SCIU4T4: Decimals, significant figures, and plots

Decimal places

Digits after the decimal point (including 0s)

Value: **1.23041**

- 5 Decimals: 1.23041
- 4 Decimals: 1.2304
- 3 Decimals: 1.230
- 2 Decimals: 1.23
- 1 Decimals: 1.2

Decimal places

Digits after the decimal point (including 0s)

Value: **1430.02021**

- 5 Decimals: 1430.02021
- 4 Decimals: 1430.0202
- 3 Decimals: 1430.020
- 2 Decimals: 1430.02
- 1 Decimals: 1430.0

Significant figures

- **All** digits of a number
- Initial 0s don't count
- Other 0s do count

- 21.341
- 0.032
- 0.010230

Significant figures

Digits needed to infer the accuracy of a value[1]

- 240.23432 implies more accuracy than 240
- 1.324 implies more accuracy than 1.3

[1] Rahman, N A. 1968. A Course in Theoretical Statistics. Charles Griffin & Company, London.

Significant figures

- **All** digits of a number
- Initial 0s don't count
- Other 0s do count

- 0.32400
- 0.00031
- 2000

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 0.1234 to 3 decimal places:

$$0.1234 \rightarrow 0.123$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 0.1235 to 3 decimal places:

$$0.1235 \rightarrow 0.124$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 3.184 to 3 significant figures:

$$3.184 \rightarrow 3.18$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 3.185 to 3 significant figures:

$$3.185 \rightarrow 3.19$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 3.195 to 3 significant figures:

$$3.195 \rightarrow 3.20$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 12.9806 to 3 significant figures:

$$12.9806 \rightarrow 13.0$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 12.9806 to 1 significant figure:

$$12.9806 \rightarrow 10$$

Rounding to specific digits or significant figures

Rules for rounding:

- Round based on digit to the right
- If digit is [0, 1, 2, 3, 4] round down
- If digit is [5, 6, 7, 8, 9] round up
- Round down keeps digit the same
- Rounding up increases digit by 1

Round 10.023 to 2 significant figures:

$$10.023 \rightarrow 10.$$

Can indicate significant figures with scientific notation

2000 in significant figures:

1. 2×10^3
2. 2.0×10^3
3. 2.00×10^3
4. 2.000×10^3

Data visualisation

- Histograms
- Barplots
- Pie Charts
- Box-whisker plots

Histogram

- Important visualisation tool
- Show **distribution** of *continuous* data
- Need for statistical decision-making
- How to build a histogram

Histogram

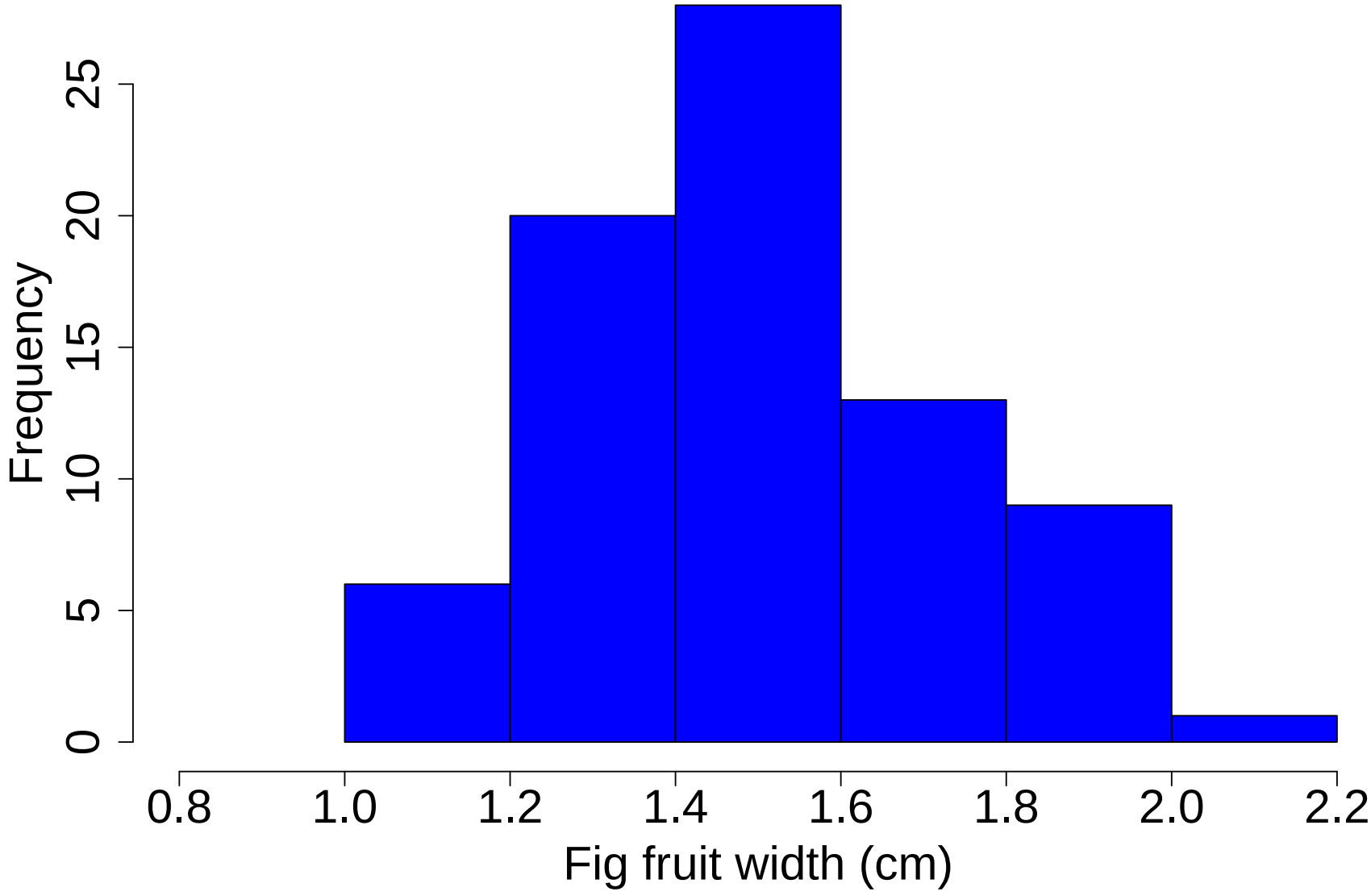


Figure 1: Fig fruit width (cm) using data from 78 fig fruits.

