Trial Reporting Capabilities of ARM 9

See www.gdmdata.com/resources/meetings.htm for presentation copy
(Meeting Calendar link on left navigation panel of www.gdmdata.com)
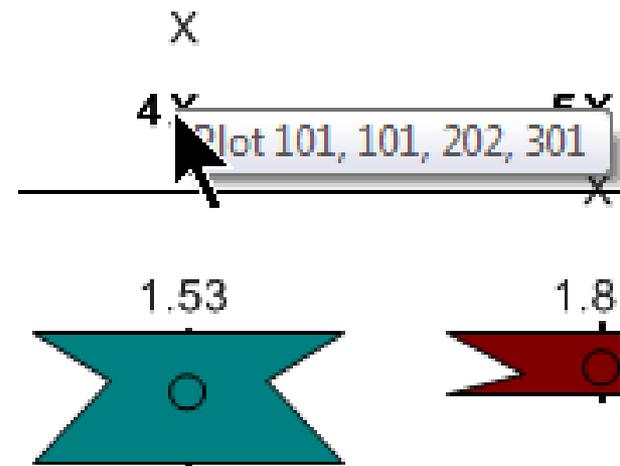
## Steven R. Gylling

Gylling Data Management, Inc.

Graphs

- Display untreated/check and reference treatments with special colors

- Hover mouse over outlier 'X' on box-whisker graph to show plot number(s) (especially useful with subsamples)

Graphs

- Auto-size graph title boxes in new graph to optimize using graph space
- Resize y-axis to show all outliers of box-whisker graph (previously you had to manually size)
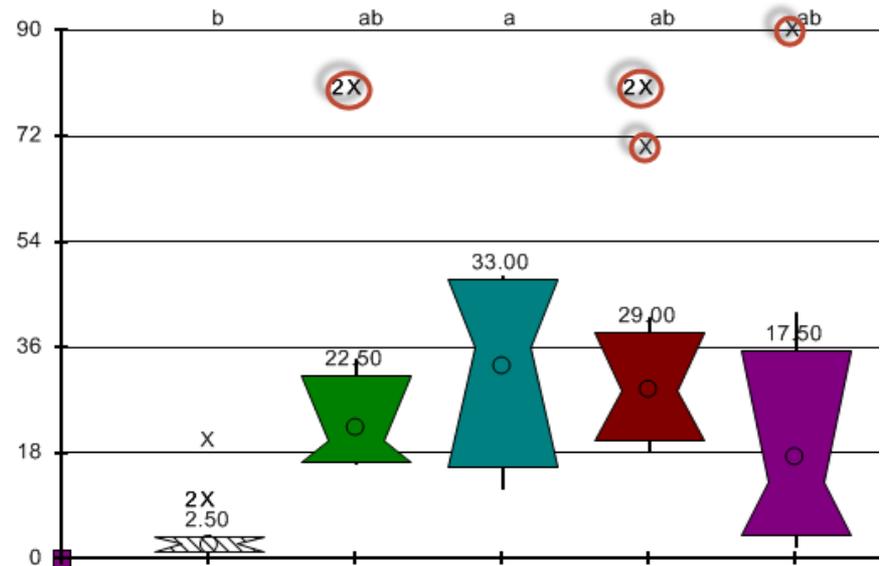
Graphs

- Use as default the size and position from previous graph

- Suppress 0 on box-whisker graph for missing treatments

- Modified Y-axis for box-whisker graphs to reduce extra space above graphs when maximum values exceed 100

Graph Tips

- Treatment Description on Trial Map is used for treatment labels on graph.

- Use Horizontal bar graph to better display long treatment names.

- Use Next Data/Previous Data buttons on Graph window to display the same graph for other data columns.

