

5.1.2: Two-Factor Factorial - Greenhouse Example (Minitab)

For Minitab, we also need to convert the data to a stacked format ([Lesson 4 2 way Stacked Dataset](#)). Once we do this, we will need to use a different set of commands to generate the ANOVA. We use...

Stat > ANOVA > General Linear Model > Fit General Linear Model

and get the following dialog box:

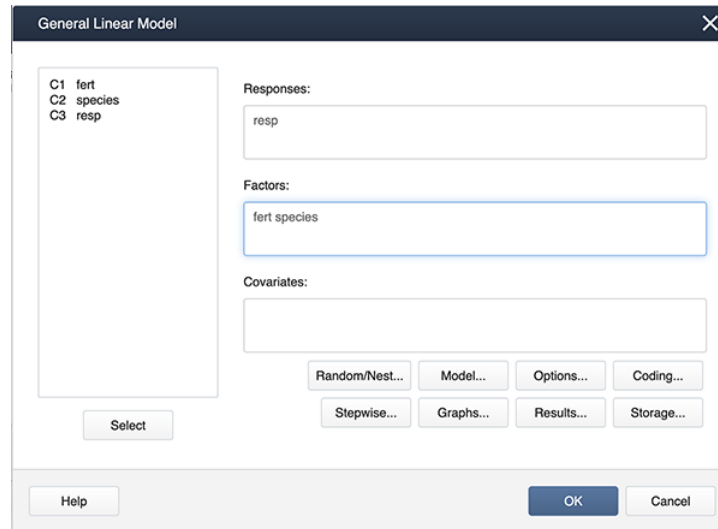


Figure 5.1.2.1: General Linear Model pop-up window.

Click on **Model...**, hold down the shift key and highlight both factors. Then click on the **Add** box to add the interaction to the model.

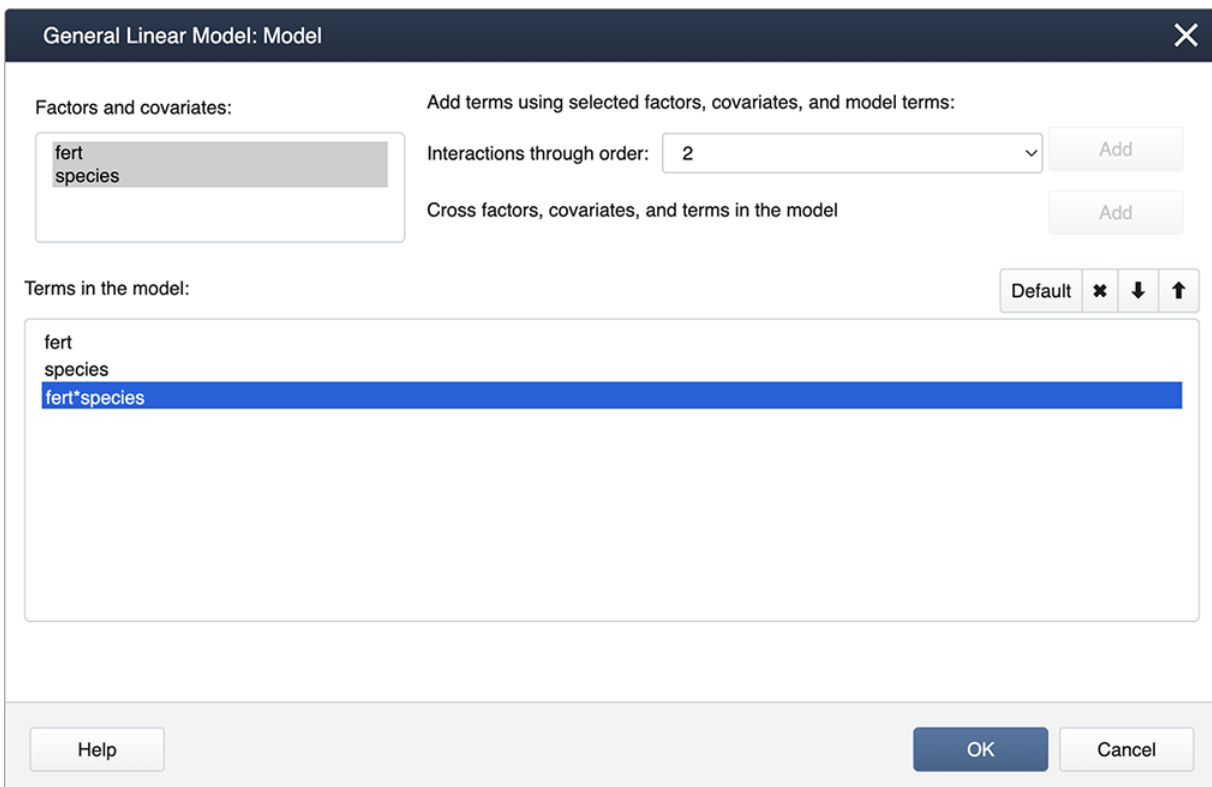


Figure 5.1.2.2: General Linear Model: Model pop-up window.

