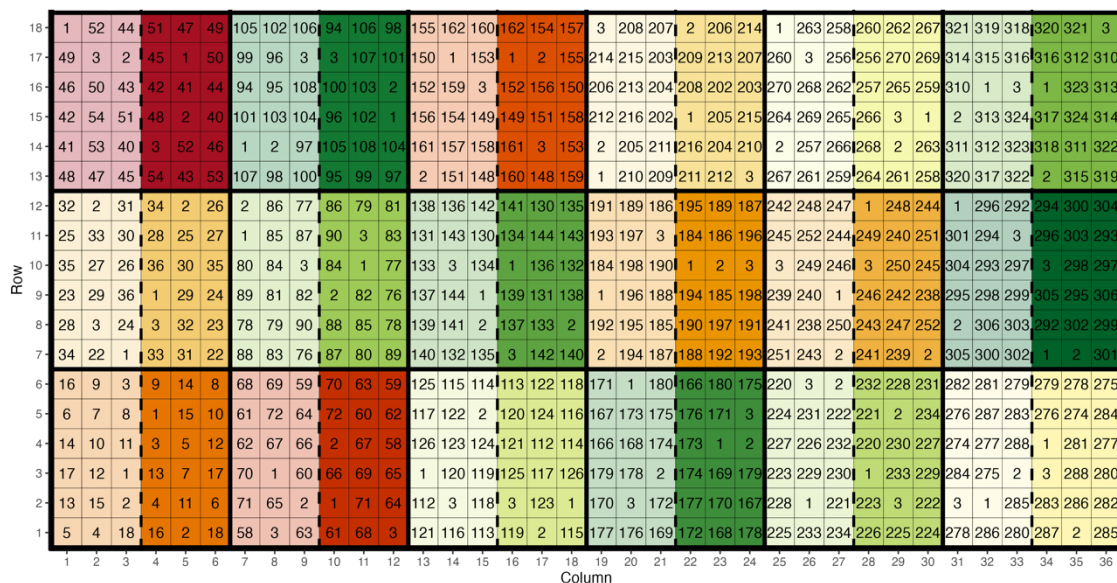


Fig. S27: Example of row-column design with 18 treatments per experiment in two blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

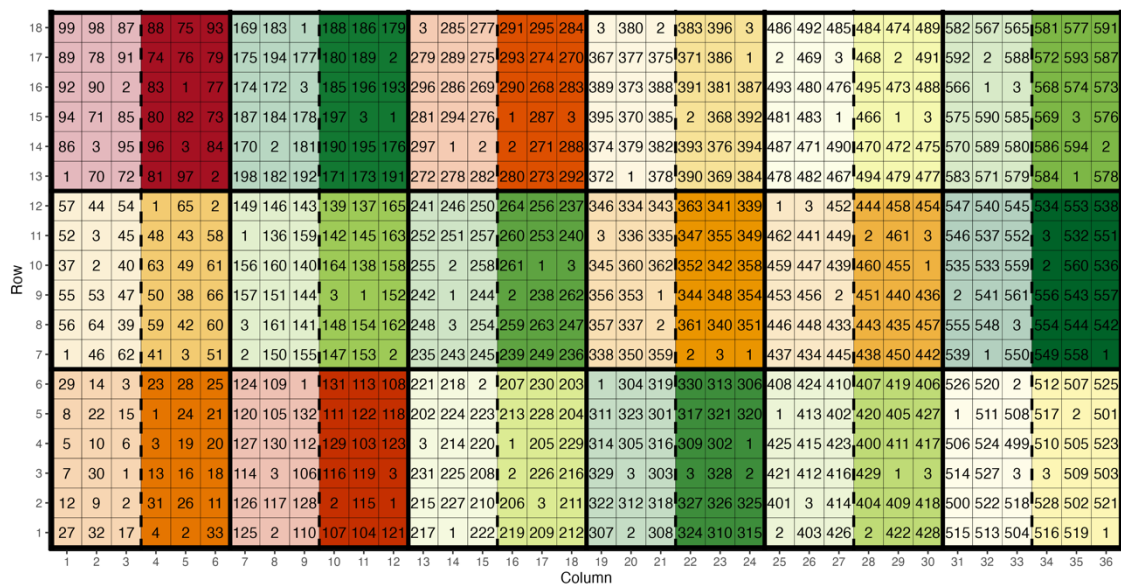


Fig. S28: Example of augmented row-column design with 33 treatments per Experiment in two blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

Designs with 6 by 6 plots and three replicates per experiment

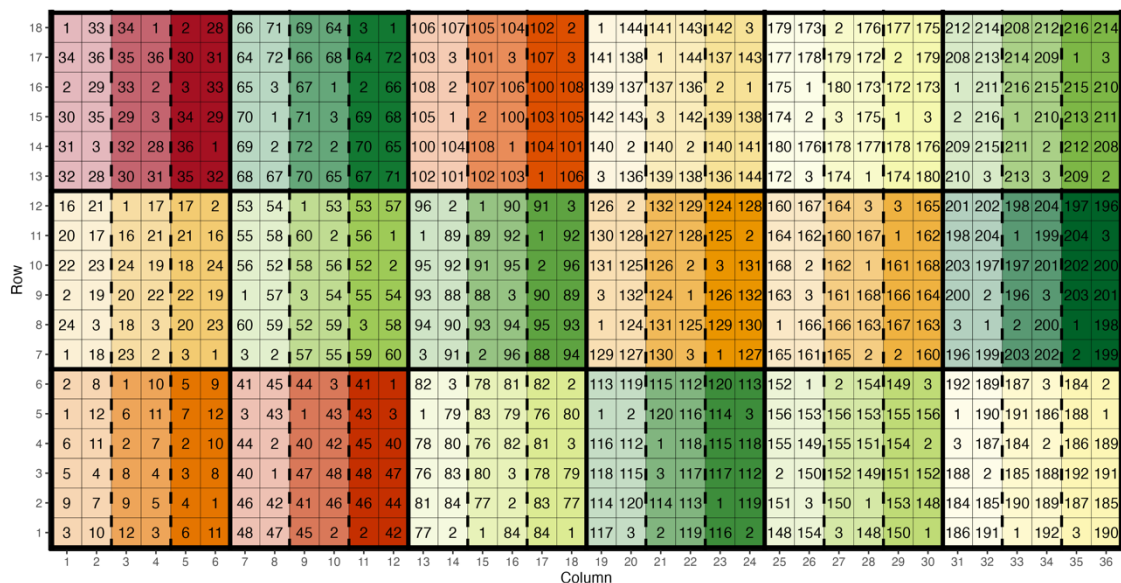


Fig. S29: Example of RCBD design with 12 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

