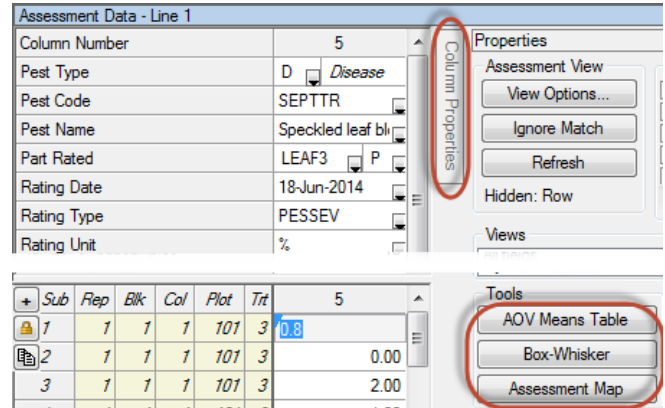# Recommended Assessment Review Methods

Recommended methods to review assessment data columns are located in **Properties** panels of the Assessment Data editor:

- **Column Properties** panel
- **Tools** section of Properties panel

By default, the Column Properties panel is hidden. To open this panel, click once on the Column Properties tab to open the panel, and then click once on the auto-hide pin to lock the panel in an open position. The Properties panel should automatically open, but use this same method if this panel is hidden too.

Recommended practices are to:

- Review new assessments while still **at the trial site**, to most efficiently verify whether any unusual values may be from a data entry mistake or a possible site (non-treatment) effect.

- Use **Column Properties** to review for entry mistakes or violations of AOV assumptions.

- Use **Tools** section for detailed review:
  - AOV to fully analyze assessments, and verify if observed treatment differences are supported by analysis.
  - Box-Whisker graph to review treatment stability and visualize treatment differences.
  - Assessment Map to identify differences that may be site-linked rather than treatment-linked.

Column Properties panel

The Column Properties panel provides:

a) Overview of data entered in current data column.

  i) Previous/Next buttons to move between columns

  ii) Column flags to explain whether data is:
    - Original = directly entered into a data column
    - Calculated = created using a data transformation formula
    - Changed = an unsaved change in data column

  iii) Range of data values:
    - Min/Max = data limits that are active for column
    - Low/High = smallest and largest values present in column, including subsamples (if present)

b) Search tool to find statistical outliers according to different outlier tests and options.

c) Refresh button to recalculate a column after edits.

d) Descriptive statistics from full analysis of data column.

  i) Least Significant Difference between treatment means at current AOV significance level

  ii) Standard Deviation and Coefficient of Variation calculated from AOV residual error

  iii) Grand Mean = mean across all treatments.
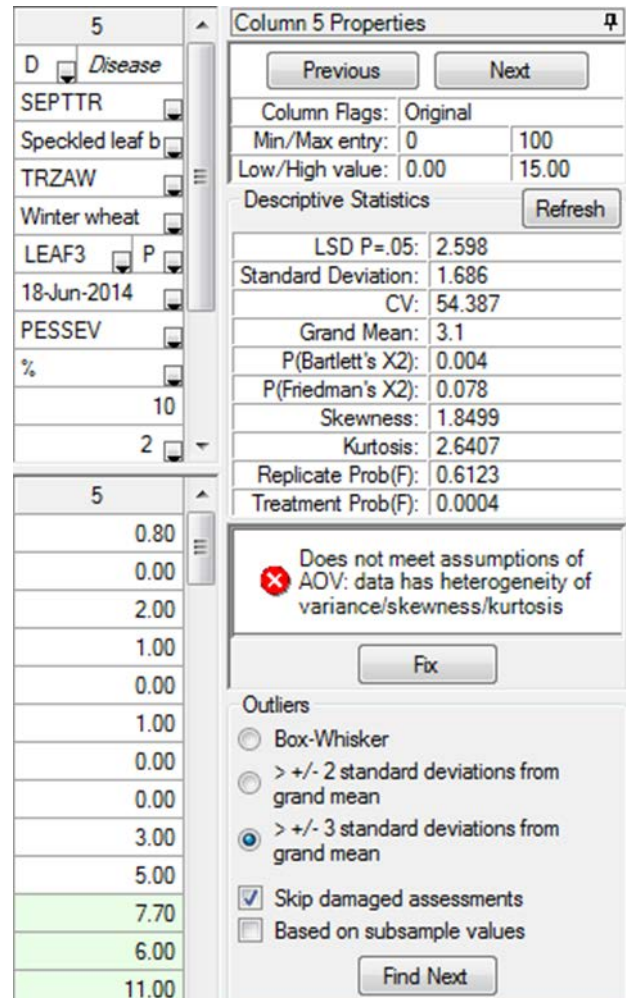
e) Whether data violates any AOV assumptions.