Histogram

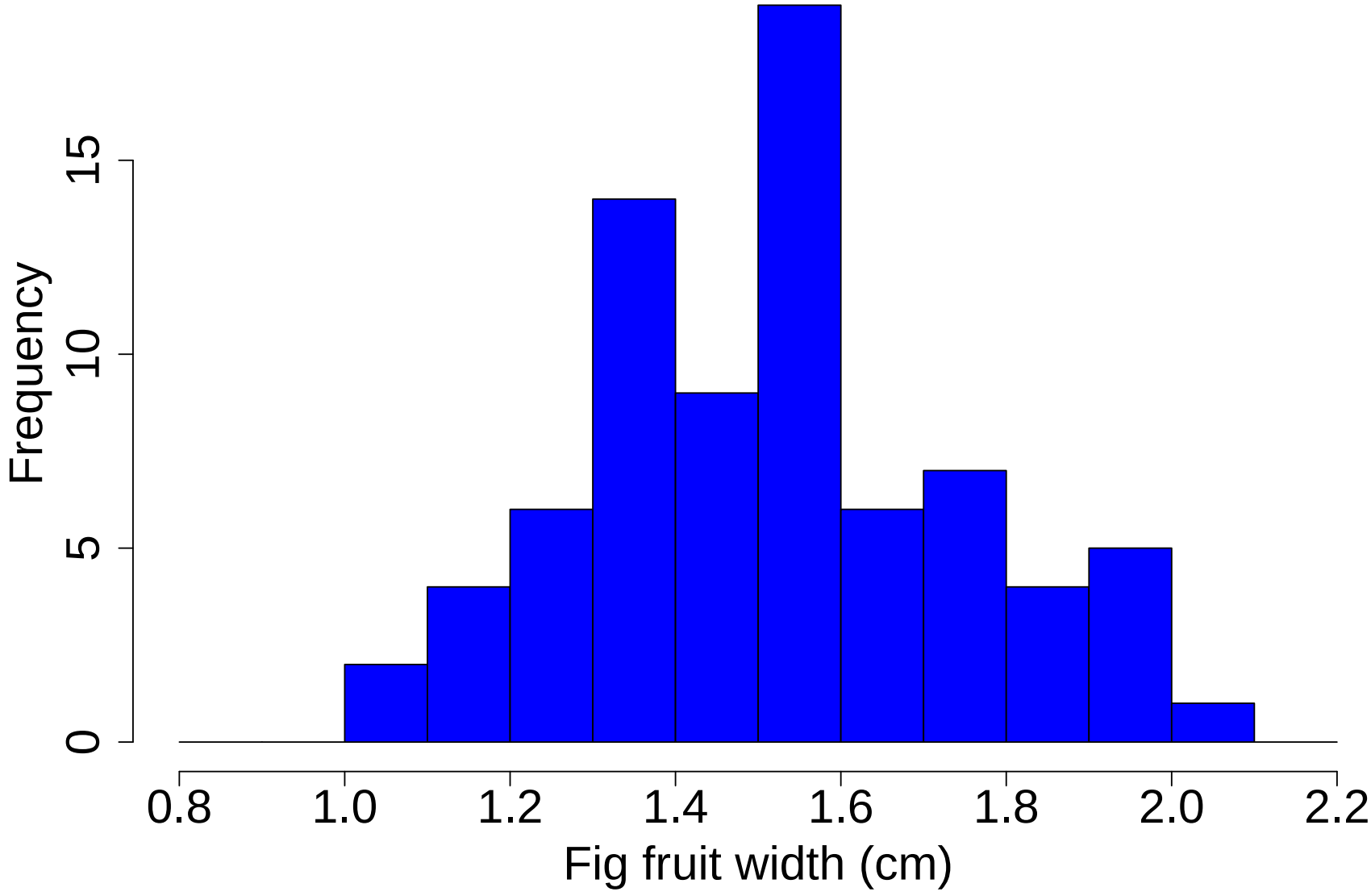


Figure 2: Fig fruit width (cm) using data from 78 fig fruits.