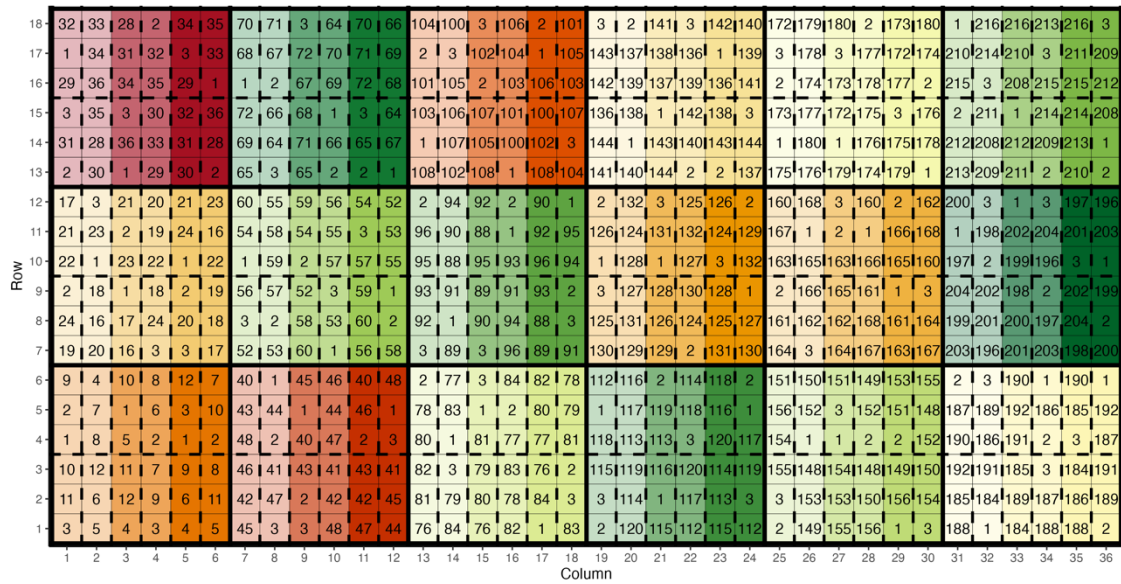


Fig. S30: Example of alpha design with 12 treatments per experiment in three blocks, each divided in 4 incomplete (mini) blocks. There are 3 check lines across the entire field. Each color represents a repetition within one experiment surrounded by bold black lines. Incomplete (mini) blocks are surrounded by dashed lines. The numbers represent line names.

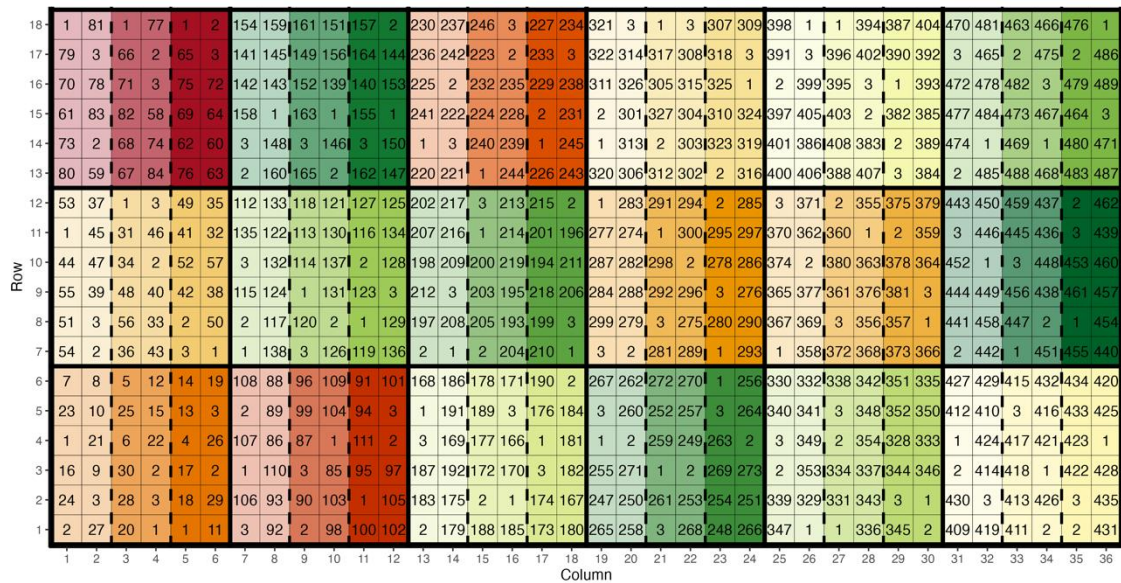


Fig. S31: Example of augmented design with 29 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

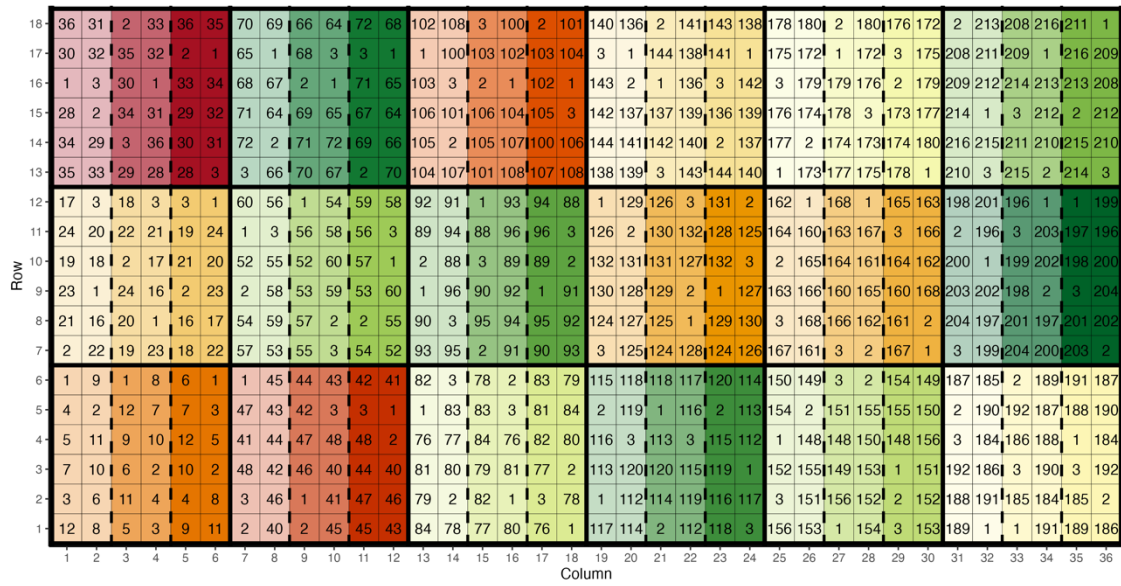


Fig. S32: Example of row-column design with 12 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