    i) Levene's Prob(F) = evidence that at least one treatment has a different variance, thus violating AOV assumption that each treatment has approximately the same variance.

    ii) P(Friedman's X2) = evidence that at least one treatment is significantly different based on Friedman's method for randomized blocks

    iii) Skewness and Kurtosis = results of normality tests, showing evidence that data distribution is "skewed", or that peak of data distribution is flatter or sharper than a normal distribution.

f) A warning panel displays when data violates assumptions of AOV, with a Fix button to use automatic corrections (data correction transformation, or exclude one: check treatment, other treatment, or replicate).

> ⊗ Does not meet assumptions of AOV: data has heterogeneity of variance/skewness/kurtosis
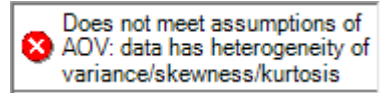
Assessment Map

The Assessment Map displays assessment data values on a trial map, to help identify whether assessment differences may be influenced by "spatial effects" that can occur from variations within the trial site.

Differences in assessment values are indicated by color intensity. Lower values display in lighter colors than higher values. Select "Color description" tab to display a color key showing range of assessment values represented by each color.

For example, if crop yields seem consistently lower in one corner of a trial, it may indicate a lower quality soil in that portion of the trial. Spatial effects can also occur from an underground drainage tile line below a portion of the trial, or a variation in pest densities across the trial.

To help identify why the box for treatment 2 in data column 3 is distorted, display the assessment map for data column 3. Notice that the value for treatment 2 "Tub.5" in replicate 3 is substantially darker than in the other replicates. It is likely that replicate 3 is causing the distorted box on this graph.

Confirm this by changing the View Options setting "View subsamples" to "Plot experimental unit Means", sorting assessment data by treatment, and then reviewing treatment 2 for data column 3:

| Rp	Bk	Col	Plot	Trt	3
1	1	4	104	2	1.30
2	2	1	201	2	0.80
3	3	2	302	2	3.90
4	4	3	403	2	1.70
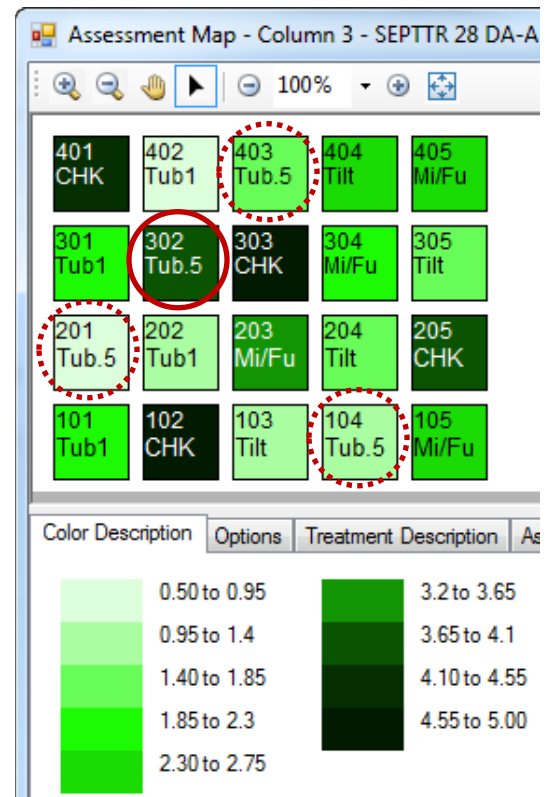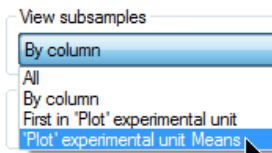
Notice that the value in replicate 3 is more than twice the value in other replicates. Keep in mind that these values are all quite low, so while a difference of > 2% is *measureable*, for this situation it is *not meaningful*.

