

7.7. Parametric two-way ANOVA with equal numbers of replicates

EXAMPLE 7.5. The weaning of *Cosmos atrosaguineus* var. 'Pip' and var. 'Christopher' onto one of four composts following propagation by tissue culture

BOX 7.8. How to carry out a two-way parametric ANOVA with equal replicates

Step 1. Set up the variables

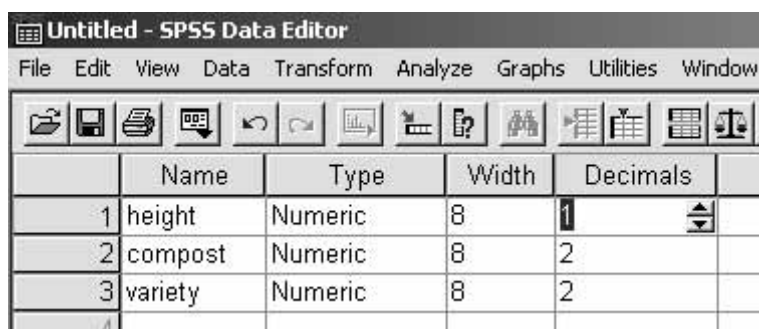
When SPSS starts up, select 'Variable View' using the tabs at the bottom left. You should get something like this:

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1										
2										
3										
4										
5										

The three variables we have are height, compost, and variety. Type their names into the first three name cells. Default properties are set for each variable.

	Name	Type	Width	Decimals	Label	Values	Missing	Columns	Align	Measure
1	height	Numeric	8	2		None	None	8	Right	Scale
2	compost	Numeric	8	2		None	None	8	Right	Scale
3	variety	Numeric	8	2		None	None	8	Right	Scale
4										
5										

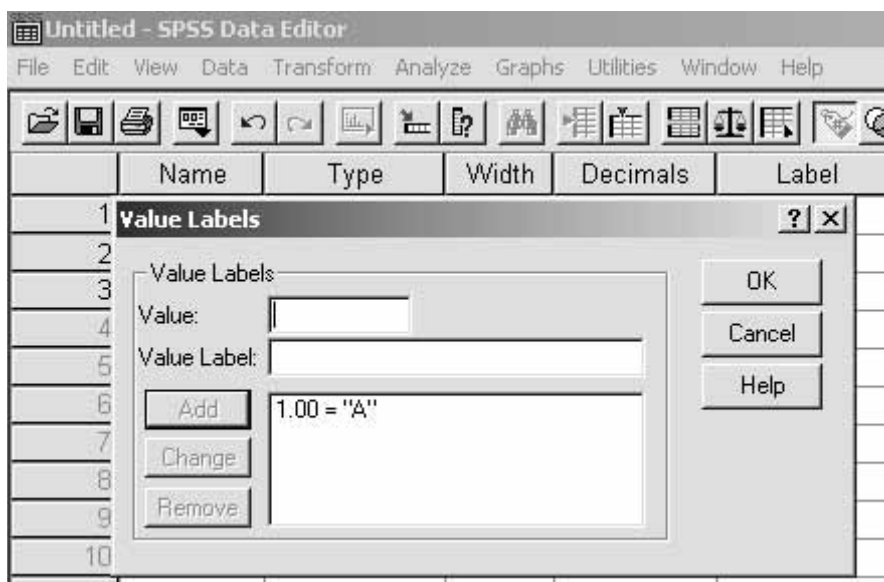
Height is a numeric variable, but our measurements are to two decimal places. To change this property, click in the 'Decimals' cell in row 1, and use the 'up' and 'down' arrows that appear to adjust the number of decimal places to 1.



The screenshot shows the SPSS Data Editor window with a table defining variables. The table has columns for Name, Type, Width, and Decimals.

	Name	Type	Width	Decimals
1	height	Numeric	8	1
2	compost	Numeric	8	2
3	variety	Numeric	8	2
4				

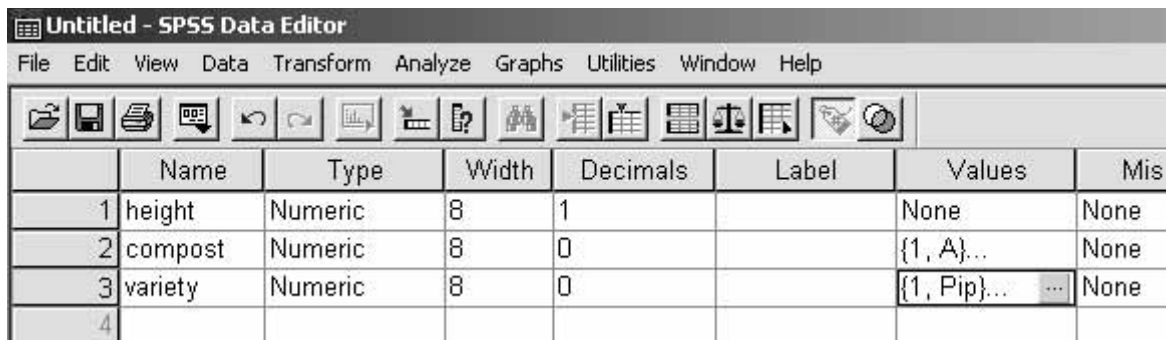
'Compost' and 'variety' are categoric variables, and SPSS works best when these are converted to values. Click in the 'Values' cell for 'compost', and then click in the grey area that appears at the right-hand side of the cell. You should get a dialogue box. In the 'Value' window, type '1', and in the 'Value Label' window, type 'A'. Click on 'Add' to enter the pair into the system.