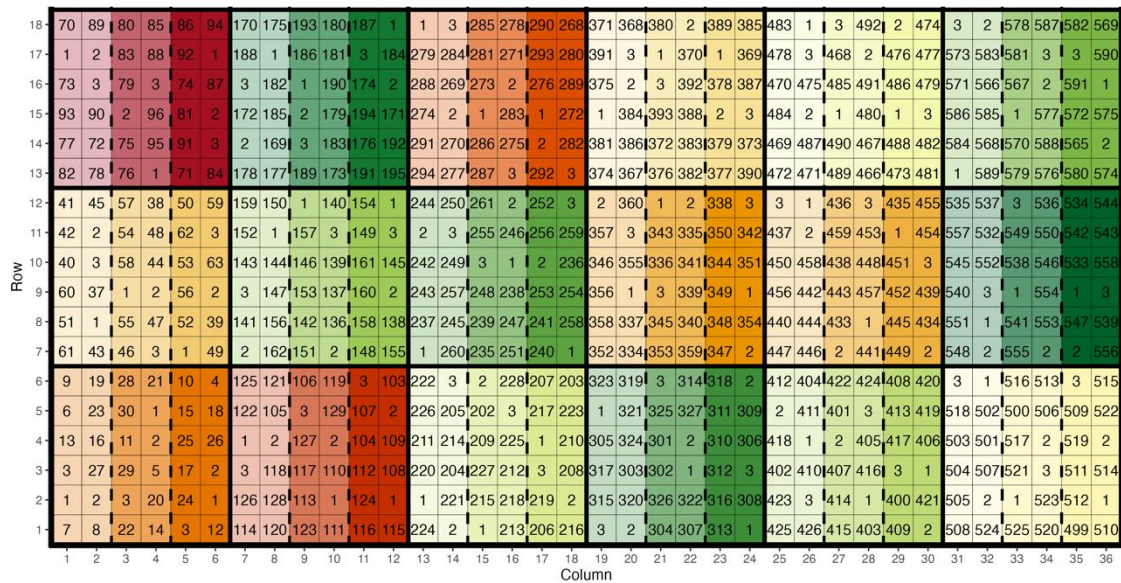


Fig. S33: Example of augmented row-column design with 29 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

Designs with 6 by 9 plots and three replicates per experiment

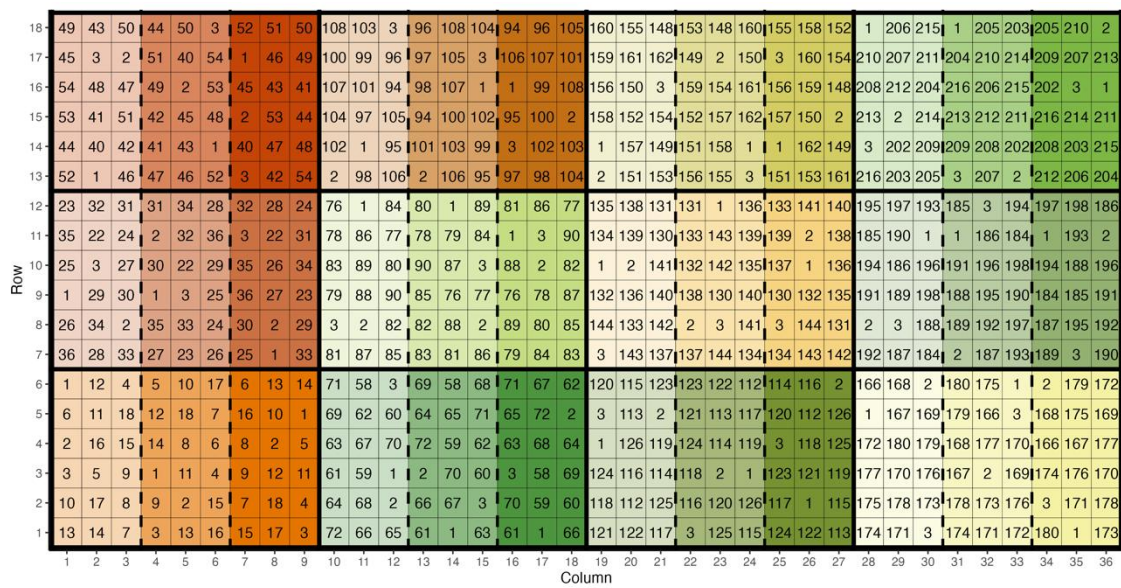


Fig. S34: Example of RCBD design with 18 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

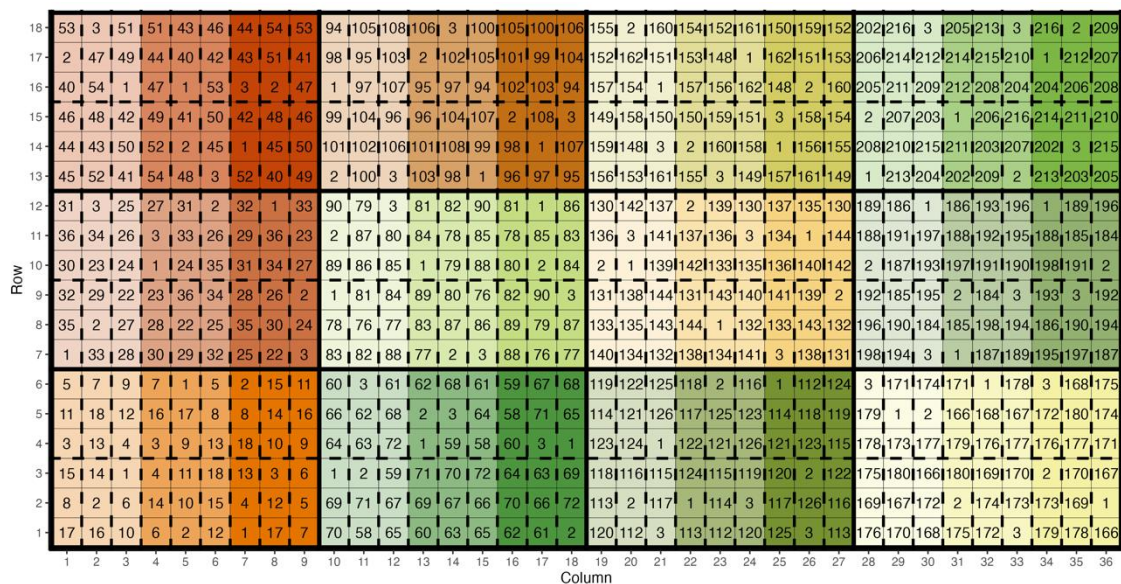


Fig. S35: Example of alpha design with 18 treatments per experiment in three blocks, each divided in 6 incomplete (mini) blocks. There are 3 check lines across the entire field. Each color represents a repetition within one experiment surrounded by bold black lines. Incomplete (mini) blocks are surrounded by dashed lines. The numbers represent line names.

