# PLANT-GROWTH EXPERIMENT

## 14. Final Comments

The plant-growth experiment is an example of a factorial experiment. A factorial experiment consists of several factors (seed, water) which are set at different levels, and a response variable (plant height). The purpose of the experiment is to assess the impact of different combinations of the levels of seed and water on plant height. Analysis of variance allows us to test the null hypothesis that seed and water have no impact on plant height. As the plant-growth experiment involved replications, so that responses are available from more than one subject at each combination of levels of seed and water, the presence of interaction can be assessed.

The General Factorial Procedure available in SPSS 8.0 provides regression analysis and analysis of variance for one dependent variable by one or more factors or variables. Analysis of variance allows us to test the null hypothesis that seed and water have no impact on plant height. The p-value of the F-test for the model is reported as zero indicating a sufficient evidence of an effect of at least one of the factors on the plant height.

The p-value of the F-test for the seed factor is reported as 0.741, indicating a sufficient evidence of no effect of seed type on the plant height. Indeed, in all graphical displays and numerical summaries we found the plant seed not affected by the seed type.

The p-value of the F-test for the water factor is reported as zero. Thus, water main effects are highly statistically significant.

The p-value of the interaction term Seed*Water is equal to 0.007, indicating a strong evidence of an interaction between the two factors.

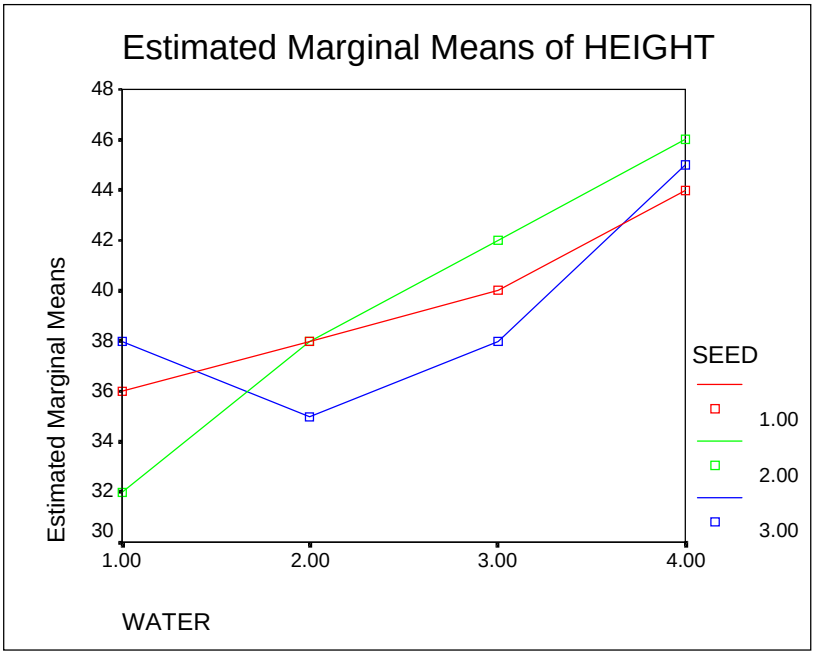
**SEED * WATER**

Dependent Variable: HEIGHT

| SEED | WATER | Mean | Std. Error | 95% Confidence Interval | |
|---|---|---|---|---|---|
| | | | | Lower Bound | Upper Bound |
| 1.00 | 1.00 | 36.000 | 1.041 | 33.732 | 38.268 |
| | 2.00 | 38.000 | 1.041 | 35.732 | 40.268 |
| | 3.00 | 40.000 | 1.041 | 37.732 | 42.268 |
| | 4.00 | 44.000 | 1.041 | 41.732 | 46.268 |
| 2.00 | 1.00 | 32.000 | 1.041 | 29.732 | 34.268 |
| | 2.00 | 38.000 | 1.041 | 35.732 | 40.268 |
| | 3.00 | 42.000 | 1.041 | 39.732 | 44.268 |
| | 4.00 | 46.000 | 1.041 | 43.732 | 48.268 |
| 3.00 | 1.00 | 38.000 | 1.041 | 35.732 | 40.268 |
| | 2.00 | 35.000 | 1.041 | 32.732 | 37.268 |
| | 3.00 | 38.000 | 1.041 | 35.732 | 40.268 |
| | 4.00 | 45.000 | 1.041 | 42.732 | 47.268 |

The combination of seed 2 and water level 4 produces the highest plants. The combination of seed 2 and water level 1 produces the lowest plants. The pooled estimate of the standard deviation is 1.041.

Now we examine the interaction effects with a profile plot. In general, profile plots (interaction plots) are useful for comparing marginal means in your model. A profile plot is a line plot in which each point indicates the estimated marginal mean of a dependent variable at one level of a factor. The plot for our data is displayed below.




The graph indicates a lack of additivity (interaction) between the means for the different seeds when taken across the water levels.

The strongest interaction effect is shown for the water level 1 with seeds 2 and 3. This corresponds to the point where the above graph displays the greatest degree of non-additivity.