Graph Tips

- Use "Error Bars" tab on Graph Options to display standard deviation or standard error bars.
  Note: ARM graph error bars use appropriate AOV error term for design. On many graph programs (such as Excel) error bars are only correct for Completely Random design.
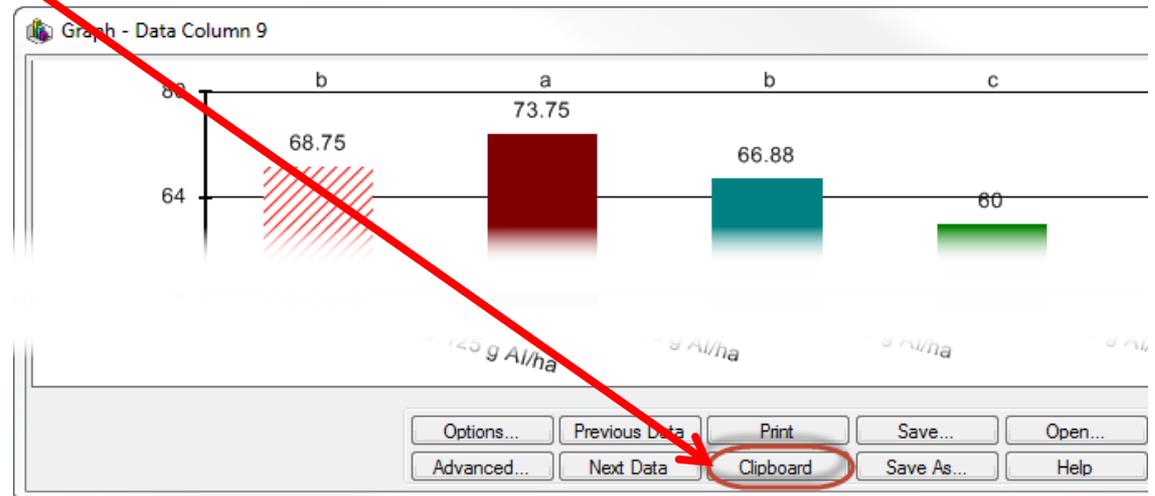
Graph Tips

- "Show data labels" on Labels tab of Graph Options shows treatment means.

- Use "Display AOV mean comparison letters" on Labels tab of Graph Options to show AOV mean comparison letters.

- Treatment selection order (e.g. 5 4 3 2 1) defines treatment order on a graph.

Graph Tips

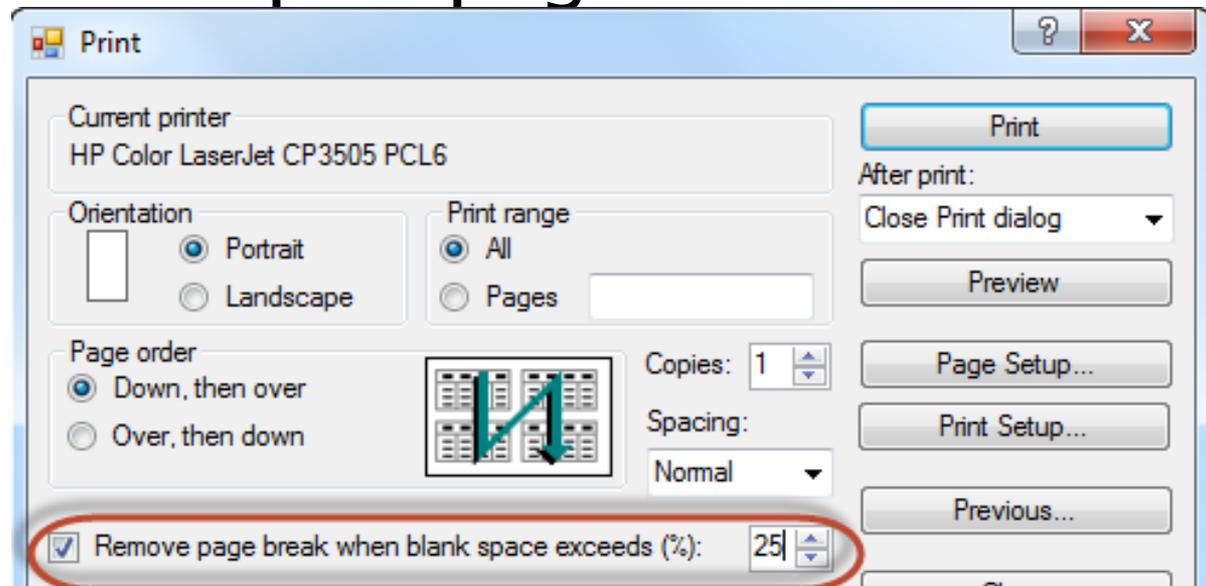- Clipboard button is the easiest way to copy graphs to another program

- Paste in destination program to include the graph.

