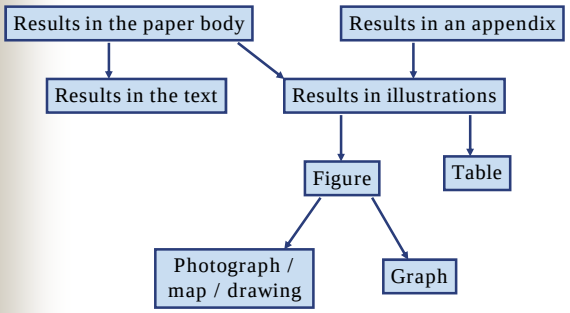
Science Methods & Practice

BES 301

February 17, 2011

Presenting & Interpreting Scientific Results

Presenting Results in a Scientific Publication



Presenting Results

Results in the text vs. Results in illustrations

Why present data in the text?

Why NOT present data in the text?

What kind of data can be presented in the text?

Presenting Results

Results in the text vs. Results in illustrations

What kind of data can be presented in the text?

- **Small amounts; simple comparisons**

" The albedo of crusted surfaces ranged from 10.6 to 12.2% while the albedo of noncrusted soil surfaces averaged more than twice that (25.2%; P<0.001 by t-test; n=12)."

Using an illustration would have taken significantly more space than this simple, clear comparison in the text.

Presenting Results

Results in the text vs. Results in illustrations

What kind of data can be presented in the text?

- **Small amounts; simple comparisons**

Table 8.3. Effect of aeration on growth of *Streptomyces coelicolor*

Temp. (°C)	No. of Expt.	Aeration of Growth Medium	Growth
24	5	+	78
24	5	-	0

In text version

Streptomyces coelicolor grew only in aerated cultures.

or

Colonies of *S. coelicolor* grew quite well under aeration at 24 °C (78 Klett units) while those without aeration under the same temperature conditions did not grow at all (0 Klett units; t = 4.85; P<.001).

Other problems with this table

Table 8.3. Effect of Aeration on Growth of *Streptomyces coelicolor*.

Temp. (°C)	No. of Expt.	Aeration of Growth Medium	Growth
24	5	+	78
24	5	-	0

Problems ?

Other problems with this table

A better table:

Table 8.3. The growth (Klett units) of *Streptomyces coelicolor* at 24 °C with and without aeration. The mean growth is presented for five experiments.

Aeration of Growth Medium	Growth
Yes	78
No	0

Indeed, there is so little quantitative information here that presentation in the text would make more sense.

Presenting Results

Results in the text vs. Results in illustrations

What kind of data can be presented in the text?

- Small amounts; simple comparisons
- **Relative comparisons of data presented in illustration**

Presenting Results

What kind of data can be presented in the text?

- **Relative comparisons of data presented in illustration**

Table 1. Water quality parameters measured in two streams of northern King County, Washington on July 14, 2007 from 1:00 to 2:00 PM. Means are shown ± 1 SD. Different letters indicate significant (P<.05) differences between sites by Student's t test.

Water Quality Parameter	Bear Creek	North Creek
pH	5.9 ± 0.2 a	5.3 ± 0.1 b
Nitrate (mg / L)	6.4 ± 1.2 a	9.2 ± 4.9 a
Dissolved oxygen (ppm)	17.5 ± 1.8 a	11.3 ± 3.3 b

Example Text:

Mean dissolved oxygen concentrations were 55% greater in Bear Creek than North Creek (Table 1). North Creek was 0.6 pH units more acidic than Bear Creek on the average.

Presenting Results

Results in the text vs. Results in illustrations

Text

What data NOT to present in the text?

Temperature measured over time varied as "t (time, in minutes)=15, T (temperature, in °C)=32; t=0, T=25; t=6, T=29; t=3, T=27; t=12, T=32; t=9, T=31.

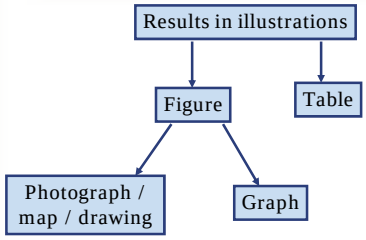
Table

Table 4. Temperature changes over the course of the experiment…

Time (minutes)	Temperature (°C)
0	25
3	27
6	29
9	31
12	32
15	32

Other suggestions for illustrations ?

Presenting Results



How do we select the type of illustration to use?

Presenting Results

Photograph / map / drawing

Presenting Results

Graph vs. Table

The use of a table or graph depends upon which of these things the writer wishes to emphasize.