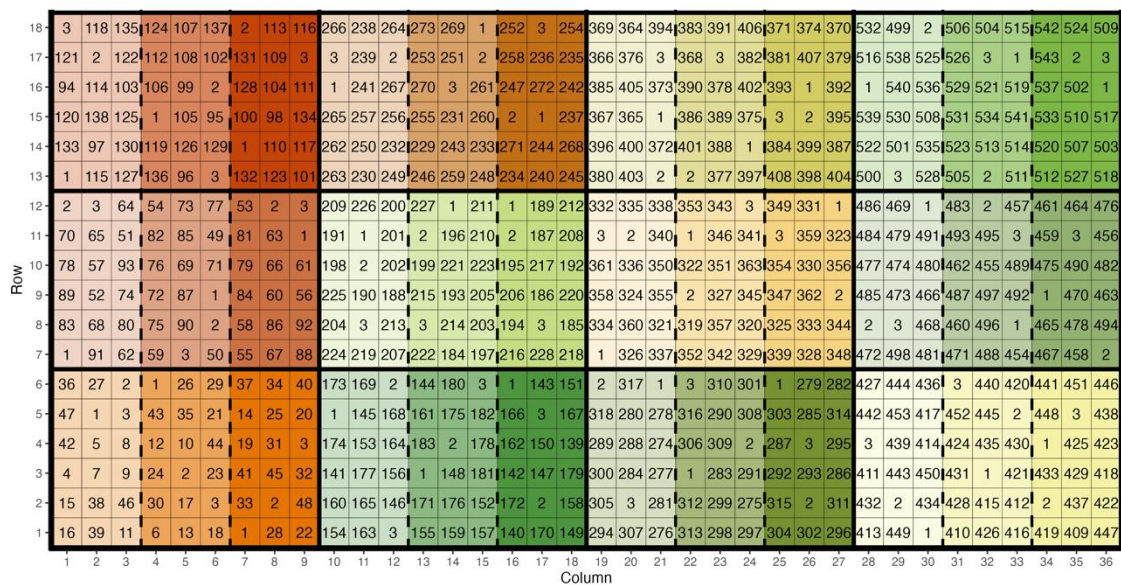


Fig. S36: Example of augmented design with 48 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

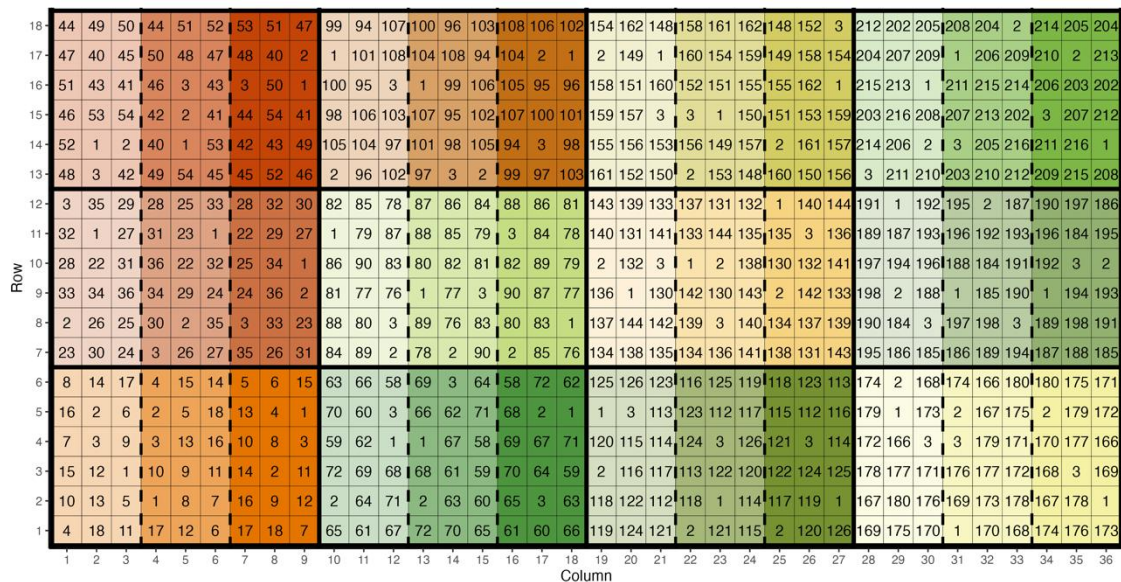


Fig. S37: Example of row-column design with 18 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

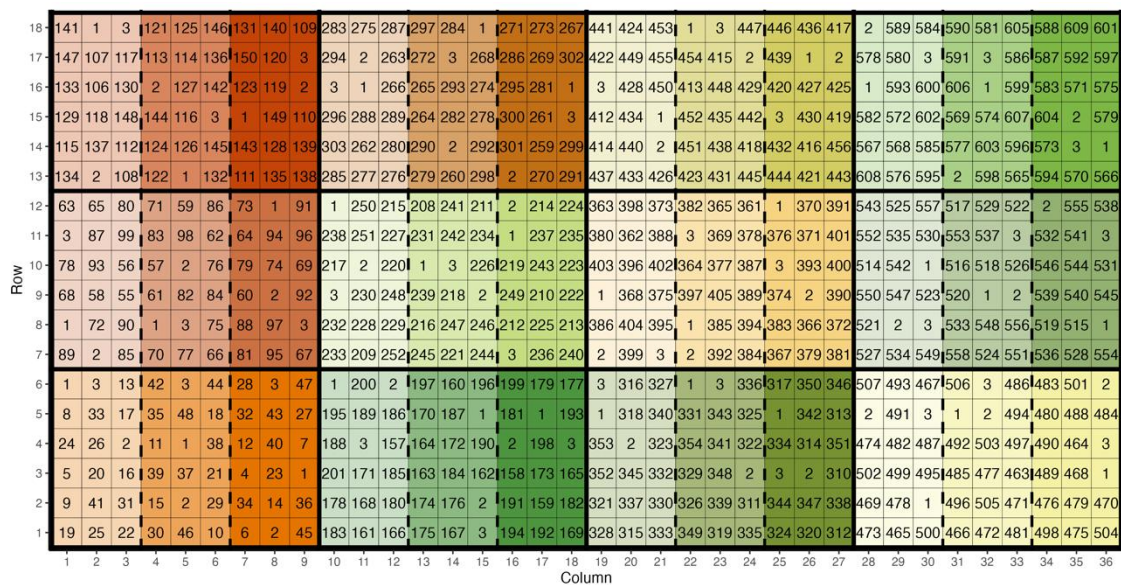


Fig. S38: Example of augmented row-column design with 48 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