Print Reports: Remove page break when...

- 'Remove page break when blank space exceeds (%)' option reduces unused space on report pages

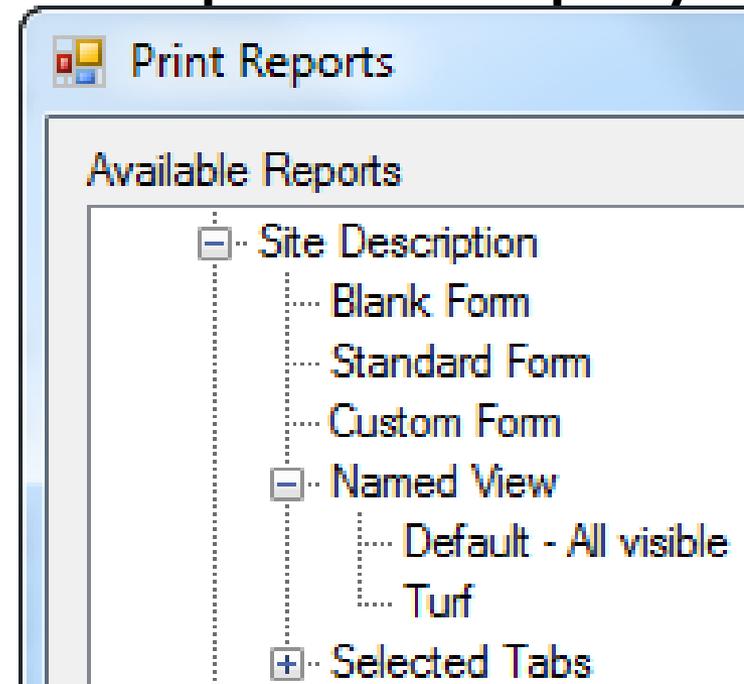# Print Reports:
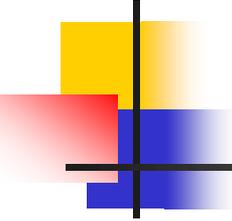# Remove page break when...

- Can shrink 4 pages to 1

Reps: 4　　Appl Code: A　　Plots: 2.5 by 10 meters
Spray vol: 200 L/ha　　Mix size: 2.15 liters (min 2.15)

Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Spray Volume	Volume Unit	Mix Size	Mix Unit	Amt Product to Measure	Rep 1	2	3	4
3	TUB	250	G/L	EC	1	l/ha	ABC					10.75 ml/mx	101	202	301	402
1	Untreated Check						ABC						102	205	303	401
4	TILT 250	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	103	204	305	404
2	TUB	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	104	201	302	403
5	MICO 60	600	G/L	EC	1.5	l/ha	AB	250	L/HA	2.65	Liters	15.9 ml/mx	105	203	304	405

Reps: 4　　Appl Code: B　　Plots: 2.5 by 10 meters
Spray vol: 200 L/ha　　Mix size: 2.15 liters (min 2.15)

Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Spray Volume	Volume Unit	Mix Size	Mix Unit	Amt Product to Measure	Rep 1	2	3	4
3	TUB	250	G/L	EC	1	l/ha	ABC					10.75 ml/mx	101	202	301	402
1	Untreated Check						ABC						102	205	303	401
4	TILT 250	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	103	204	305	404
2	TUB	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	104	201	302	403
5	MICO 60	600	G/L	EC	1.5	l/ha	AB	250	L/HA	2.65	Liters	15.9 ml/mx	105	203	304	405

Reps: 4　　Appl Code: C　　Plots: 2.5 by 10 meters
Spray vol: 200 L/ha　　Mix size: 2.15 liters (min 2.15)

Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl Code	Spray Volume	Volume Unit	Mix Size	Mix Unit	Amt Product to Measure	Rep 1	2	3	4
3	TUB	250	G/L	EC	1	l/ha	ABC					10.75 ml/mx	101	202	301	402
1	Untreated Check						ABC						102	205	303	401
4	TILT 250	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	103	204	305	404
2	TUB	250	G/L	EC	0.5	l/ha	ABC					5.375 ml/mx	104	201	302	403
5	FUNGOL	200	G/L	SC	1.25	l/ha	C					13.44 ml/mx	105	203	304	405

Sort Order: Application Code, Replicate 1

New Site Description Reports

- New Site Description reports simplify changing between common report uses

Print Reports

Available Reports

- Site Description
  - Blank Form
  - Standard Form
  - Custom Form
  - Named View
    - Default - All visible
    - Turf
  - Selected Tabs

New Site Description Reports

- Allow printing several report segments

Report set

Add ->

Remove

Load Set...