Histogram

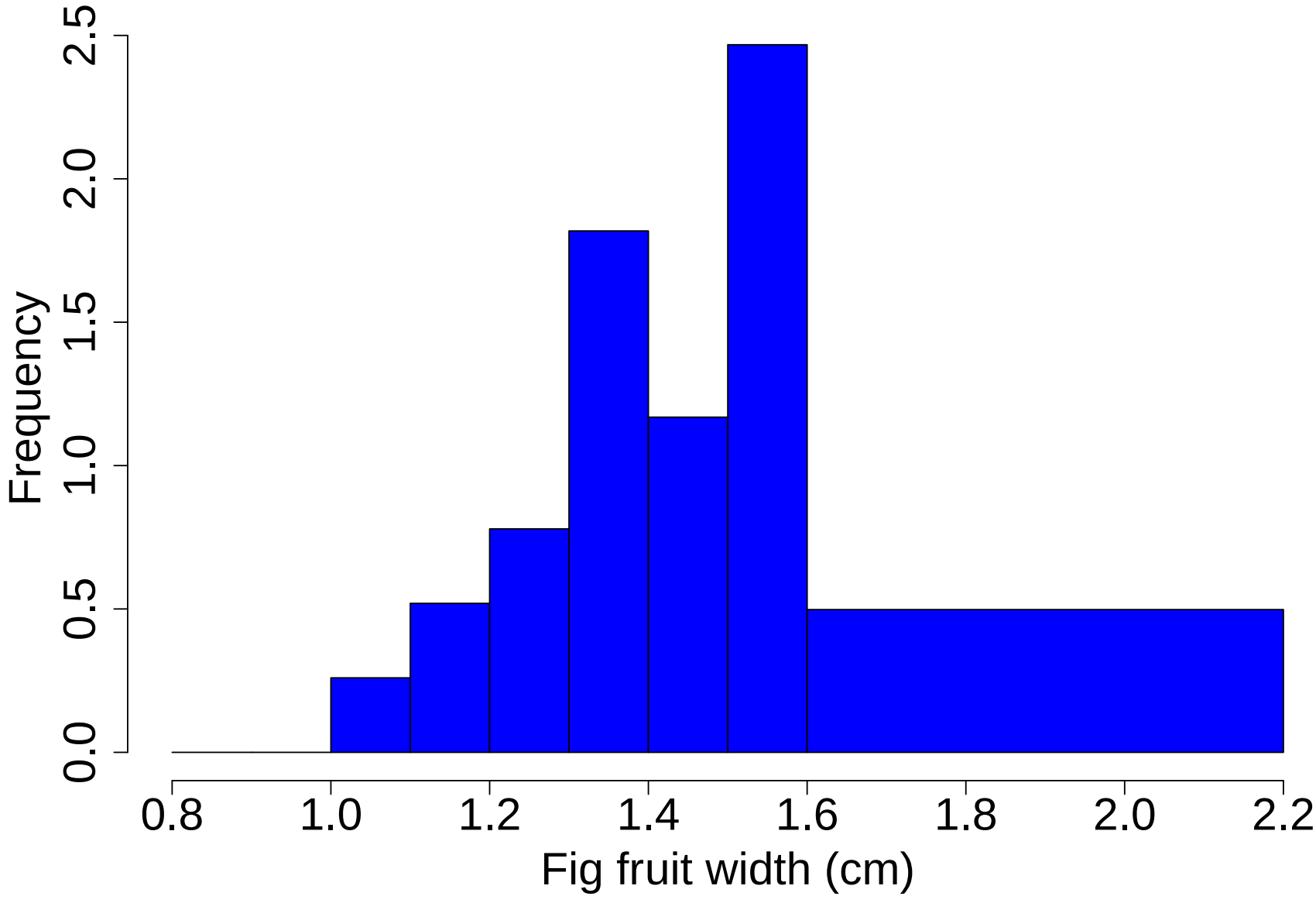


Figure 3: Fig fruit width (cm) using data from 78 fig fruits.

Barplots

- Visualise *categorical* data
- Categories separated in bars
- Heights indicate magnitudes
- Different from histograms

Barplots

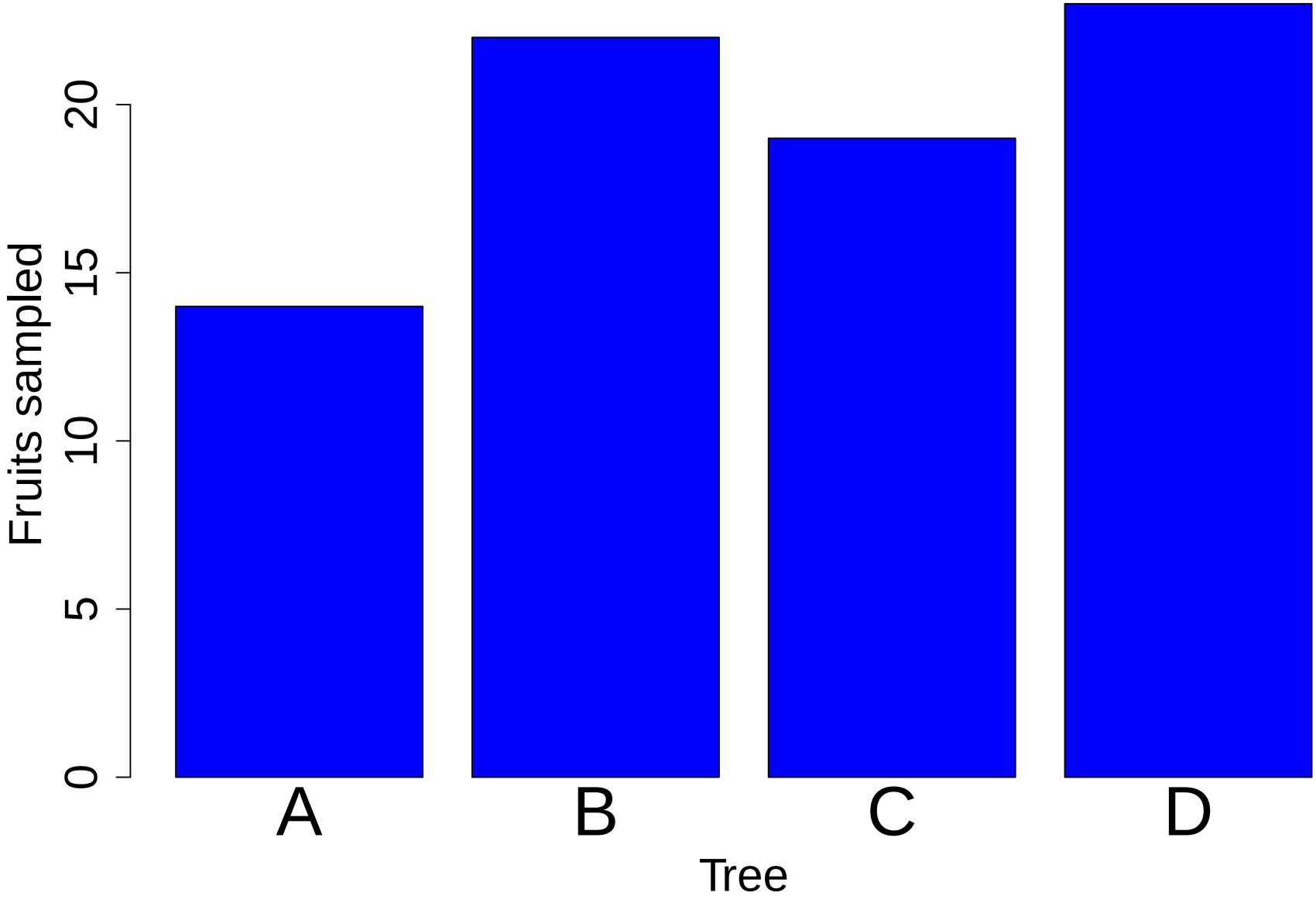


Figure 4: Fruits from each of four trees (78 total).

Pie charts

- Visualise *categorical* data
- Show percentage of categories
- Used less often than barplots
- Do not show absolute magnitude