Designs with 9 by 9 plots and three replicates per experiment

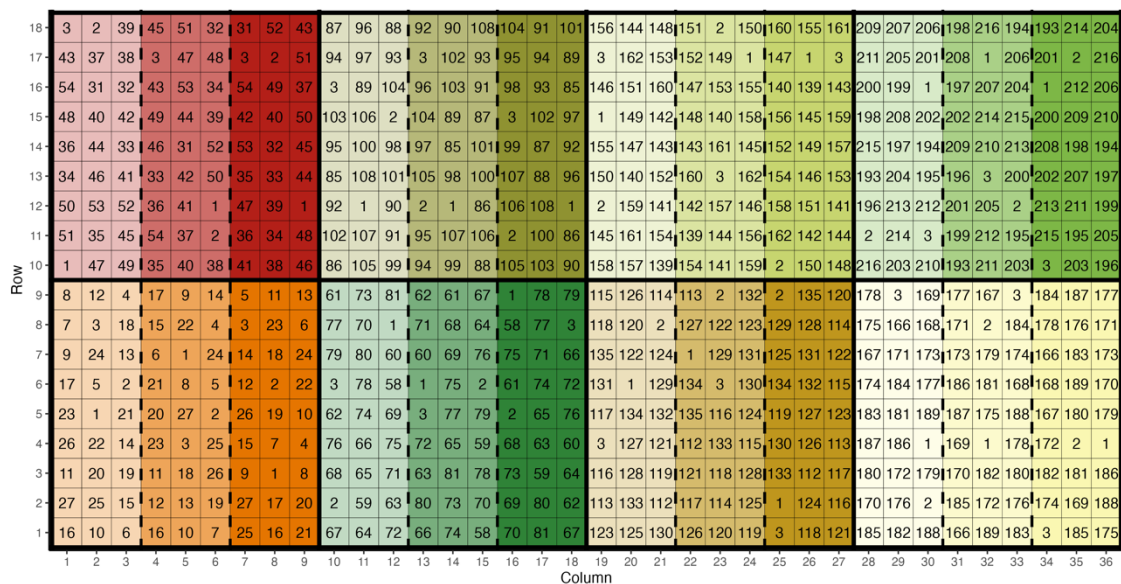


Fig. S39: Example of RCBD design with 27 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

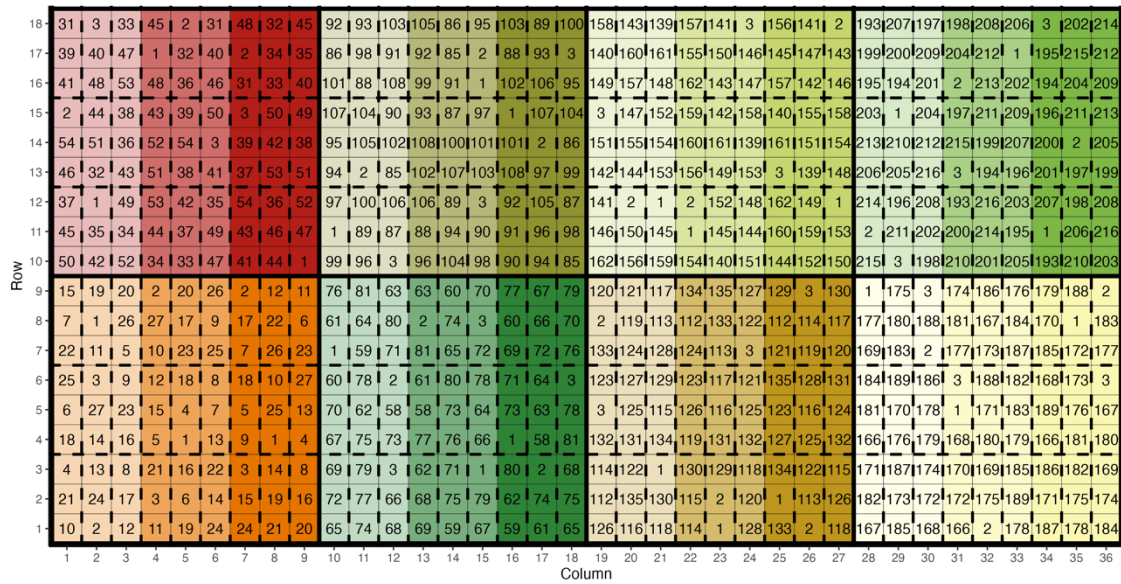


Fig. S40: Example of alpha design with 27 treatments per experiment in three blocks, each divided in 9 incomplete (mini) blocks. There are 3 check lines across the entire field. Each color represents a repetition within one experiment surrounded by bold black lines. Incomplete (mini) blocks are surrounded by dashed lines. The numbers represent line names.

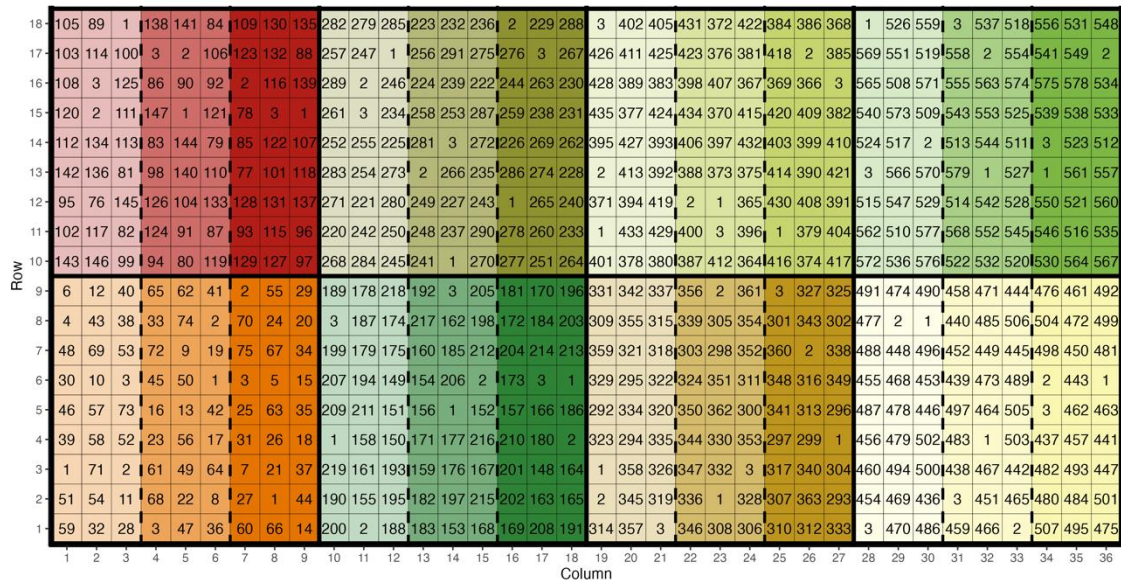


Fig. S41: Example of augmented design with 75 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