View subsamples

> By column
> All
> By column
> First in 'Plot' experimental unit
> 'Plot' experimental unit Means

Assessment Map panel

Assessment Map - Column 3 - SEPTTR 28 DA-A

⊕ ⊖ 🖐 ▶ | ⊖ 100% ▾ ⊕ 🔲

401 CHK	402 Tub1	403 Tub.5	404 Tilt	405 Mi/Fu
301 Tub1	302 Tub.5	303 CHK	304 Mi/Fu	305 Tilt
201 Tub.5	202 Tub1	203 Mi/Fu	204 Tilt	205 CHK
101 Tub1	102 CHK	103 Tilt	104 Tub.5	105 Mi/Fu

Color Description | Options | Treatment Description | As

| | 0.50 to 0.95 | | 3.2 to 3.65 |
	0.95 to 1.4		3.65 to 4.1
	1.40 to 1.85		4.10 to 4.55
	1.85 to 2.3		4.55 to 5.00
	2.30 to 2.75		

Box-Whisker graph

Box-Whisker displays a box-whisker graph for the current data column using current graph option settings.

This graph type shows the "spread" of treatment data around the median, using a "box" and "whiskers" to break down each data group by percentiles. The **box** extends from 25th to the 75th percentile and is divided by the median. The **whiskers** extend from ends of the box to the largest and smallest non-outlier values. An **outlier** is a point that lies outside of the box by more than 1.5 times the height of the box, and is indicated by "x" on the graph.
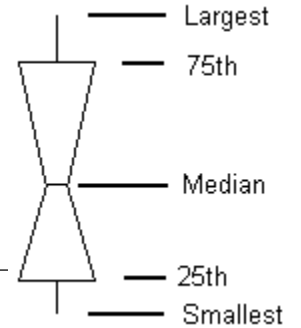
The example below is from data column number 3 in example tutorial trial G-All7_Fung:
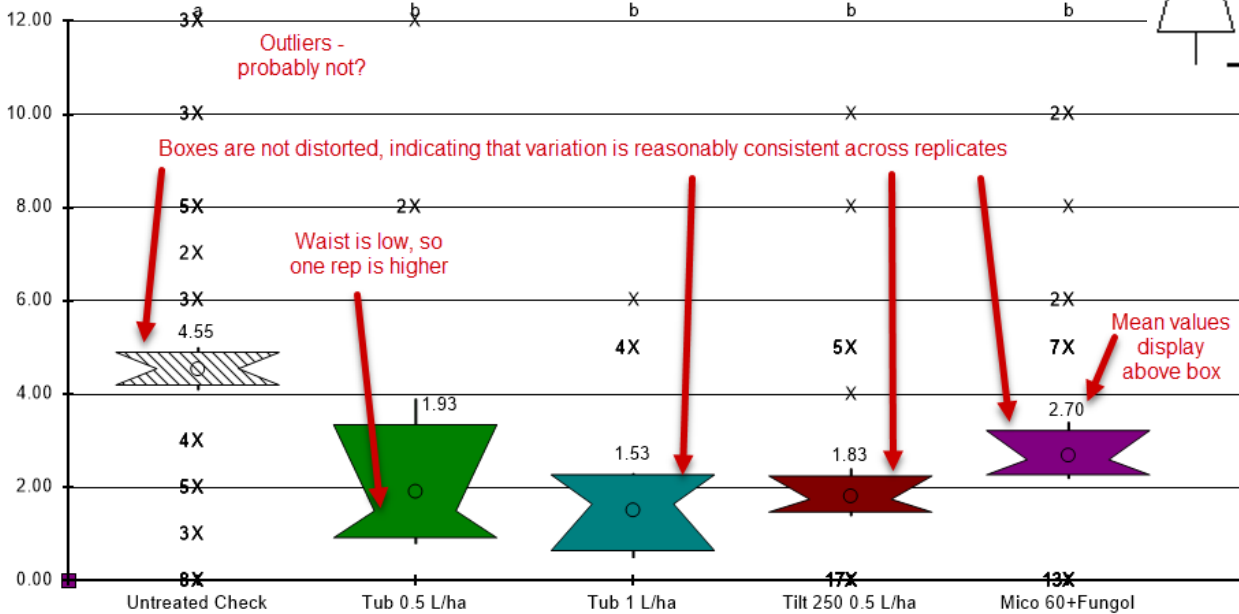
Options used to create this graph are:
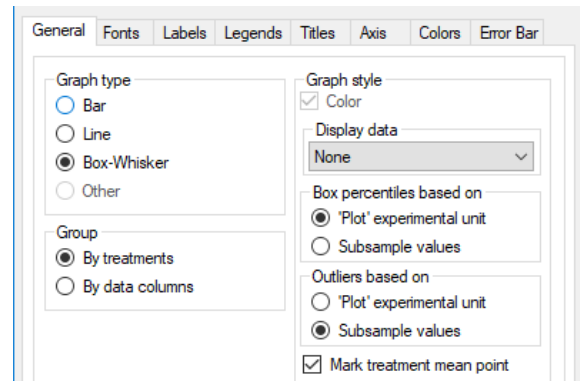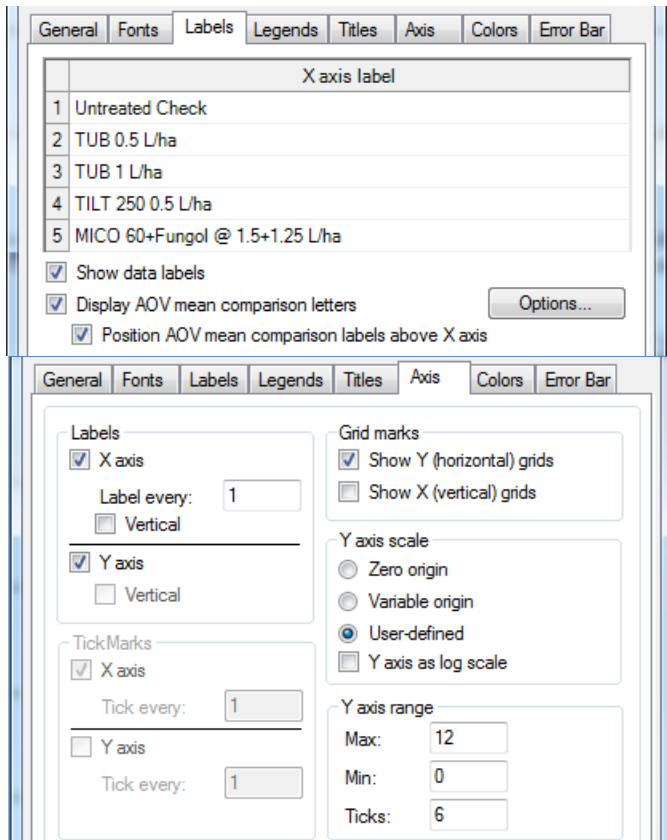
Benefits of using these option settings:

    a) Display subsample values that are possible "outliers", outside of box by > 1.5 times box height.

    b) Display treatment mean as "O" on box.

    c) Display mean values on the graph.

    d) Mean comparison letters above top axis.

    e) Y grid lines make it easier to read value of positions within the graph.

    f) Scale graph to show all possible outliers within boundaries of the graph.