Pie charts

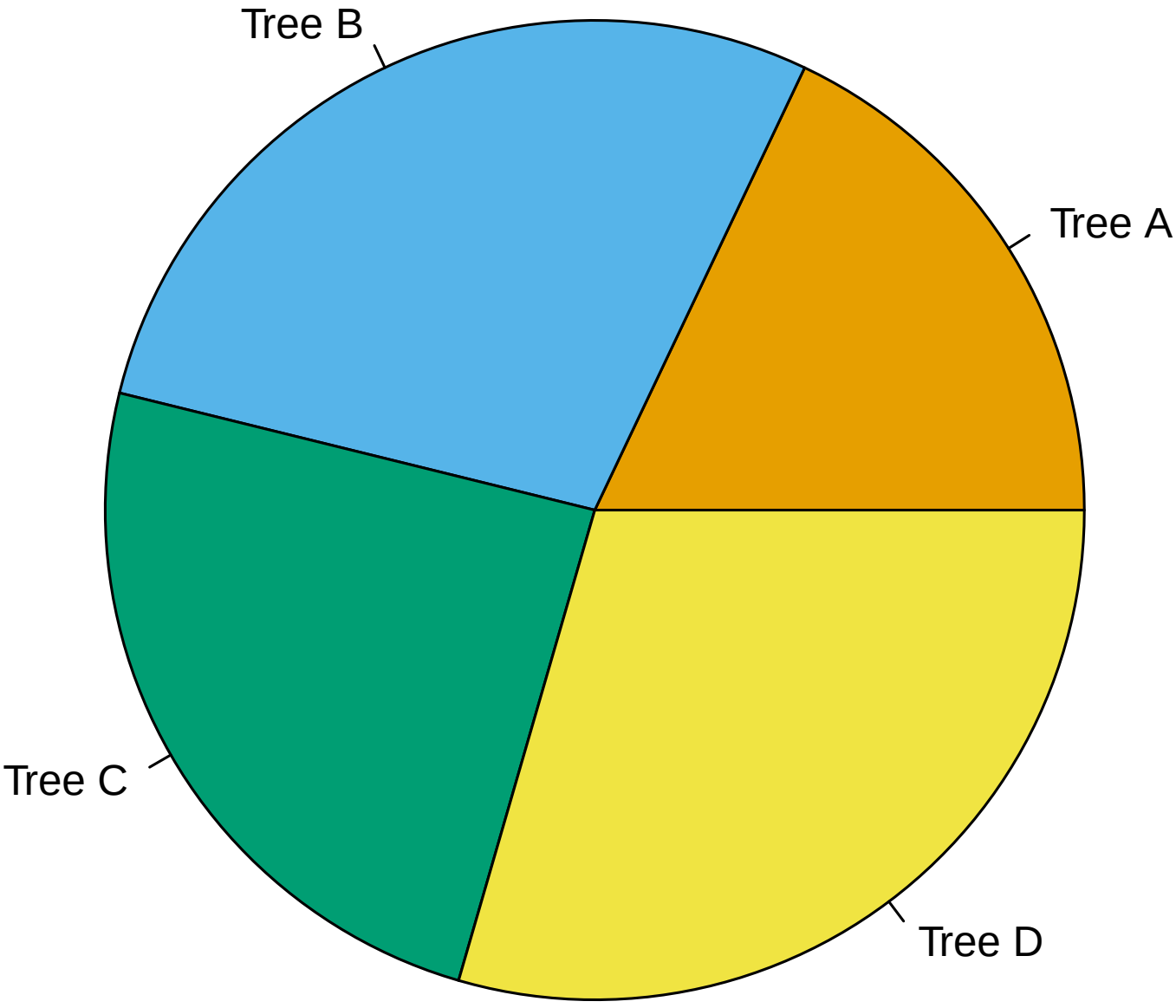
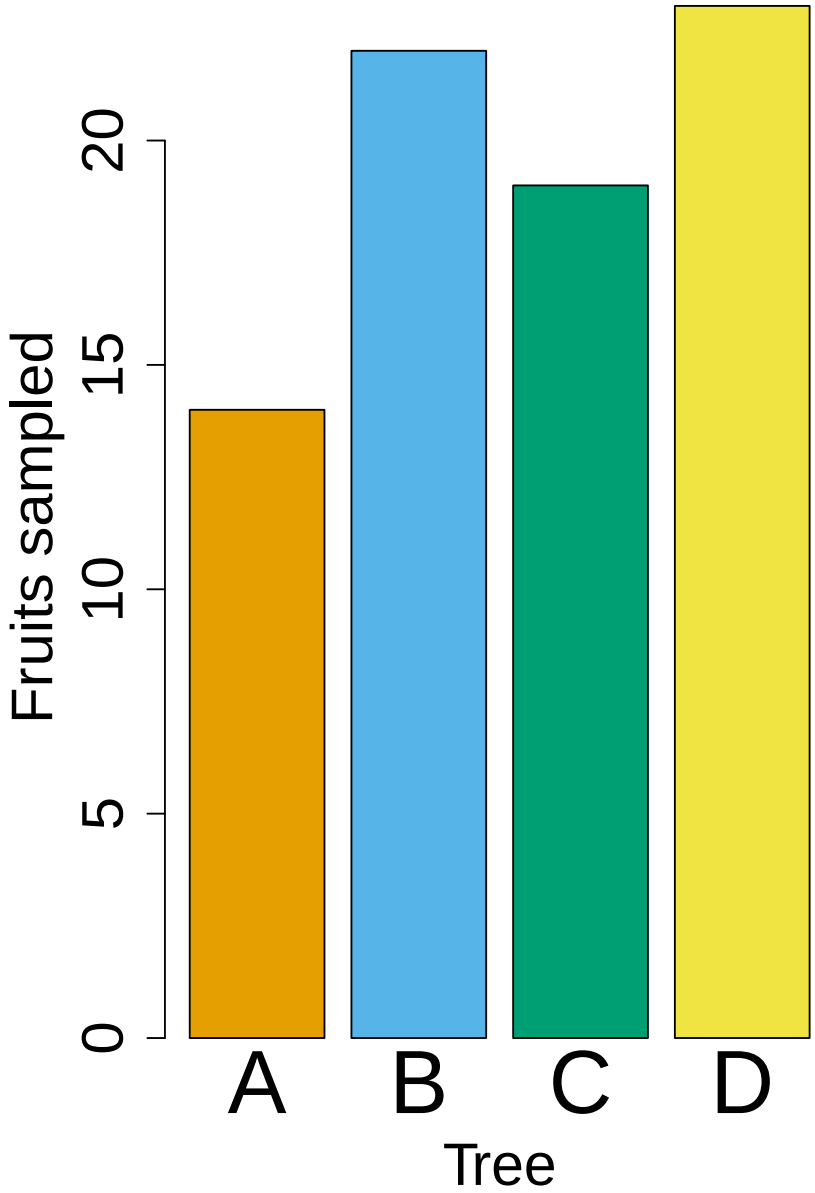


Figure 5: Pie chart of fruits from 4 trees.