Repeat for the three other pairs '2' and 'B', '3' and 'C', '4' and 'D'. Then click on 'OK'.

We don't really need decimals for the values, so change the decimals property of 'compost' to zero.

Repeat the process for the varieties: '1' and 'Pip'; '2' and 'Christopher'.

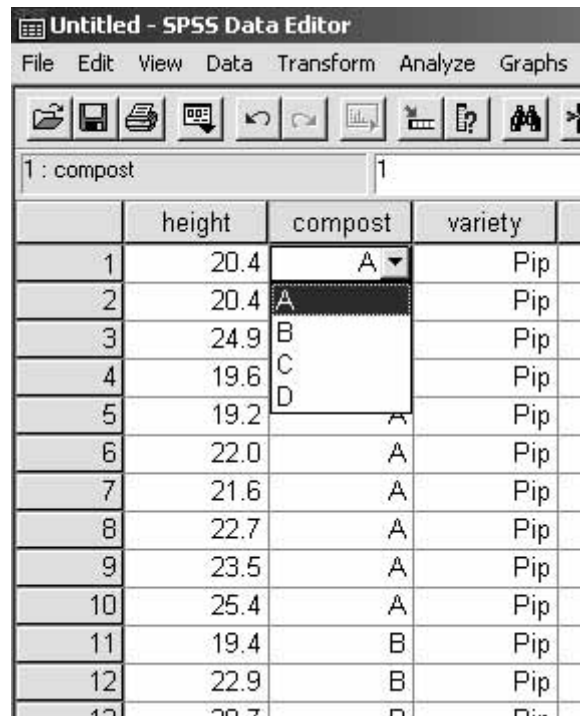


The screenshot shows the 'Variable View' tab in SPSS. The table below represents the data shown in the image:

	Name	Type	Width	Decimals	Label	Values	Mis
1	height	Numeric	8	1		None	None
2	compost	Numeric	8	0		{1, A}...	None
3	variety	Numeric	8	0		{1, Pip}... ..	None
4							

Transfer to 'Data View' by using the tabs at the bottom left.

Enter the data. The heights will need to be entered individually (if you have a word-processed file, it may be possible to copy and paste). The composts are selected from the drop-down menu that appears when you click in one of the 'compost' column cells, and similarly for the variety.

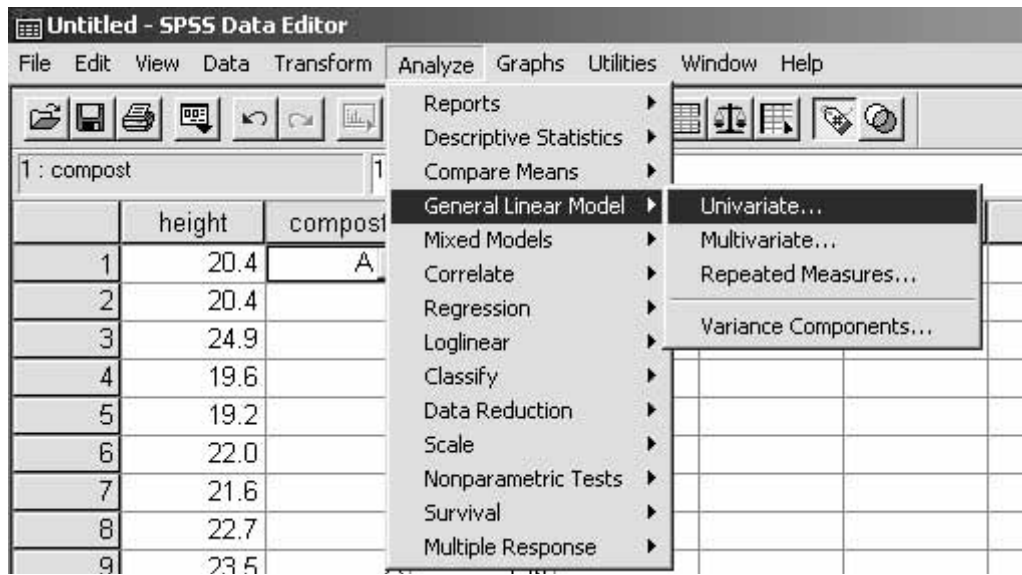


The screenshot shows the 'Data View' tab in SPSS. The table below represents the data shown in the image:

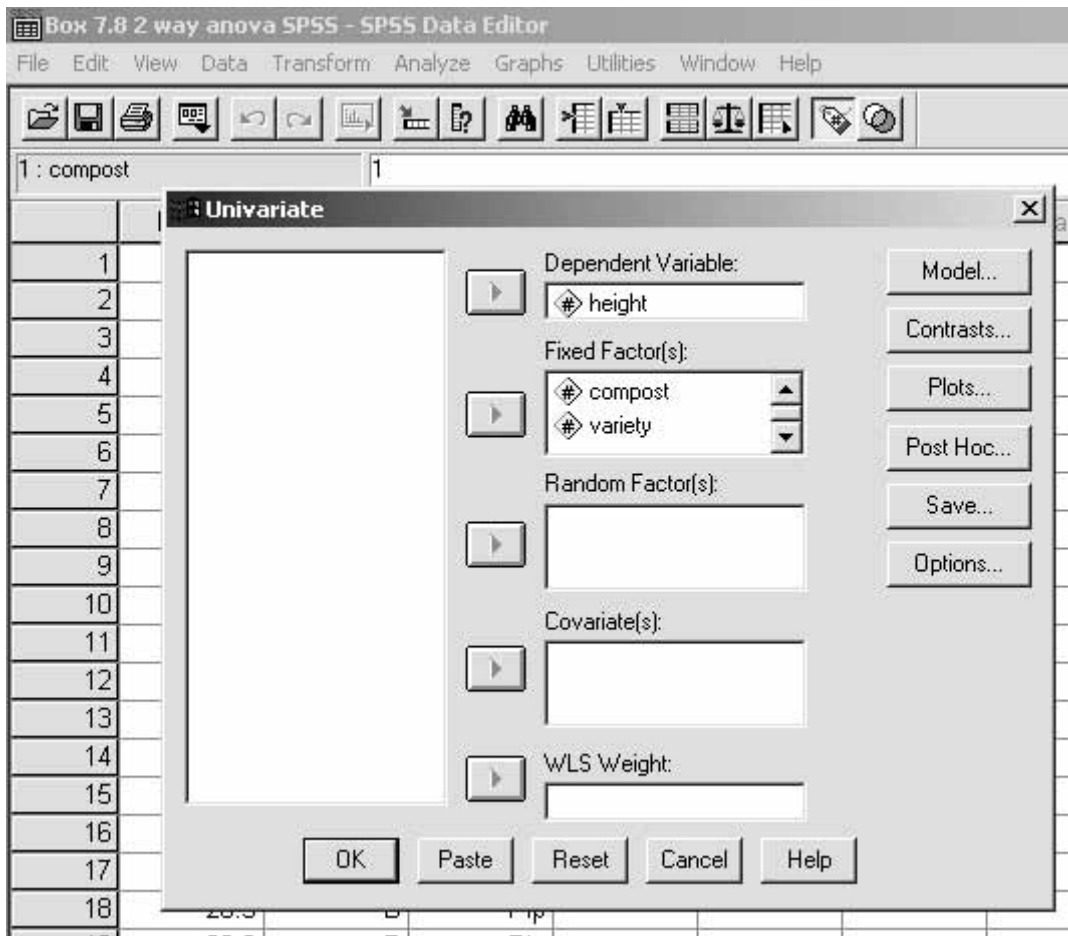
	height	compost	variety
1	20.4	A	Pip
2	20.4	A	Pip
3	24.9	B	Pip
4	19.6	C	Pip
5	19.2	D	Pip
6	22.0	A	Pip
7	21.6	A	Pip
8	22.7	A	Pip
9	23.5	A	Pip
10	25.4	A	Pip
11	19.4	B	Pip
12	22.9	B	Pip

Step 2. Perform the test.

Go to 'Analyze', 'General Linear Model', 'Univariate'.



The dependent variable is the plantlet height. Click on height to highlight it, then click on the appropriate arrow to transfer it across into the 'Dependent Variable' window. In the same way, transfer both 'compost' and 'variety' into the 'Fixed Factor(s)' window.



Click on 'OK'. The output will appear in a separate window.

Univariate Analysis of Variance

Between-Subject Factors

	Value Label	N
COMPOST 1	A	20
2	B	20
3	C	20
4	D	20
VARIETY 1	Pip	40
2	Christopher	40

Tests of Between-Subjects Effects

Dependent Variable: HEIGHT

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	782.574(a)	7	111.796	7.221	.000
Intercept	30089.403	1	30089.403	1943.493	.000
COMPOST	59.871	3	19.957	1.289	.285
VARIETY	607.753	1	607.753	39.255	.000
COMPOST * VARIETY	114.949	3	38.316	2.475	.068
Error	1114.713	72	15.482		
Total	31986.690	80			
Corrected Total	1897.287	79			

a. R Squared = .412 (Adjusted R Squared = .355)

Step 3. Decide what the results mean.

(1) The value of F for the effect of compost on height is 1.289, and the corresponding significance is 0.285. Since this is greater than 0.05, we conclude that there is no significant difference between the heights of plantlets raised in different composts.

(2) The value of F for the effect of variety on compost is 39.255, and the corresponding p value is less than 0.001. We conclude that there is a significant ($F = 39.255$; $p < 0.001$) dependence of height on variety.

(3) The value of F for the interaction between 'compost' and 'variety' is 2.475, and the corresponding significance is 0.068. Since this is greater than 0.05, we conclude that there is no significant interaction between the compost and the variety.