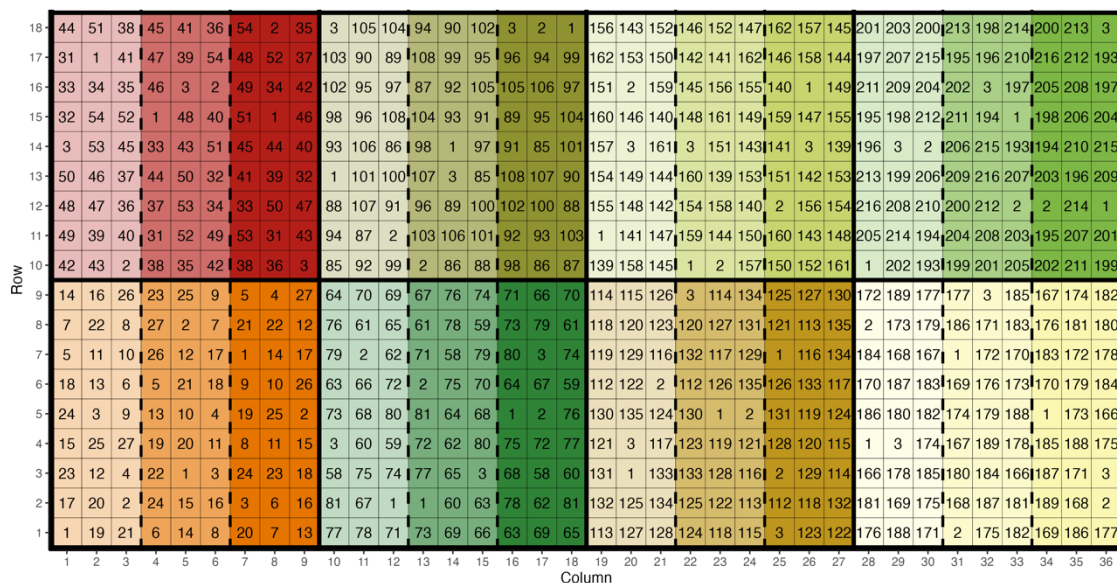


Fig. S42: Example of row-column design with 27 treatments per experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

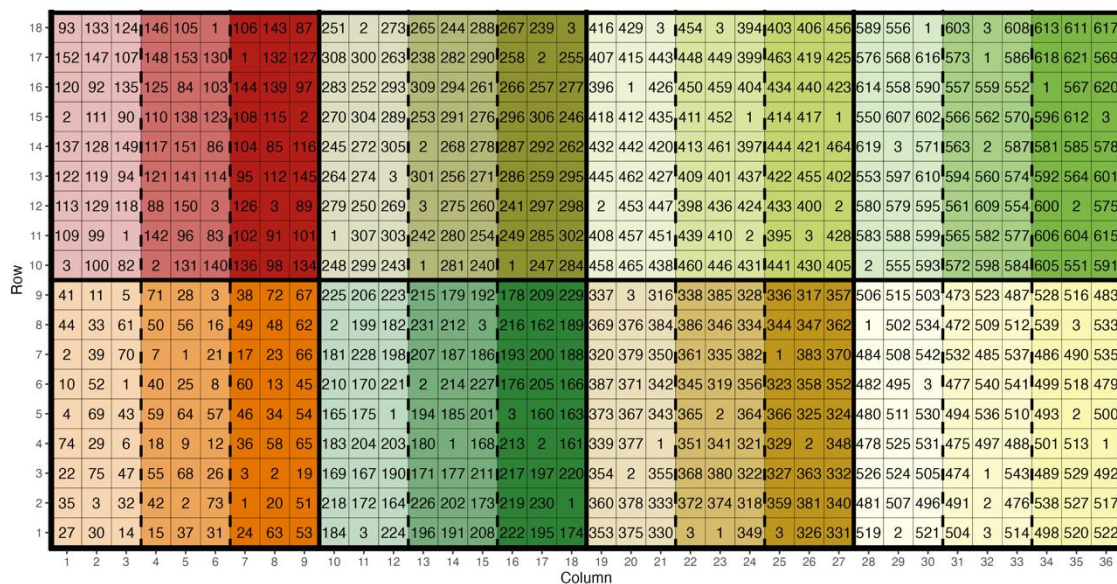


Fig. S43: Example of augmented row-column design with 75 treatments per Experiment in three blocks. There are 3 check lines across the entire field. Each color represents a repetition (complete block) within one experiment surrounded by bold black lines. The numbers represent line names.