Presenting Results Practice: Example 1

Observation: Salmonberry (*Rubus spectabilis*) reproduces better in floodplain habitat than on hillsides.

Question: Why does salmonberry reproduce better in floodplain habitat than on hillsides?

Hypothesis 1: Salmonberry reproduces better in floodplain habitats because soil conditions are more favorable there than on hillside.

H1A: Soil moisture is greater in the floodplain than on the hillslope.

H1B: Soil nitrogen is greater in the floodplain than on the hillslope.

H1C: Soil pH is more neutral in the floodplain than on the hillslope.

Presenting Results Practice: Example 1

5 sites at each location (hillslope & floodplain) were sampled for soil moisture, nitrogen & pH

What do we do now to test the hypotheses?

Soil Characteristic	Floodplain	Hillslope
Soil Moisture	65.2	42.1
	64.3	26.2
	55.9	15.1
	59.7	52.9
	60.1	44.5
Soil Nitrogen	0.19	0.10
	0.14	0.23
	0.16	0.05
	0.17	0.26
	0.16	0.07
Soil pH	6.9	5.0
	6.7	4.1
	6.5	5.3
	6.4	4.7
	6.6	5.8

Presenting Results Practice: Example 1

Presentation of data in a table

Upper Bound Line

Headings for variables

Soil Characteristic	Floodplain	Hillside

Heading Bound Line

Data Space

Lower Bound Line

Presenting Results Practice: Example 1

Presentation of data in a table

Table 1. Moisture content, nitrogen concentration, and pH of soils from the North Creek floodplain and adjacent western hillside on July 22, 2003 at the UW Bothell campus, Bothell, Washington. Means (n=5) are shown ± 1 SD. Different letters indicate significant differences (P<.05) between sites for each soil characteristic by Student's t-test.

Soil Characteristic	Floodplain	Hillside
Moisture (% wet weight)	61.0 ± 3.8 a	36.2 ± 15.2 b
Nitrogen (% dry weight)	0.16 ± 0.02 a	0.14 ± 0.10 a
pH	6.6 ± 0.2 a	5.0 ± 0.6 b

Use spacing and clear columns to make it easily readable

Use consistent number of decimal places for each variable & parameter

Presenting Results Practice: Example 1

Professional style table: Use this for class

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Informal style table: Not for class use

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Presenting Results Practice: Example 1

11 Elements of an expanded table caption

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Presenting Results Practice: Example 1

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Presenting Results Practice:
keystroke hints for special characters

Symbol	Keystrokes
±	ALT – 241
µ	ALT – 230
°	ALT - 248

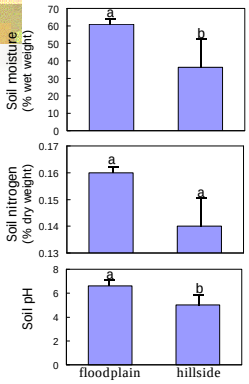
1. Hold down ALT key
2. Type number on NUMBER PAD
3. Release ALT key (symbol appears!)

Do not use:	14.65 +/- 12.60	Difficult to read
Use:	14.65 ± 12.60	Easier to read

Graph Example

Presenting Results Practice: Example 1

Dependent variables



Independent variables

Figure 1. Moisture content, nitrogen concentration, and pH of soils from the North Creek floodplain and adjacent western hillside on July 22, 2003 at the UW Bothell campus, Bothell, Washington. Means (n=5) are shown + 1 SD. Different letters indicate significant differences (P<.05) between sites for each soil characteristic by Student's t-test.

Text Presentation: Example

Table 1. Moisture content, nitrogen concentration, and pH of soils from the North Creek floodplain and adjacent western hillside on July 22, 2003 at the UW Bothell campus, Bothell, Washington. Means (n=5) are shown ± 1 SD. Different letters indicate significant differences (P<.05) between sites for each soil characteristic by Student's t-test.

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pH	6.6 ± 0.2 a	5.0 ± 0.6 b

TEXT: **XX = ?**

Soil moisture was XX % greater in the floodplain than on the hillside on a relative basis (Table 1). Soil moisture was considerably more variable on the hillside. Soil nitrogen concentrations did not differ between the sites, though it was more variable on the hillside. Hillside soils were 24% more acidic (1.6 pH units lower) and more variable than floodplain soils.

Using Relative Comparisons: Example

Soil Characteristic	Floodplain	Hillside
Moisture (% wet weight)	61.0 ± 3.8 a	36.2 ± 15.2 b
Nitrogen (% dry weight)	0.16 ± 0.02 a	0.14 ± 0.10 a
pH	6.6 ± 0.2 a	5.0 ± 0.6 b

Soil moisture was 68.5 % greater in the floodplain than on the hillside (Table 1).