Save Set...

Clear Set

Site Description - Selected Tabs - 1,2
Σ AOV Means Table
Site Description - Selected Tabs - 4,11
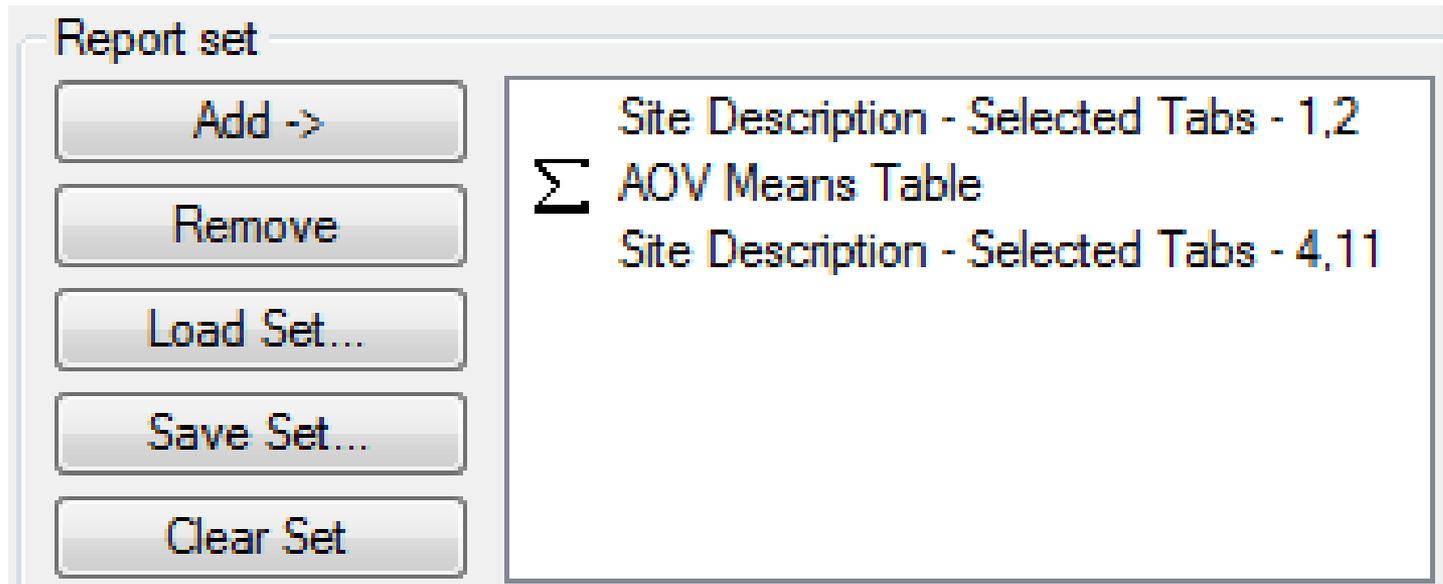
New Site Description Reports

- Allows you to create your own custom reports

Print Selected Replicates

- General Summary report option to exclude replicates that may be damaged

Print Selected Replicates

- Similar prompting as selected data columns or header rows

AOV Means Table Report OSLs

- New significance levels for LSD, SNK, and Tukey's mean comparisons of 15, 20, 25, 30, 40, 50%

AOV Means Table Report Options

| Pre-mix Ingredient | Fields to Print | Global - General |
| AOV Means Table Report Options | | General Sur |

Mean comparison test

Test: Student-Newman-Keuls

Significance level: 5%

1%
5%
10%
15%
20%
25%
30%
40%
50%

☑ Use FAOV complete error for split-plot trials
☑ Only when significant AOV treatment P(F)

Adjusted treatment mean

☐ Use adjusted mean as primary mean
☐ Calculate adjusted mean only when justified by

Mean descriptions

AOV Means Table Report OSLs

- Allows selecting appropriate significance levels according to 'penalty of failure' for tested treatments.