4. Sensitivity analyses

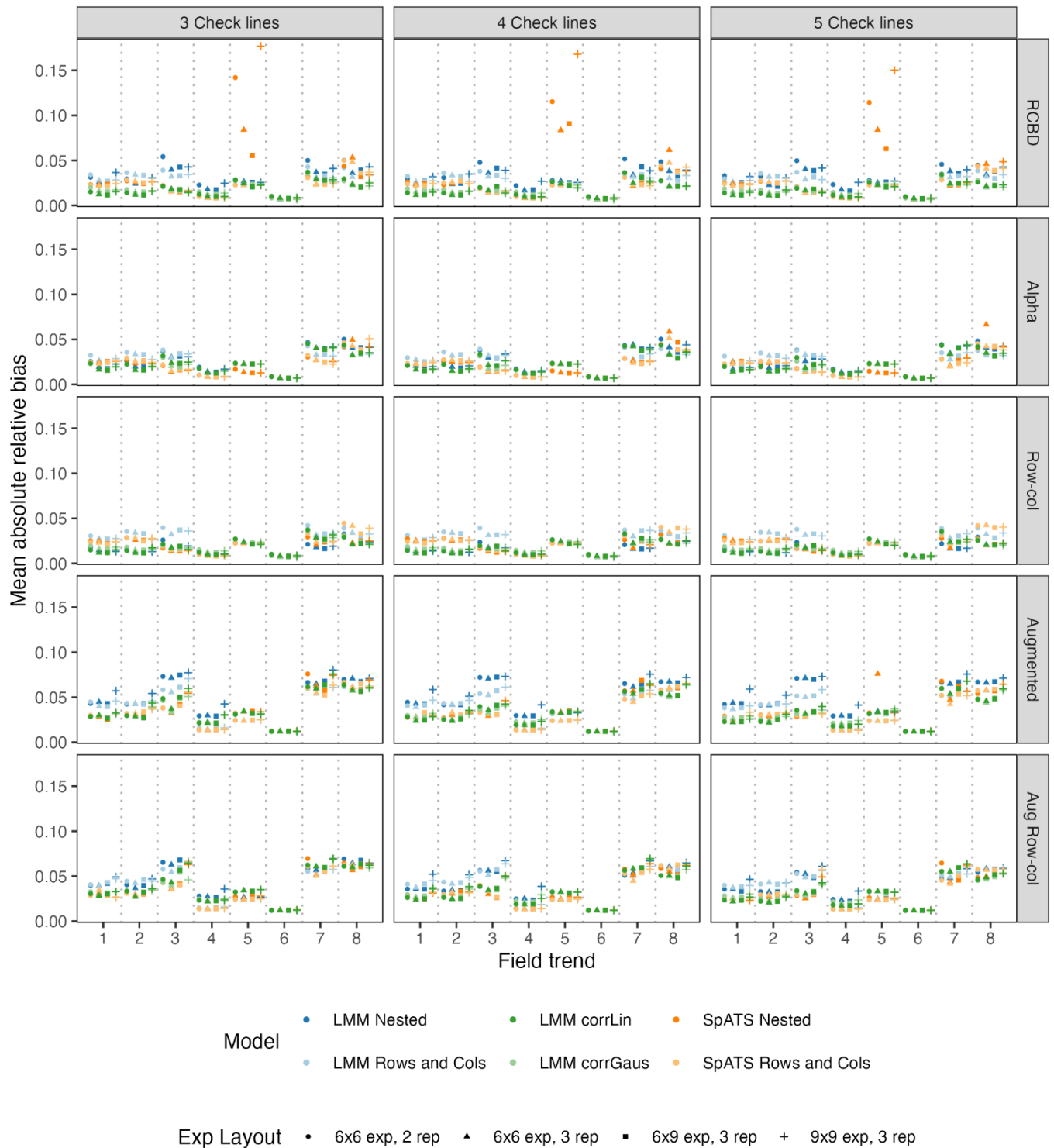


Fig. S44: Mean absolute relative bias for different combinations of field trend, design and analysis strategy. Values are mean values over 500 simulated data sets. Additive error structure with higher degree of spatial variation.

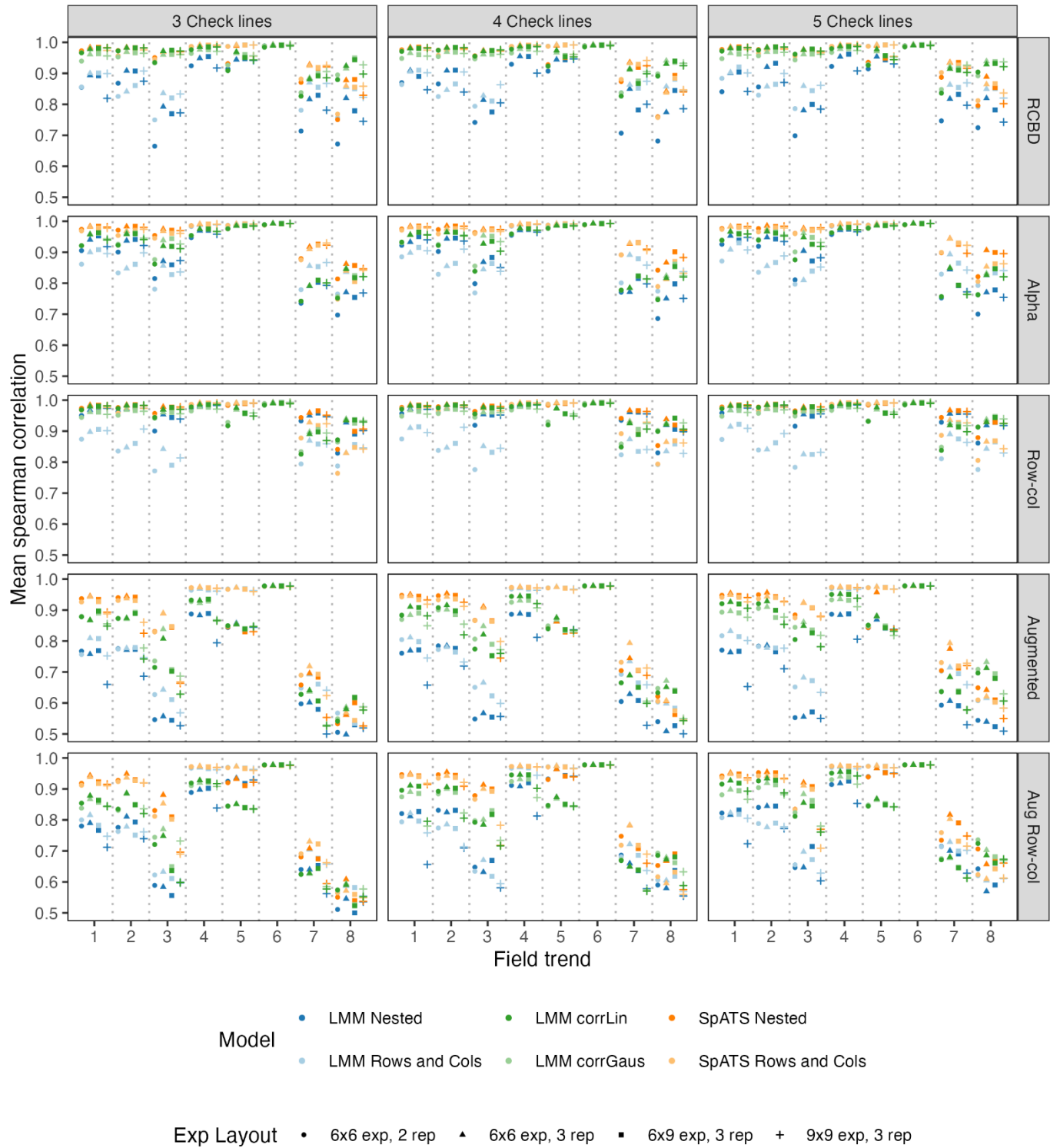


Fig. S45: Spearman correlation to true yield for different combinations of field trend, design and analysis strategy. Values are mean values over 500 simulated data sets. Additive error structure with higher degree of spatial variation.