Soil moisture was 40.7 % less on the hillside than in the floodplain (Table 1).

Interpreting Presented Data: Example 1

Table 1. Moisture content, nitrogen concentration . . . (see caption on previous slides)

Soil Characteristic	Floodplain	Hillside
Moisture (% wet weight)	61.0 ± 3.8 a	36.2 ± 15.2 b
Nitrogen (% dry weight)	0.16 ± 0.02 a	0.14 ± 0.10 a
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Moisture:

Interpreting Presented Data: Example

Table 1. Moisture content, nitrogen concentration ...

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pH	6.6 ± 0.2 a	5.0 ± 0.6 b

Moisture:

Nitrogen:

pH:

Overall Conclusion:

Interpreting Presented Data: Example

Table 1. Moisture content, nitrogen concentration ...

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pH	6.6 ± 0.2 a	5.0 ± 0.6 b

Moisture:

Nitrogen:

pH:

Which of the three results is the most conclusive scientific result?

Presenting Results Practice: Example 2

In order to better understand the implications of the previous soil tests, we conduct a greenhouse experiment with salmonberry – examining the exact responses of reproduction to varying levels of water and nitrogen.

Results

Number of flowers produced per plant

WATER LEVEL (% soil moisture)	GROWTH MEDIUM NITROGEN CONC. (ppm) 1,000	10,000
2.0	10	10
	8	11
	7	8
7.0	12	15
	9	17
	8	15
12.0	13	22
	17	24
	16	27

Is this table appropriate for presentation in a paper?

Presenting Results Practice: Example 2

Table 2. The response of flower production (number of flowers per plant) in *Rubus spectabilis* to varying soil moisture and nitrogen concentration. Means (n=3) are shown ± 1 SD. Different lowercase letters indicate significant differences (P<.05) among soil moisture levels within each nitrogen class by Student's t-test. Different uppercase letters indicate significant differences (P<.05) between soil nitrogen classes within each soil moisture level by Student's t-test.

Soil Moisture (% wet weight)	Nitrogen Concentation (ppm) 1,000	10,000
2	8.3 ± 1.5 aA	9.7 ± 1.5 aA
7	9.7 ± 2.1 aA	15.7 ± 1.2 bB
12	15.3 ± 2.1 bA	24.3 ± 2.5 cB

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Interpreting Results Practice: Example 2

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Moisture: Salmonberry flowering is generally enhanced by more soil moisture, though it is more sensitive to moisture where nitrogen is more abundant

Nitrogen: Salmonberry flowering is enhanced by more nitrogen, though only at moderate to high levels of soil moisture.

There is certainly an interactive effect of moisture and nitrogen: ***the effect of one independent variable depends upon the level of the other independent variable***

Presenting Results Practice: Example 2

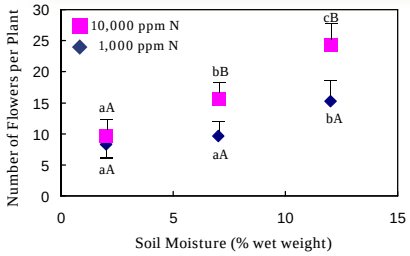

Figure 2. The response of flower production (number of flowers per plant) in *Rubus spectabilis* to varying soil moisture and nitrogen concentration. Means (n=3) are shown + or - 1 SD. Different lowercase letters indicate significant differences (P<.05) among soil moisture levels within each nitrogen class by Student's t-test. Different uppercase letters indicate significant differences (P<.05) between soil nitrogen classes within each soil moisture level by Student's t-test.

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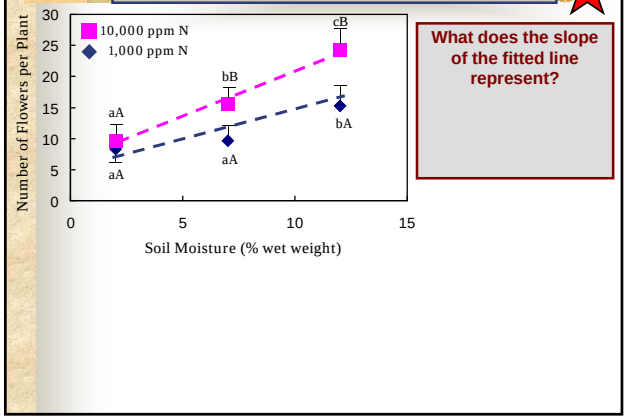

What does the slope of the fitted line represent?