  Example: new 'plant health' products frequently improve yield, yet a failure loses only cost of product, so reduced significance levels are more appropriate than for crop protection products.

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- ARM 9 always tests homogeneity of variance and normality for summaries
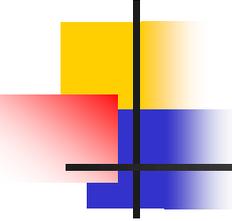- Possible solutions are listed on Summary Report Messages:
  - Apply data correction transformation
  - Exclude check treatment
  - Exclude treatment with highest or lowest standard deviation (if either works)*

  * ARM cannot automatically apply
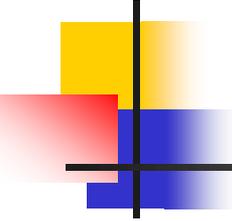
Assumptions of AOV

- Normality: distribution of observations from which samples were collected is a normal "bell" curve.

- Homogeneity of variances: different treatments do not change variability of observations.

- Additivity: observations of treatment effects are additive (linear), not multiplicative.

Skewness

- Skewness measures asymmetry of the data distribution: the peak on a data distribution graph is shifted either right or left

Negative Skew   Positive Skew
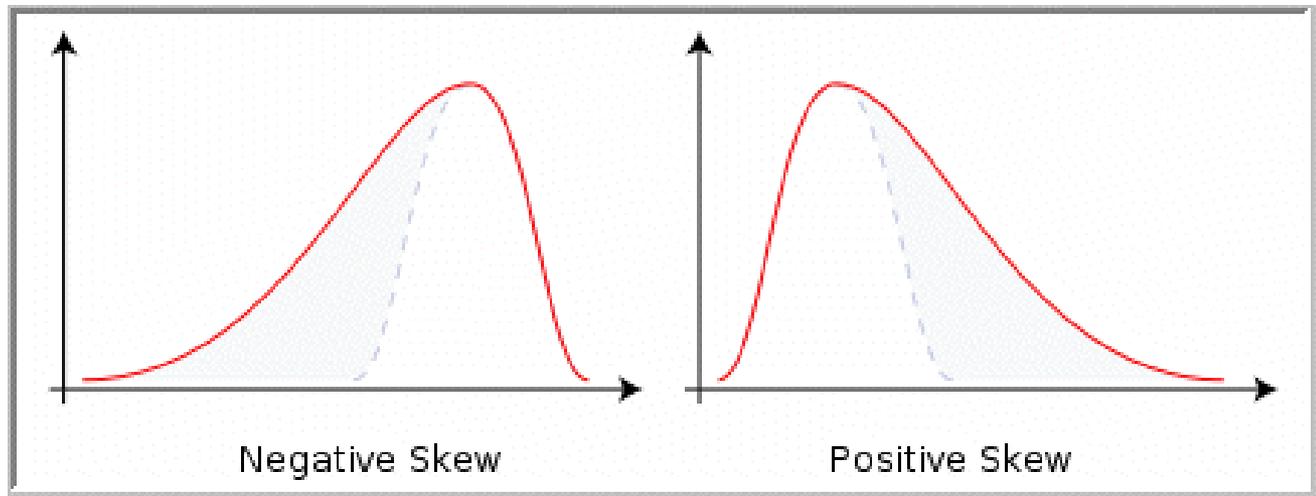
Kurtosis

- Kurtosis measures "peakedness" of data distribution: the peak is either flatter or sharper than a normal distribution