Barplot versus pie charts



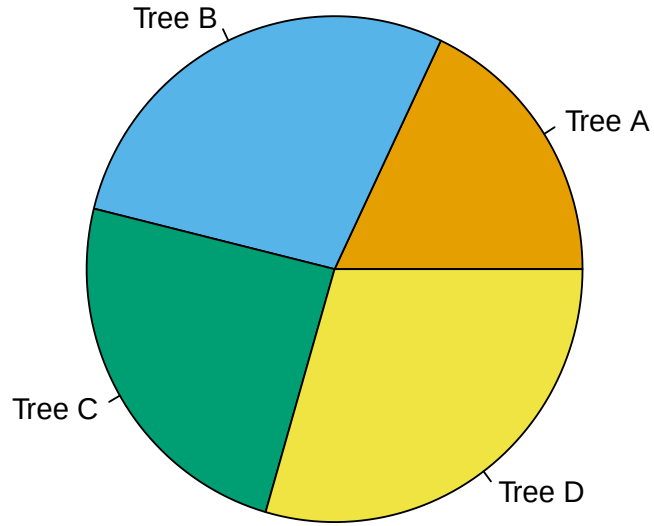


Figure 6: Barplot and pie chart of fruits from 4 trees.

Box-whisker plots (boxplots)

- Show distributions
- Visualise summary statistics
- Can compare distributions
- More compact than a histogram (but a bit less information)

Box-whisker plots (boxplots)

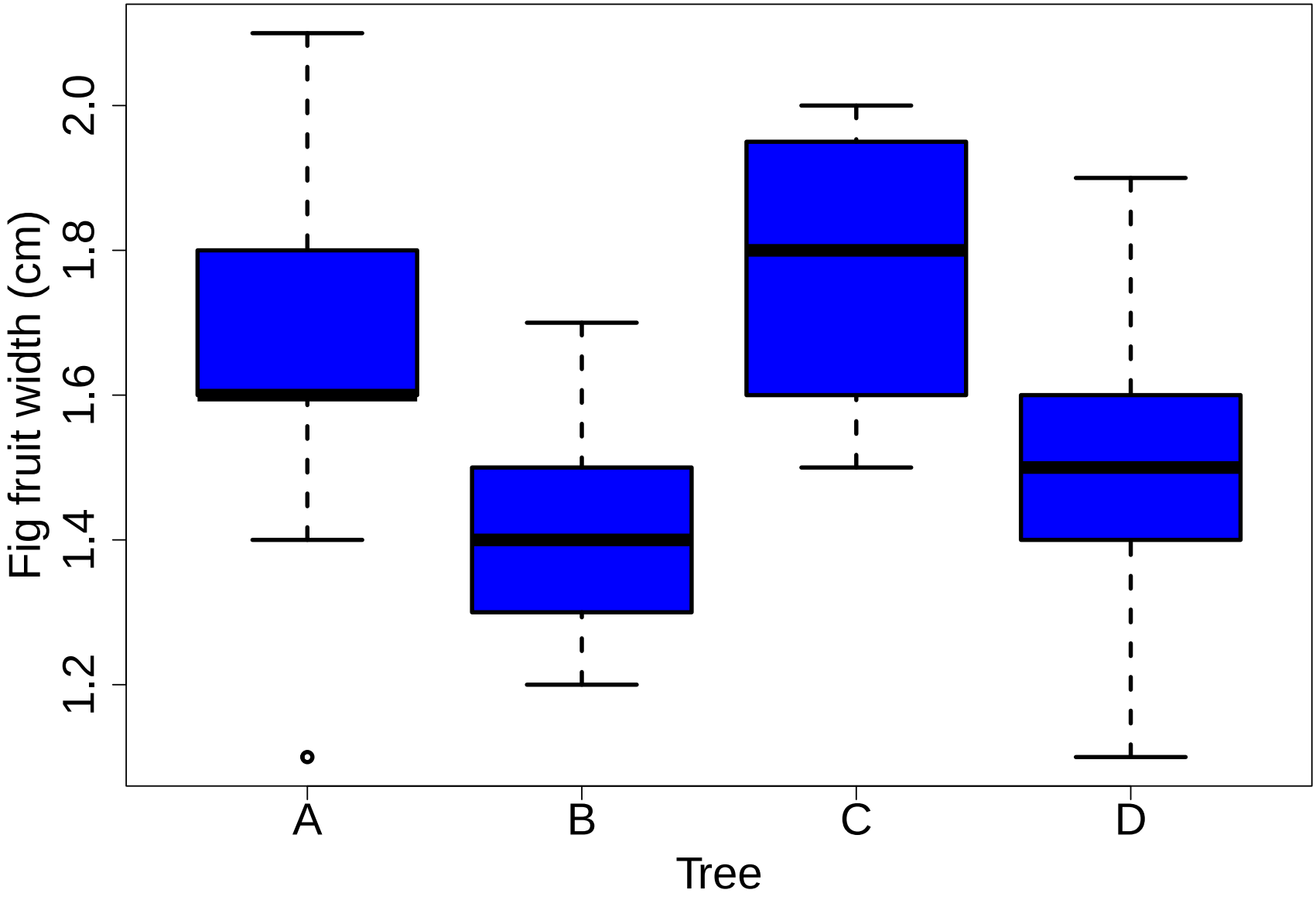


Figure 7: Boxplot of fig fruit widths (cm) collected from 4 trees.