These commands will produce the ANOVA results below which are similar to the output generated by SAS (shown in the previous section).

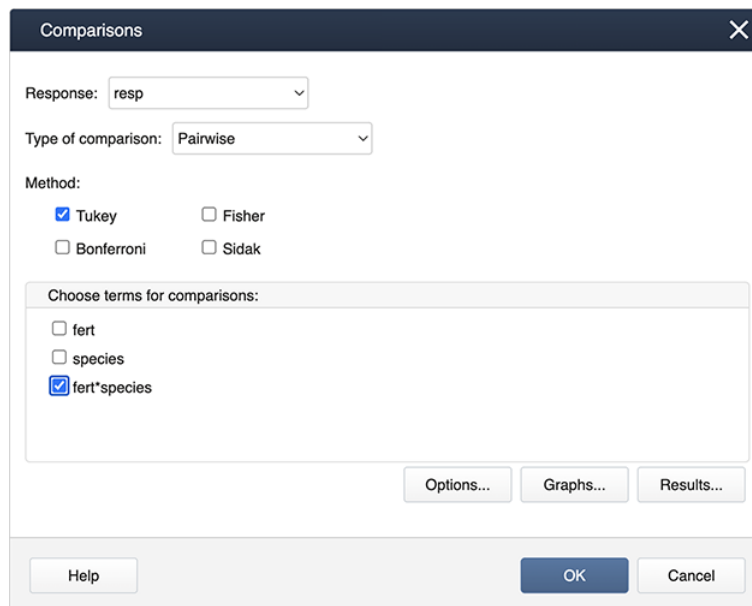
Analysis of Variance

Source	DF	Adj SS	Adj MS	F-value	P-value
fert	3	745.44	248.479	73.10	0.000
species	1	236.74	236.741	69.65	0.000
fert*species	3	50.58	16.861	4.96	0.005
Error	40	135.97	3.399		
Total	47	1168.73			

Following the ANOVA run, you can generate the mean comparisons by

Stat > ANOVA > General Linear Model > Comparisons

Then specify the *fert*species* interaction term for the comparisons by checking the box.

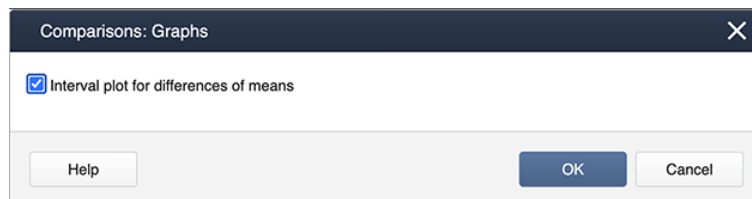


The 'Comparisons' dialog box shows the following settings:

- Response: resp
- Type of comparison: Pairwise
- Method:
 - ☒ Tukey
 - ☐ Fisher
 - ☐ Bonferroni
 - ☐ Sidak
- Choose terms for comparisons:
 - ☐ fert
 - ☐ species
 - ☒ fert*species
- Buttons: Options..., Graphs..., Results..., Help, OK, Cancel

Figure 5.1.2.3: Comparisons pop-up window.

Then choose **Graphs** to get the following dialog box, where "Interval plot for difference of means" should be checked.



The 'Comparisons: Graphs' dialog box shows the following settings:

- ☒ Interval plot for differences of means
- Buttons: Help, OK, Cancel

Figure 5.1.2.4: Comparisons: Graphs pop-up window.

The outputs are shown below.

Grouping Information Using the Tukey Method and 95% Confidence

fert	species	N	Mean	Grouping
f3	SppB	6	37.0667	A
f1	SppB	6	31.6167	B
f2	SppB	6	30.0500	B
f3	SppA	6	29.2000	B C
f1	SppA	6	28.6000	B C
f2	SppA	6	25.8667	C D
control	SppB	6	23.7000	D E
control	SppA	6	21.0000	E

Means that do not share a letter are significantly different.


 Minitab Tukey Simultaneous 95% confidence intervals graph of differences of means for resp.

Figure 5.1.2.5: Tukey simultaneous 95% confidence intervals.

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