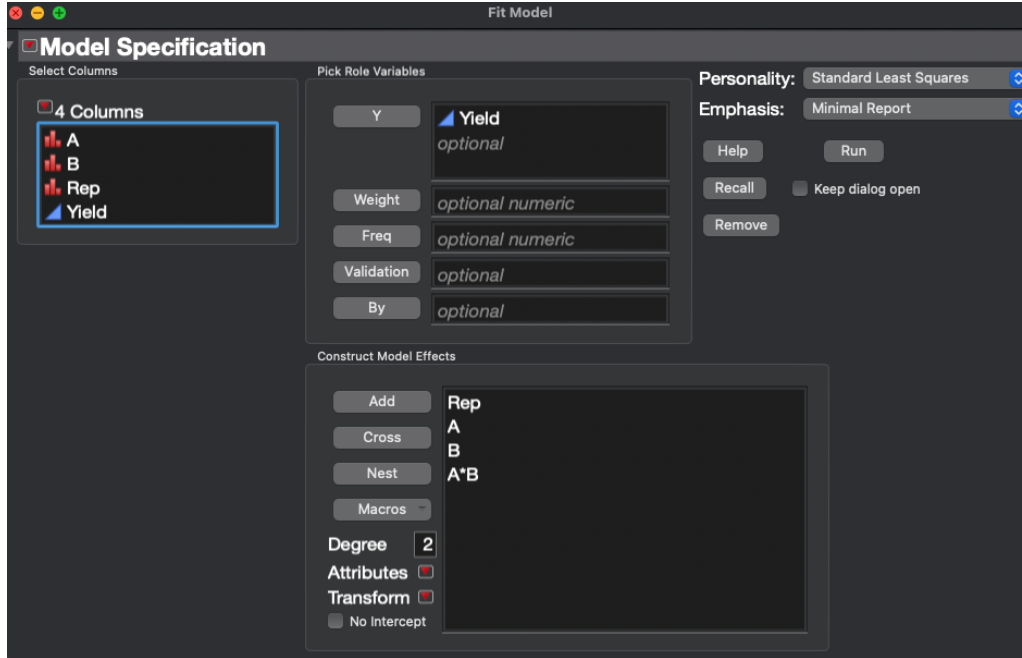


## JMP for RCBD with a Factorial Arrangement, with A and B Fixed

JMP model statements for RCBD with a factorial arrangement, A and B both fixed



## JMP Output for RCBD with a Factorial Arrangement, with A and B Fixed

### Response Yield Effect Summary

Source	LogWorth	PValue
B	4.756	0.00002
A	4.480	0.00003
A*B	3.135	0.00073
Rep	2.269	0.00538

### Summary of Fit

RSquare	0.739833
RSquare Adj	0.650633
Root Mean Square Error	8.294197
Mean of Response	38.05208
Observations (or Sum Wgts)	48

### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	12	6846.9800	570.582	8.2941
Error	35	2407.7798	68.794	<b>Prob &gt; F</b>
C. Total	47	9254.7598		<.0001*

### Effect Tests

Source	Nparm	DF	Sum of Squares	F Ratio	Prob > F
Rep	5	5	1387.8185	4.0347	0.0054*
A	1	1	1558.3802	22.6529	<.0001*
B	3	3	2428.6240	11.7677	<.0001*
A*B	3	3	1472.1573	7.1332	0.0007*

# JMP Output for RCBD with a Factorial Arrangement, with A and B Fixed

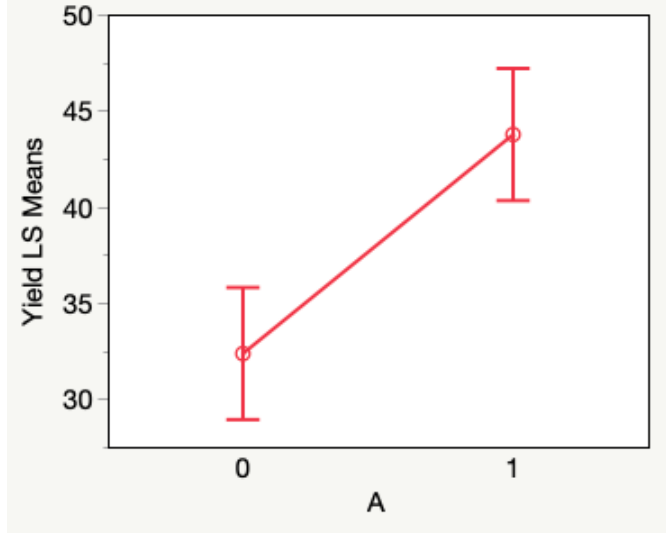
## Effect Details

A

### Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
0	32.354167	1.6930459	32.3542
1	43.750000	1.6930459	43.7500