Boxplot versus histogram

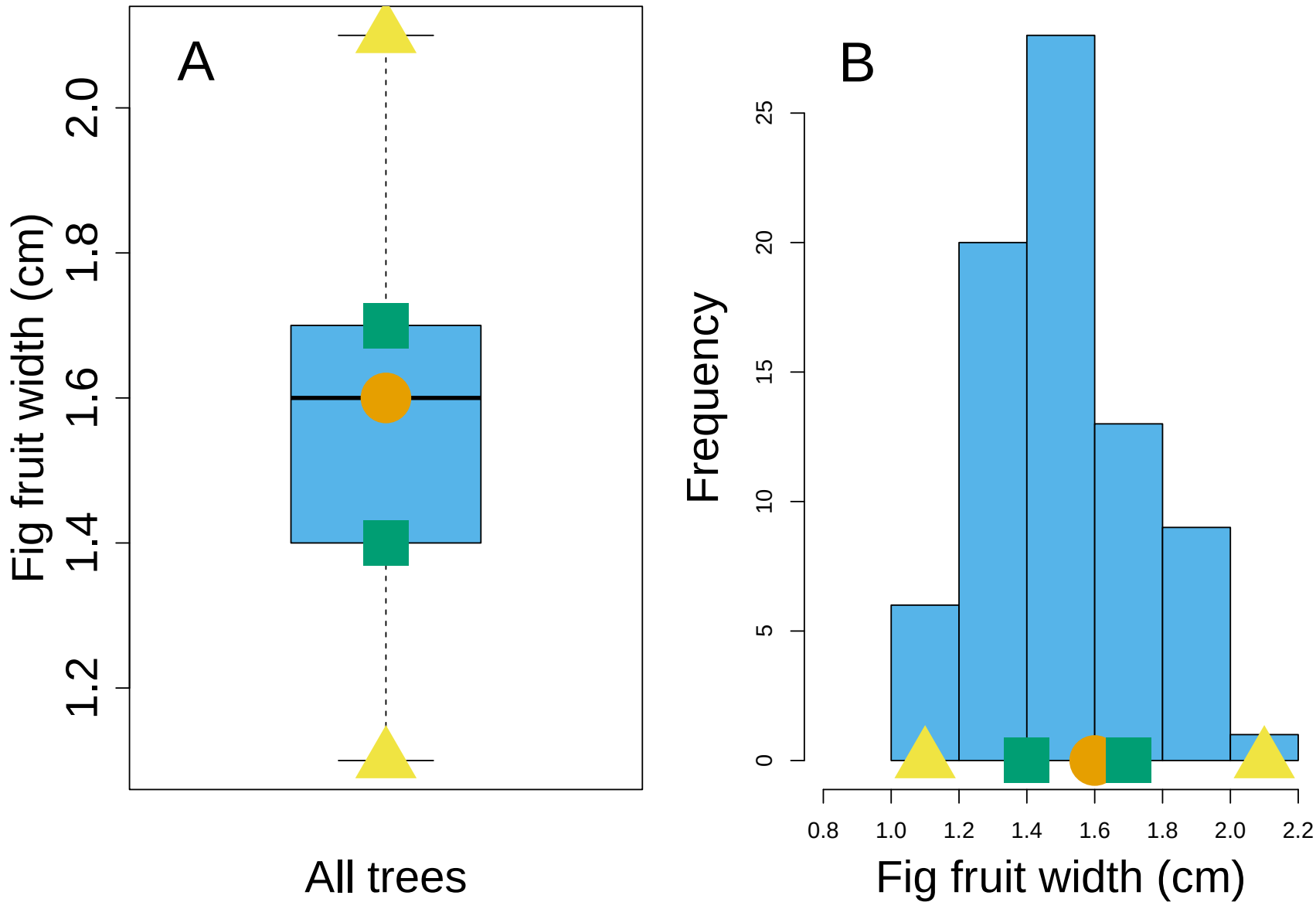


Figure 8: Boxplot (A) vs Histogram (B) of fig fruit widths (cm)

Data visualisation principles

1. Show the data
2. Make the meaning clear
3. Avoid distorting what the data have to say
4. Make the data accessible
5. Focus on the content

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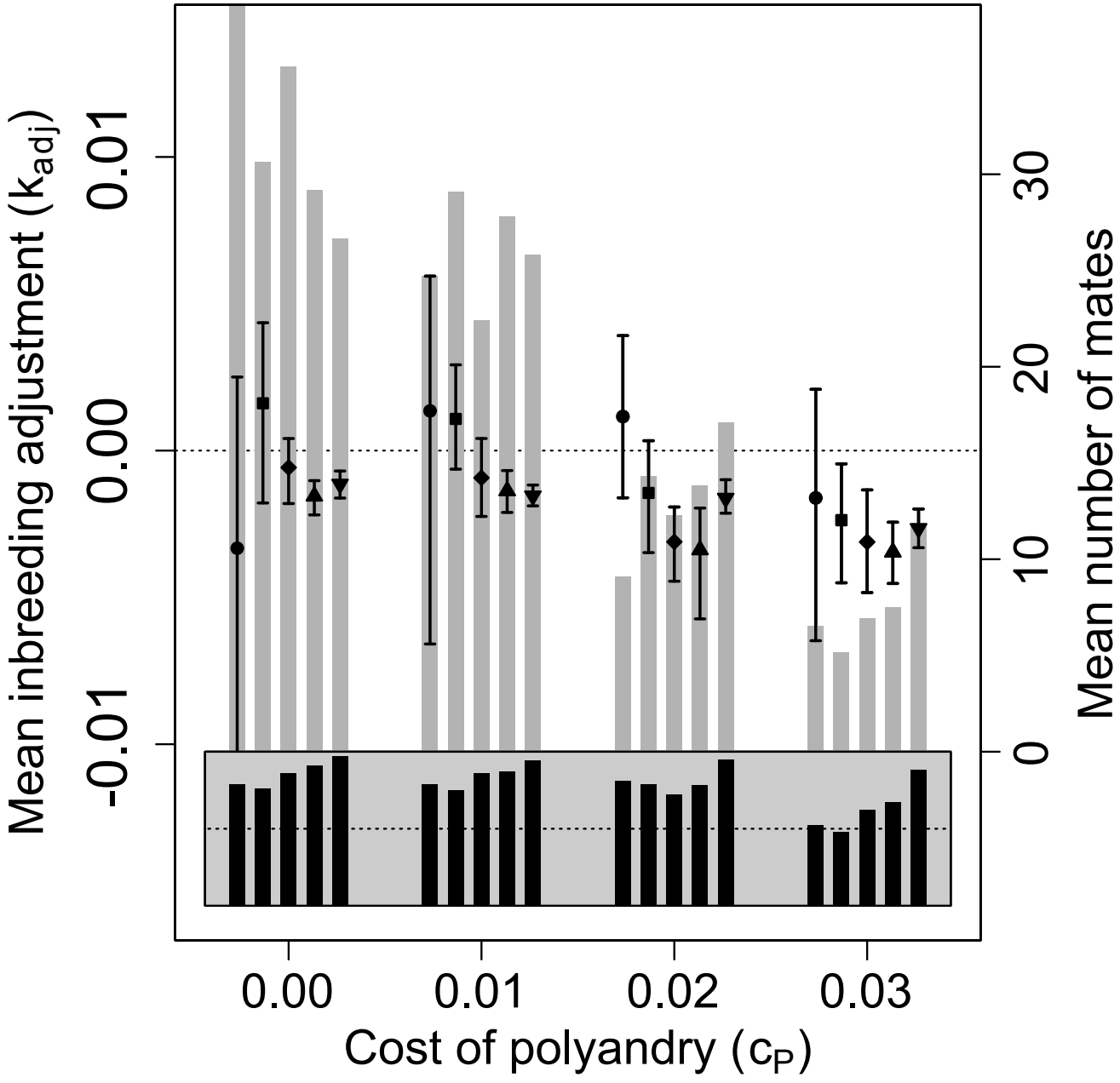
[1] David Sterratt. 2025. CC BY-SA 4.0 Source: https://github.com/Inf2-FDS/fds-visualisation