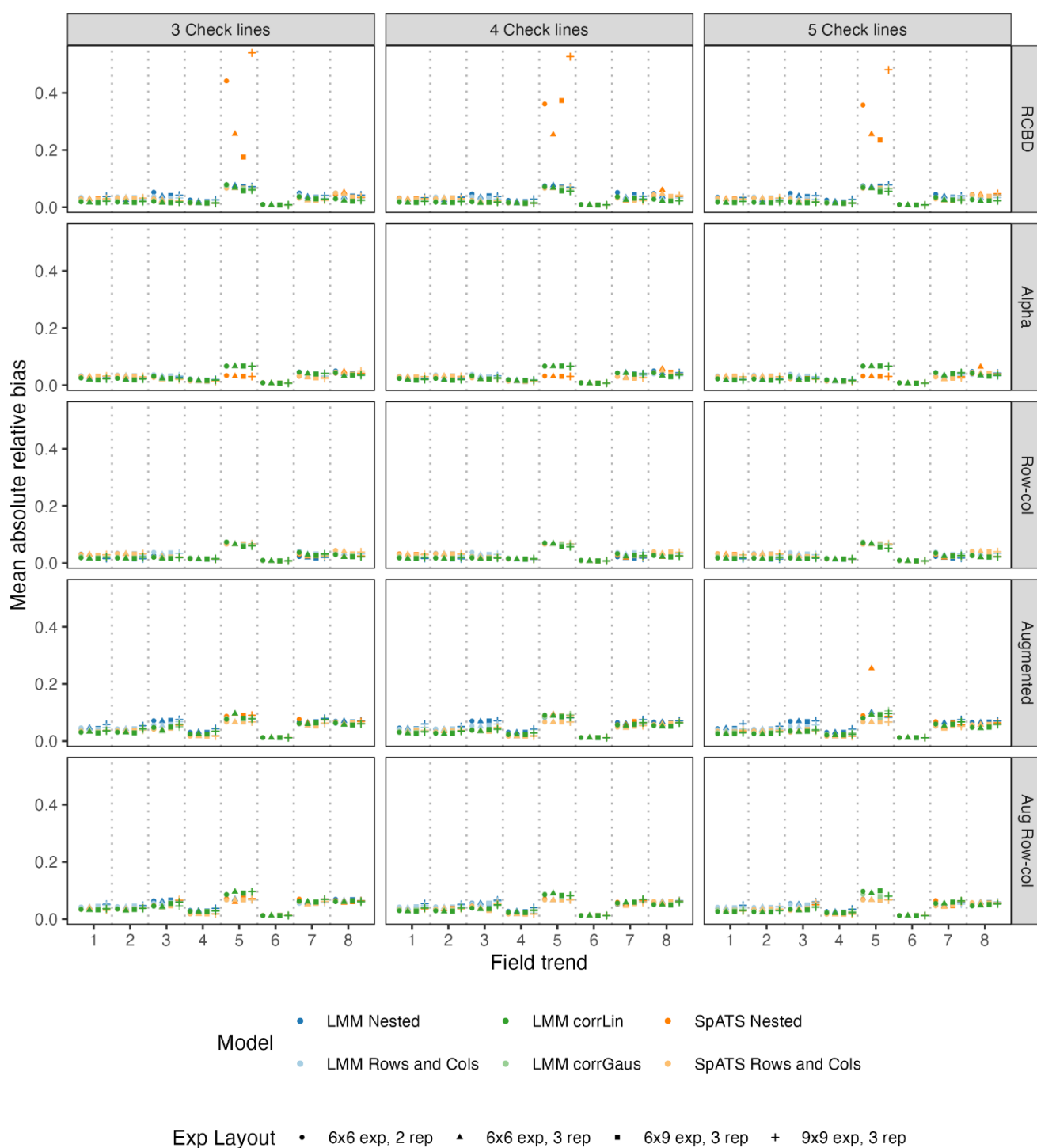


Fig. S46: Mean absolute relative bias between estimated and true yield for different combinations of field trend, design and analysis strategy. Values are mean values over 1000 Simulated data sets. Multiplicative error structure

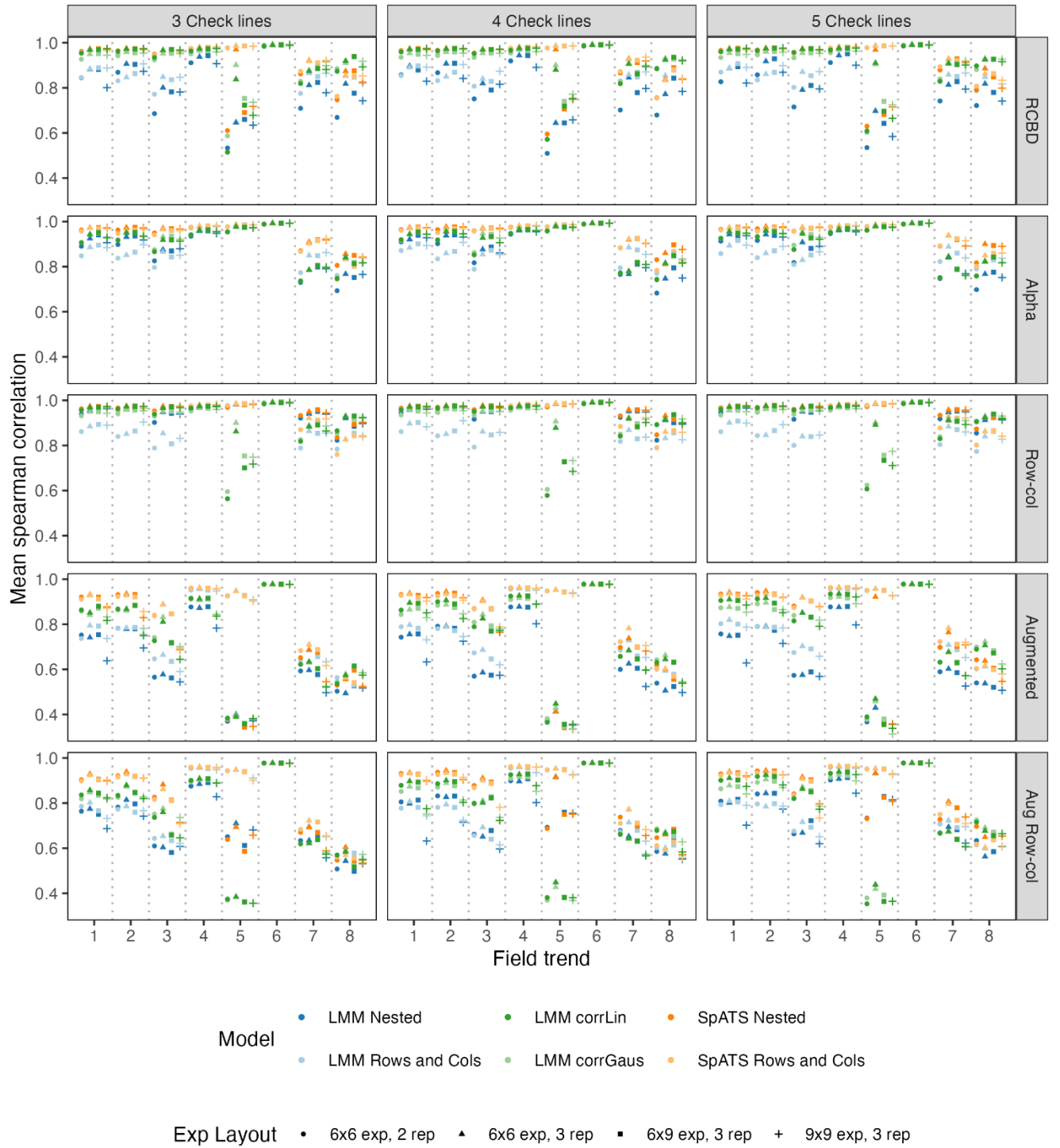


Fig. S47: Mean spearman correlations for different combinations of field trend, design and analysis strategy. Values are mean values over 1000 Simulated data sets. Multiplicative error structure.