### Least Squares Means Plot



### LSMeans Differences Student's t

$\alpha=0.050$   $t=2.03011$

LSMean[i] By LSMean[j]

Mean[i]-Mean[j]	0	1
Std Err Dif		
Lower CL Dif		
Upper CL Dif		
0	0	-11.396
	0	2.39433
	0	-16.257
	0	-6.5351
1	11.3958	0
	2.39433	0
	6.53509	0
	16.2566	0

Level		Least Sq Mean
1	A	43.750000
0	B	32.354167

Levels not connected by same letter are significantly different.

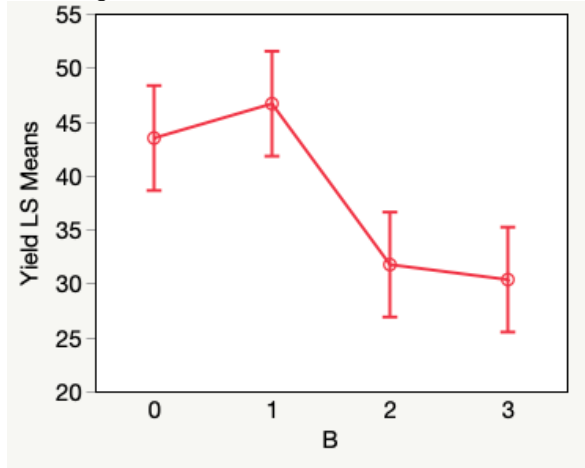
## JMP Output for RCBD with a Factorial Arrangement, with A and B Fixed

**B**

**Least Squares Means Table**

Level	Least Sq Mean	Std Error	Mean
0	43.466667	2.3943285	43.4667
1	46.650000	2.3943285	46.6500
2	31.741667	2.3943285	31.7417
3	30.350000	2.3943285	30.3500

**Least Squares Means Plot**



**LSMeans Differences Student's t**

$\alpha=0.050$   $t=2.03011$

LSMean[i] By LSMean[j]

Mean[i]-Mean[j]	0	1	2	3
Std Err Dif				
Lower CL Dif				
Upper CL Dif				
0	0	-3.1833	11.725	13.1167
	0	3.38609	3.38609	3.38609
	0	-10.057	4.85087	6.24253
	0	3.6908	18.5991	19.9908
1	3.18333	0	14.9083	16.3
	3.38609	0	3.38609	3.38609
	-3.6908	0	8.0342	9.42587
	10.0575	0	21.7825	23.1741
2	-11.725	-14.908	0	1.39167
	3.38609	3.38609	0	3.38609
	-18.599	-21.782	0	-5.4825
	-4.8509	-8.0342	0	8.2658
3	-13.117	-16.3	-1.3917	0
	3.38609	3.38609	3.38609	0
	-19.991	-23.174	-8.2658	0
	-6.2425	-9.4259	5.48247	0