Data visualisation principles: Show the data

- Show as much as possible
- Try to avoid a confusion
- No one “right” visualisation
- Help reader compare several pieces of data

Data visualisation principles: Show the data



Data visualisation principles: Show the data

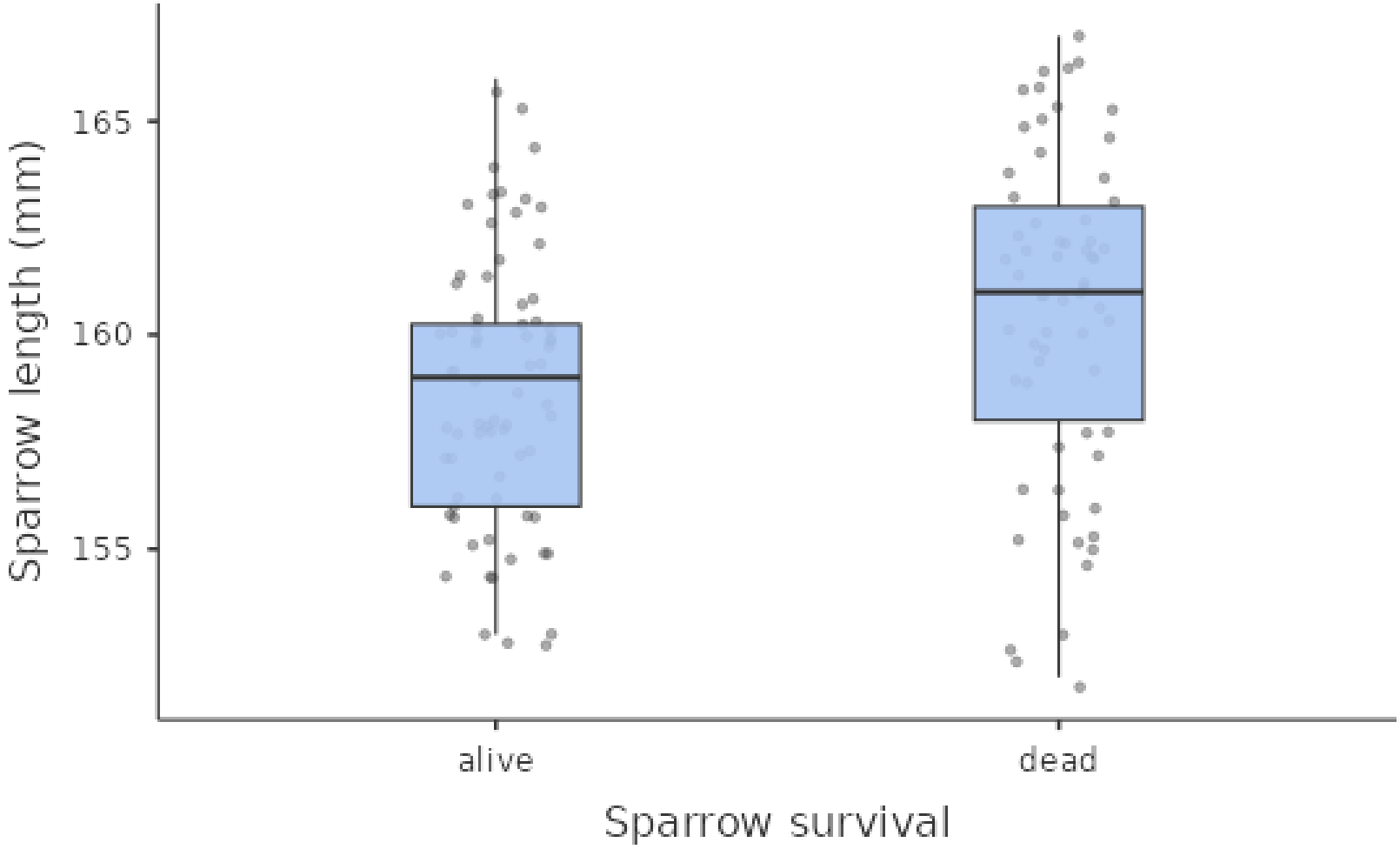
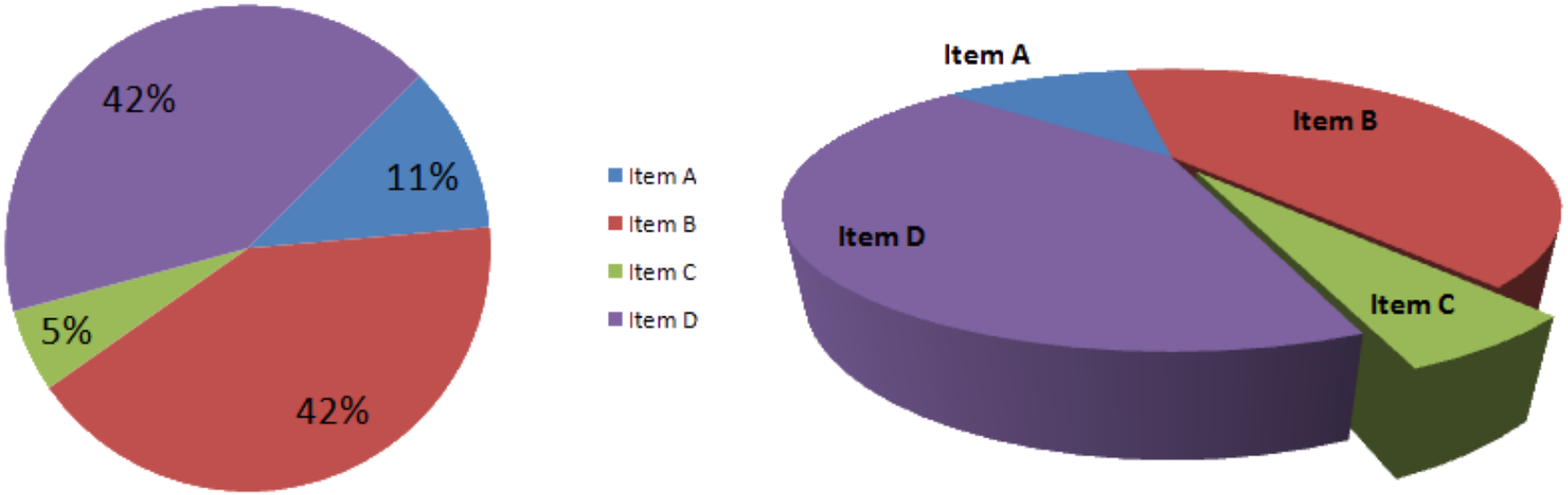


Figure 9: Sparrow length (mm) for different survival outcomes following an unusually large storm at Brown University in 1898 (N = 136).