General benefits of using a box-whisker graph to review data are:

a) Box height shows amount of variability within a treatment, thus is a measure of assessment consistency or "stability" of each treatment.

b) Waist position indicates whether variability is skewed, when one replicate is somewhat higher or lower than others. For example, when waist is "low", then a value in one of the replicates is somewhat higher than in other replicates. The box at right is treatment 2 from data column number 3 in example trial G-All7_Fung.

c) Provides a visual mean comparison, since treatments where boxes overlap are probably not significantly different.

d) Simplest method to identify heterogeneous treatments, indicated when height of treatment boxes are substantially larger or smaller than other treatments.
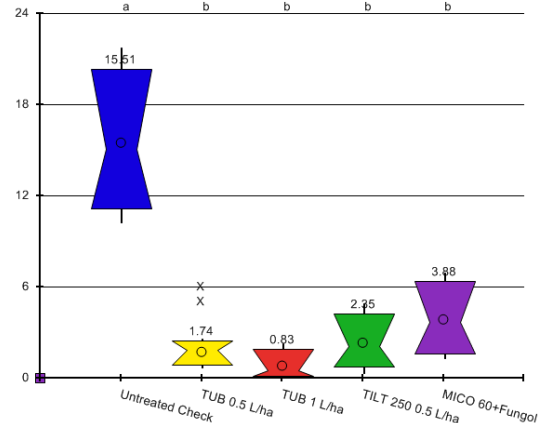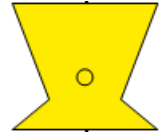
In the example at right, the height of the box for "Untreated check" treatment 1 in data column 7 is much taller than the other 4 treatments. Levene's homogeneity test for data column 7 indicates 91% chance of heterogeneity, with significant skewness and kurtosis (non-normality).

AOV Means Table

AOV Means Table displays a preview of the AOV Means Table report beginning at the current data column, using current report options. To change AOV Means Table report options:

a) Click the Printer icon on toolbar (or click File - Print Reports).

b) On left, click on AOV Means Table report under Available Reports.

c) On right, set report options as desired. Here are recommended defaults to use:

i) Use a mean comparison method that maintains the selected significance level regardless of how many treatments are in the trial.

ii) Performs a "protected" mean comparison test, so mean comparisons are only performed when Treatment P(F) indicates that "at least one treatment appears to be significantly different".

iii) Tests for heterogeneity, skewness, or kurtosis. These indicate whether the data violates assumptions for analysis of variance and should be corrected to ensure adequate precision from the mean comparison test.

Pest Name	Speckled leaf >
Part Rated	LEAF3 P
Rating Date	Jun-18-2018
Rating Type	PESSEV
Rating Unit	%
Number of Subsamples	10
Trt-Eval Interval	15 DA-B

Trt No.	Treatment Name	Rate	Rate Unit	5
1	Untreated Check			8.25 a
2	Tub	0.5	l/ha	1.83 b
3	Tub	1	l/ha	1.46 b
4	Tilt 250	0.5	l/ha	2.30 b
5	Mico 60 Fungol	1.5 1.25	l/ha l/ha	1.67 b

LSD P=.05 (% mean diff)	2.598 (84%)
Standard Deviation	1.686
CV	54.39
Levene's F	3.29
Levene's Prob(F)	0.04*
Skewness	1.8499*
Kurtosis	2.6407*
Minimum Replicates (power = 80)	2
Largest Mean Difference (% mean diff)	6.785 (219%)
Replicate F	0.625
Replicate Prob(F)	0.6123
Treatment F	11.778
Treatment Prob(F)	0.0004

AOV Means Table Report Options

Report options | General Summary | Report Preview

Mean comparison test

Test: Student-Newman-Keuls

Significance or alpha level: 5%

☑ Use FAOV complete error for split-plot trials
☑ Only when significant AOV Treatment P(F)
Symbol indicating no significant difference between treatment means: a

Adjusted treatment mean
☐ Use adjusted mean as primary mean
☐ Calculate adjusted mean only when justified by AOV

Mean descriptions
☐ Minimum and maximum
☐ Standard deviation
☐ Median
☐ Adjusted mean (when available)
Arranged
○ Beside mean   ● Under mean

Descriptive statistics
☑ LSD (or HSD if Tukey's)
☑ Standard deviation
☑ Coefficient of variation (CV)
☐ Grand mean
☑ Homogeneity of variance test   Levene's
☐ Friedman's method for randomised blocks
☑ Skewness
☑ Kurtosis
☑ Post-hoc power analysis