## JMP Output for RCBD with a Factorial Arrangement, with A and B Fixed

Level		Least Sq Mean
1	A	46.650000
0	A	43.466667
2	B	31.741667
3	B	30.350000

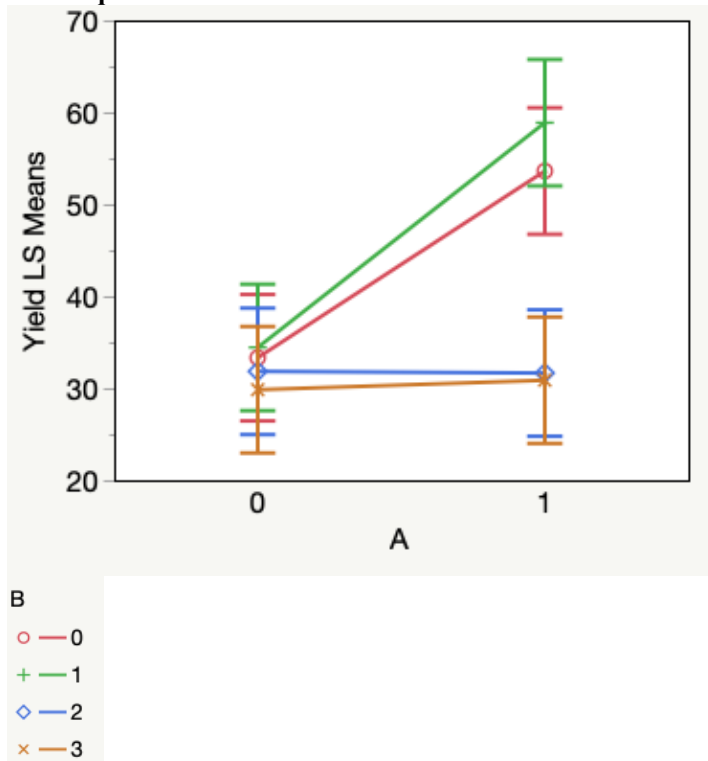
Levels not connected by same letter are significantly different.

### A\*B

#### Least Squares Means Table

Level	Least Sq Mean	Std Error
0,0	33.316667	3.3860919
0,1	34.433333	3.3860919
0,2	31.833333	3.3860919
0,3	29.833333	3.3860919
1,0	53.616667	3.3860919
1,1	58.866667	3.3860919
1,2	31.650000	3.3860919
1,3	30.866667	3.3860919

#### Least Squares Means Plot



## JMP Output for RCBD with a Factorial Arrangement, with A and B Fixed

### LSMeans Differences Student's t

$\alpha=0.050$   $t=2.03011$

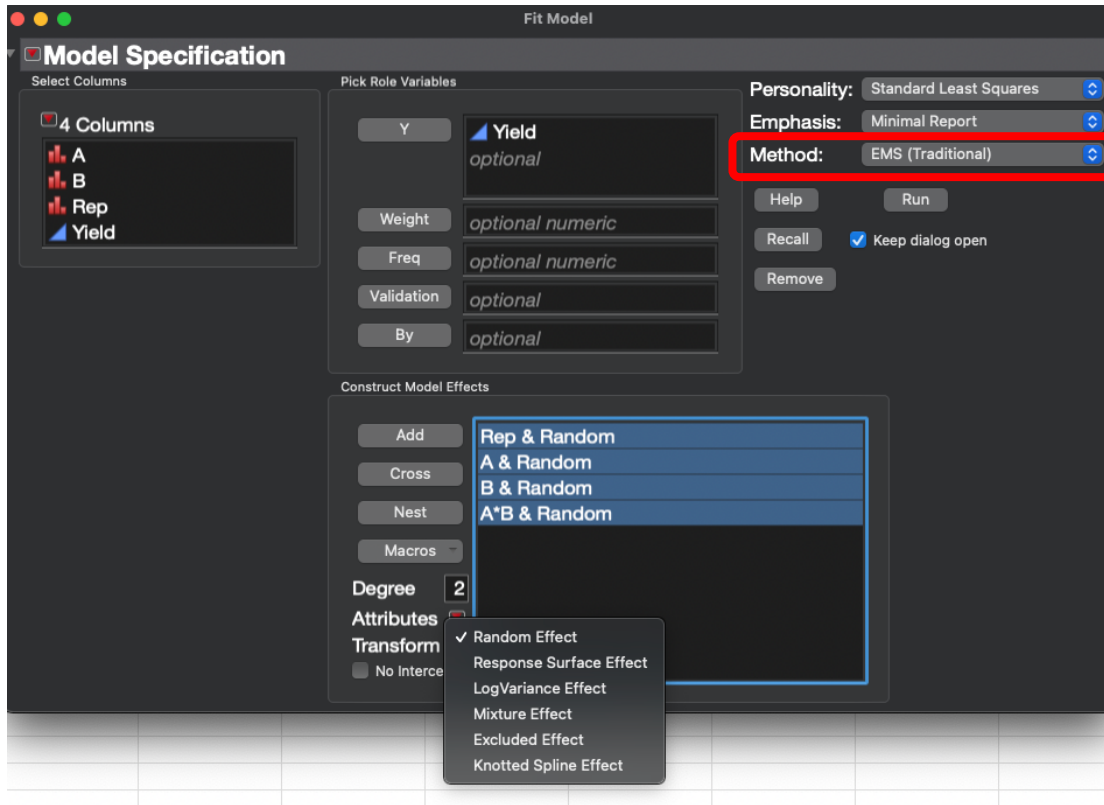
LSMean[i] By LSMean[j]