Make the meaning clear

- Informative captions
- Meaningful axis labels
- Relevant units
- Describe error bars

Avoid distorting what the data have to say

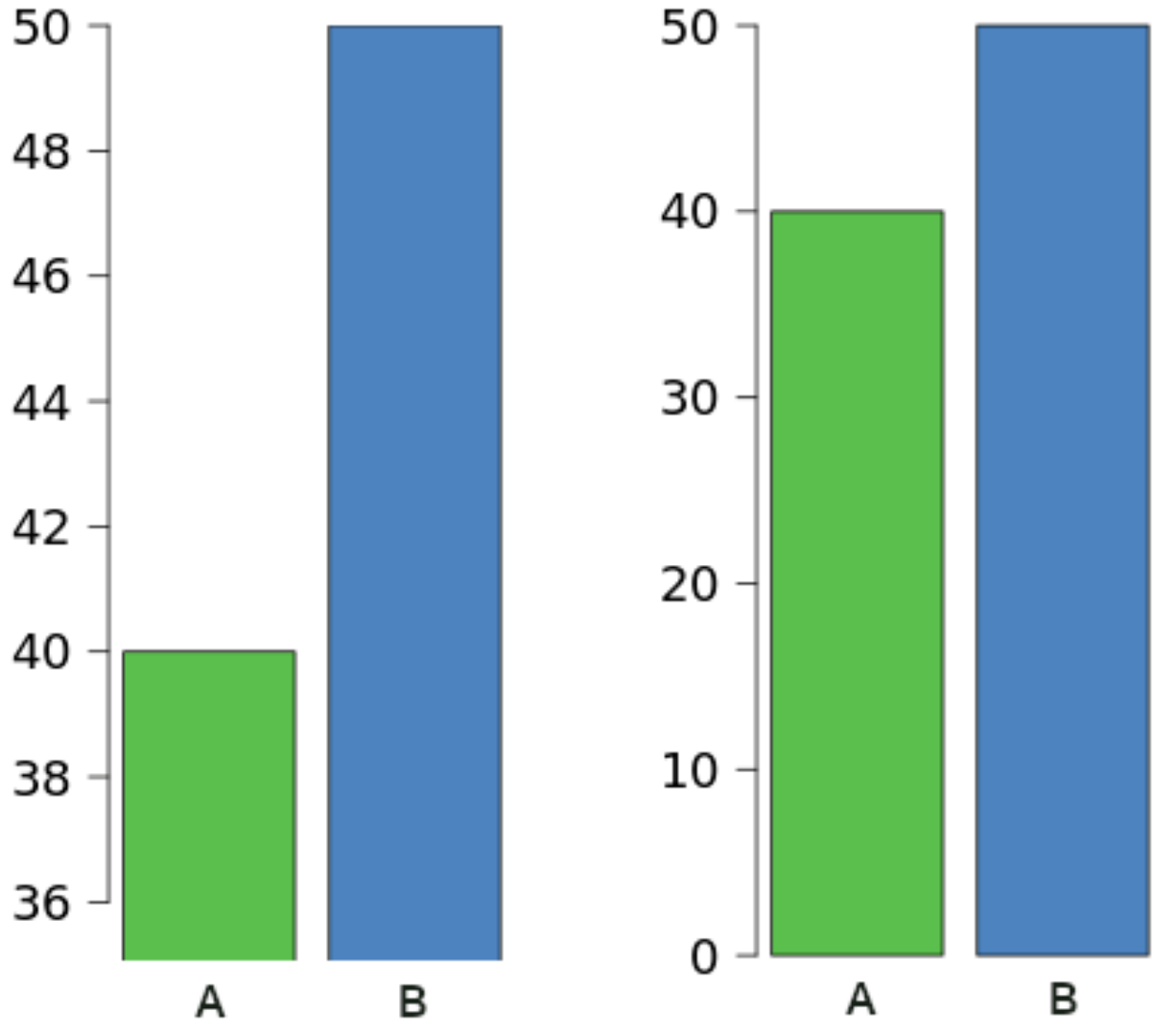


- Need to clearly see patterns in data
- Avoid the use of 3D if possible
- Easier to compare lengths than areas[1]
- Easier to compare lengths than angles[1]

[1] David Sterratt. 2025. CC BY-SA 4.0 Source: https://github.com/Inf2-FDS/fds-visualisation

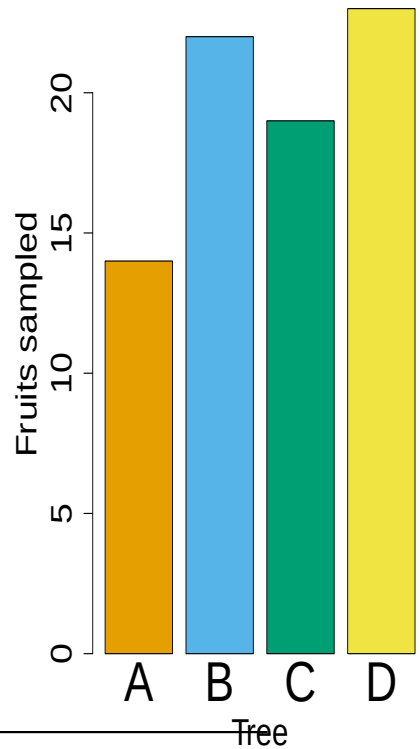
[2] **Image:** Public domain.

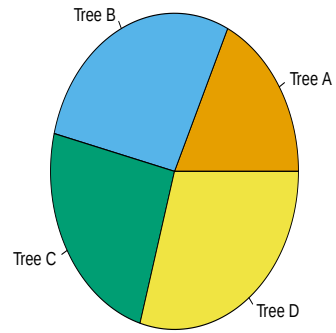
Avoid distorting what the data have to say



Make the data accessible

- Ensure text is legible
- Avoid unncessary colours
- Select colours carefully[1]





[1] David Sterratt. 2025. CC BY-SA 4.0 Source: https://github.com/Inf2-FDS/fds-visualisation

[2] Wexler, S, et al. 2017. The Big Book of Dashboards: Visualizing Your Data

Focus on the content

- Avoid colours or 3D with no meaning[1]
- Avoid vertical grid lines
- Use consistent colours across a report
- Use an appropriate number of decimals
- Check wording and spelling
- Consider plotting modules in jamovi

[1] David Sterratt. 2025. CC BY-SA 4.0 Source: https://github.com/Inf2-FDS/fds-visualisation