Mean[i]-Mean[j]	0,0	0,1	0,2	0,3	1,0	1,1	1,2	1,3
Std Err Dif								
Lower CL Dif								
Upper CL Dif								
0,0	0	-1.1167	1.48333	3.48333	-20.3	-25.55	1.66667	2.45
	0	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866
	0	-10.838	-8.2382	-6.2382	-30.021	-35.271	-8.0548	-7.2715
	0	8.60482	11.2048	13.2048	-10.579	-15.829	11.3882	12.1715
0,1	1.11667	0	2.6	4.6	-19.183	-24.433	2.78333	3.56667
	4.78866	0	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866
	-8.6048	0	-7.1215	-5.1215	-28.905	-34.155	-6.9382	-6.1548
	10.8382	0	12.3215	14.3215	-9.4618	-14.712	12.5048	13.2882
0,2	-1.4833	-2.6	0	2	-21.783	-27.033	0.18333	0.96667
	4.78866	4.78866	0	4.78866	4.78866	4.78866	4.78866	4.78866
	-11.205	-12.321	0	-7.7215	-31.505	-36.755	-9.5382	-8.7548
	8.23816	7.12149	0	11.7215	-12.062	-17.312	9.90482	10.6882
0,3	-3.4833	-4.6	-2	0	-23.783	-29.033	-1.8167	-1.0333
	4.78866	4.78866	4.78866	0	4.78866	4.78866	4.78866	4.78866
	-13.205	-14.321	-11.721	0	-33.505	-38.755	-11.538	-10.755
	6.23816	5.12149	7.72149	0	-14.062	-19.312	7.90482	8.68816
1,0	20.3	19.1833	21.7833	23.7833	0	-5.25	21.9667	22.75
	4.78866	4.78866	4.78866	4.78866	0	4.78866	4.78866	4.78866
	10.5785	9.46184	12.0618	14.0618	0	-14.971	12.2452	13.0285
	30.0215	28.9048	31.5048	33.5048	0	4.47149	31.6882	32.4715
1,1	25.55	24.4333	27.0333	29.0333	5.25	0	27.2167	28
	4.78866	4.78866	4.78866	4.78866	4.78866	0	4.78866	4.78866
	15.8285	14.7118	17.3118	19.3118	-4.4715	0	17.4952	18.2785
	35.2715	34.1548	36.7548	38.7548	14.9715	0	36.9382	37.7215
1,2	-1.6667	-2.7833	-0.1833	1.81667	-21.967	-27.217	0	0.78333
	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866	0	4.78866
	-11.388	-12.505	-9.9048	-7.9048	-31.688	-36.938	0	-8.9382
	8.05482	6.93816	9.53816	11.5382	-12.245	-17.495	0	10.5048
1,3	-2.45	-3.5667	-0.9667	1.03333	-22.75	-28	-0.7833	0
	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866	4.78866	0
	-12.171	-13.288	-10.688	-8.6882	-32.471	-37.721	-10.505	0
	7.27149	6.15482	8.75482	10.7548	-13.029	-18.279	8.93816	0

Level		Least Sq Mean
1,1	A	58.866667
1,0	A	53.616667
0,1	B	34.433333
0,0	B	33.316667
0,2	B	31.833333
1,2	B	31.650000
1,3	B	30.866667
0,3	B	29.833333

Levels not connected by same letter are significantly different.

# JMP for RCBD with a Factorial Arrangement, with A and B Random



Notice the Method is EMS (Traditional)

## Output for JMP Analysis of an RCBD with a Factorial Arrangement, A and B Random

### Response Yield

#### Summary of Fit

RSquare	0.739833
RSquare Adj	0.650633
Root Mean Square Error	8.294197
Mean of Response	38.05208
Observations (or Sum Wgts)	48

#### Analysis of Variance

Source	DF	Sum of Squares	Mean Square	F Ratio
Model	12	6846.9800	570.582	8.2941
Error	35	2407.7798	68.794	Prob > F
C. Total	47	9254.7598		<.0001*

Error MS

#### Parameter Estimates

Term	Estimate	Std Error	t Ratio	Prob> t
Intercept	38.052083	1.197164	31.79	<.0001*
Rep[1]	-5.339583	2.676941	-1.99	0.0539
Rep[2]	1.2229167	2.676941	0.46	0.6506
Rep[3]	-2.239583	2.676941	-0.84	0.4085
Rep[4]	-7.002083	2.676941	-2.62	0.0131*
Rep[5]	6.9979167	2.676941	2.61	0.0131*
A[0]	-5.697917	1.197164	-4.76	<.0001*
B[0]	5.4145833	2.073549	2.61	0.0132*
B[1]	8.5979167	2.073549	4.15	0.0002*
B[2]	-6.310417	2.073549	-3.04	0.0044*
A[0]*B[0]	-4.452083	2.073549	-2.15	0.0388*
A[0]*B[1]	-6.51875	2.073549	-3.14	0.0034*
A[0]*B[2]	5.7895833	2.073549	2.79	0.0084*

Notice A1 level is missing and the B3 level is missing.

The EMS method does not provide estimates for the last level of factors or the interactions.



## Output for JMP Analysis of an RCBD with a Factorial Arrangement, A and B Random

### Expected Mean Squares

The Mean Square per row by the Variance Component per column  
EMS

	Intercept	Rep&Random	A&Random	B&Random	A*B&Random
Intercept	0	0	0	0	0
Rep&Random	0	8	0	0	0
A&Random	0	0	24	0	6
B&Random	0	0	0	12	6
A*B&Random	0	0	0	0	6

plus 1.0 times Residual Error Variance

### Variance Component Estimates

Component	Var Comp Est	Percent of Total
Rep&Random	26.09625	11.045
A&Random	44.48588	18.829
B&Random	26.56852	11.245
A*B&Random	70.3209	29.764
Residual	68.79371	29.117
Total	236.2653	100.000

These are the estimates of the variances for each SOV. For example,  $\sigma_A^2 = 22.57$ , which is calculated from  $(MS A - MS AxB)/rb$ .

$\sigma_{AB}^2 = 70.3209$ , which is calculated from  $(MS AxB - MS error)/r$ .

These estimates based on equating Mean Squares to Expected Value.

### Test Denominator Synthesis

Source	MS Den	DF Den	Denom MS Synthesis
Rep&Random	68.7937	35	Residual
A&Random	490.719	3	A*B&Random
B&Random	490.719	3	A*B&Random
A*B&Random	68.7937	35	Residual

This column shows you what the program used as the denominator of the  $F$ -test.

## Output for JMP Analysis of an RCBD with a Factorial Arrangement, A and B Random

### Tests wrt Random Effects

Source	SS	MS Num	DF Num	F Ratio	Prob > F
Rep&Random	1387.82	277.564	5	4.0347	0.0054*
A&Random	1558.38	1558.38	1	3.1757	0.1728
B&Random	2428.62	809.541	3	1.6497	0.3455
A*B&Random	1472.16	490.719	3	7.1332	0.0007*

### A&Random Effect Test

Sum of Squares	F Ratio	DF	Prob > F
1558.3802	3.1757	1	0.1728

Denominator MS Synthesis: **A\*B&Random**  
Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
0	32.354167	4.5217949	32.3542
1	43.750000	4.5217949	43.7500

This shows you what was used as the denominator of the *F*-test and was used to perform the mean separation.

### B&Random Effect Test

Sum of Squares	F Ratio	DF	Prob > F
2428.6240	1.6497	3	0.3455

Denominator MS Synthesis: **A\*B&Random**  
Least Squares Means Table

Level	Least Sq Mean	Std Error	Mean
0	43.466667	6.3947837	43.4667
1	46.650000	6.3947837	46.6500
2	31.741667	6.3947837	31.7417
3	30.350000	6.3947837	30.3500

## Output for JMP Analysis of an RCBD with a Factorial Arrangement, A and B Random

### A\*B&Random Effect Test

Sum of Squares	F Ratio	DF	Prob > F
1472.1573	7.1332	3	0.0007*

### Denominator MS Synthesis: Residual Least Squares Means Table

Level	Least Sq Mean	Std Error
0,0	33.316667	3.3860919
0,1	34.433333	3.3860919
0,2	31.833333	3.3860919
0,3	29.833333	3.3860919
1,0	53.616667	3.3860919
1,1	58.866667	3.3860919
1,2	31.650000	3.3860919
1,3	30.866667	3.3860919

## Output for JMP Analysis of an RCBD with a Factorial Arrangement A Random and B Fixed

### Response Yield

#### Summary of Fit

RSquare	0.727167
RSquare Adj	0.708565
Root Mean Square Error	8.294197
Mean of Response	38.05208
Observations (or Sum Wgts)	48

#### Parameter Estimates

Term	Estimate	Std Error	DFDen	t Ratio	Prob> t
Intercept	38.052083	6.067588	1.278	6.27	0.0650
B[0]	5.4145833	5.538045	3	0.98	0.4003
B[1]	8.5979167	5.538045	3	1.55	0.2183
B[2]	-6.310417	5.538045	3	-1.14	0.3373

#### Random Effect Predictions

Term	BLUP	Std Error	DFDen	t Ratio	Prob> t
Rep[1]	-4.016176	3.120786	8.204	-1.29	0.2332
Rep[2]	0.9198188	3.120786	8.204	0.29	0.7755
Rep[3]	-1.684506	3.120786	8.204	-0.54	0.6037
Rep[4]	-5.266629	3.120786	8.204	-1.69	0.1290
Rep[5]	5.2634945	3.120786	8.204	1.69	0.1292
Rep[6]	4.7839979	3.120786	8.204	1.53	0.1629
A[0]	-3.903697	5.408052	1	-0.72	0.6020
A[1]	3.9036969	5.408052	1	0.72	0.6020
A[0]*B[0]	-5.370636	6.728114	2.858	-0.80	0.4857
A[0]*B[1]	-7.147578	6.728114	2.858	-1.06	0.3695
A[0]*B[2]	3.4352552	6.728114	2.858	0.51	0.6464
A[0]*B[3]	2.9122039	6.728114	2.858	0.43	0.6957
A[1]*B[0]	5.3706364	6.728114	2.858	0.80	0.4857

The value calculated for a random variable is call a BLUP (best linear unbiased predictor).

In the REML analysis, all levels of a factor have a BLUP. In the EMS analysis, the last level was missing.

**Output for JMP Analysis of an RCBD with a Factorial Arrangement  
A Random and B Fixed**

Term	BLUP	Std Error	DFDen	t Ratio	Prob> t
A[1]*B[1]	7.1475779	6.728114	2.858	1.06	0.3695
A[1]*B[2]	-3.435255	6.728114	2.858	-0.51	0.6464
A[1]*B[3]	-2.912204	6.728114	2.858	-0.43	0.6957

**REML Variance Component Estimates**

Random Effect	Var Ratio	Var Component	Std Error	95% Lower	95% Upper	Wald p-Value
Rep	0.3793406	26.09625	22.03941	-17.1002	69.2927	0.2364
A	0.6466562	44.48588	93.333655	-138.4447	227.41648	0.6336
A*B	1.0221996	70.320898	66.834633	-60.67258	201.31437	0.2927
Residual		68.793708	16.444842	45.25617	117.05653	
Total		209.69674	107.50835	94.168607	804.13712	

-2 LogLikelihood = 339.73700671

Note: Total is the sum of the positive variance components.

Total including negative estimates = 209.69674

**Fixed Effect Tests**

Source	Nparm	DF	DFDen	F Ratio	Prob > F
B	3	3	3	1.6497	0.3455

*F*-tests are calculated only on the fixed effects. What should be the denominator to test B if B is a fixed effect?

AxB, which has 3 df

**Effect Details**

**B**

**Least Squares Means Table**

Level	Least Sq Mean	Std Error
0	43.466667	8.2149603
1	46.650000	8.2149603
2	31.741667	8.2149603
3	30.350000	8.2149603

**Output for JMP Analysis of an RCBD with a Factorial Arrangement  
A Random and B Fixed**

**A**

**Least Squares Means Table**

<b>Level</b>	<b>Least Sq Mean</b>	<b>Std Error</b>
0	34.148386	4.6450812
1	41.955780	4.6450812

**A\*B**

**Least Squares Means Table**

<b>Level</b>	<b>Least Sq Mean</b>	<b>Std Error</b>
0,0	34.192333	3.8921672
0,1	35.598725	3.8921672
0,2	31.273225	3.8921672
0,3	29.358507	3.8921672
1,0	52.741000	3.8921672
1,1	57.701275	3.8921672
1,2	32.210108	3.8921672
1,3	31.341493	3.8921672