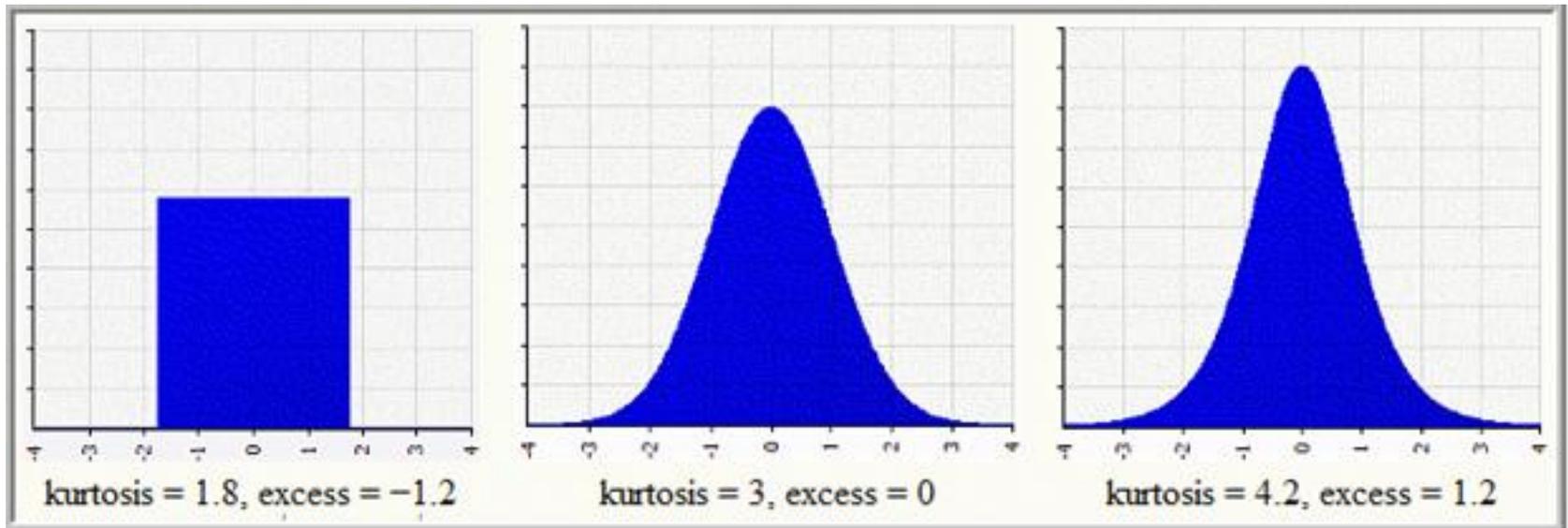| kurtosis = 1.8, excess = −1.2 | kurtosis = 3, excess = 0 | kurtosis = 4.2, excess = 1.2 |

Correcting Heterogeneity of Variance

- Data Correction Transform

- Eliminate 'different' treatment (often the check)

Rating Type ARM Action Codes			COUINS APC	COUINS EC APC	COUINS TL[1] APC	COUINS TS[1] APC
Trt No.	Treatment Name	Rate Rate Unit	1	2	3	4
1 Untreated Check			106.3 a (0.0%)	106.3 (0.0%)	105.5 a (0.0%)	105.9 a (0.0%)
2 Sure Kill NIS		250 g ai/ha 0.5 % v/v	13.5 bc (87.3%)	13.5 b (87.3%)	12.6 cd (88.1%)	13.0 cd (87.7%)
3 Super Stomp NIS		250 g ai/ha 0.5 % v/v	17.0 bc (84.0%)	17.0 b (84.0%)	17.0 bc (83.9%)	17.0 c (84.0%)
4 Sure Kill NIS		375 g ai/ha 0.5 % v/v	9.5 c (91.1%)	9.5 b (91.1%)	9.0 d (91.4%)	9.2 d (91.3%)
5 Super Stomp NIS		375 g ai/ha 0.5 % v/v	24.0 b (77.4%)	24.0 a (77.4%)	22.8 b (78.3%)	23.4 b (77.9%)
LSD (P=.05)			8.93	6.15	0.14t	0.62t
Standard Deviation			5.80	3.84	0.09t	0.40t
CV			17.03	24.03	6.52	7.73
Bartlett's X2			12.244	6.488	7.706	5.596
P(Bartlett's X2)			0.016*	0.09	0.103	0.231
Skewness			1.6078*	0.677	0.8784	1.34*
Kurtosis			1.0506	-0.0687	-0.2758	0.399

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- Apply automatic transformations or treatment exclusions to data columns that violate assumptions of AOV:

Prompt
Yes
No

AOV Means Table Report Options

Pre-mix Ingredient	Fields to Print	Global - General	Global - Page Heading
AOV Means Table Report Options		General Summary	General

Missing data estimates
⦿ Yates

Assessment data header rows
List:

☐ Identify when selected treatments are summarized
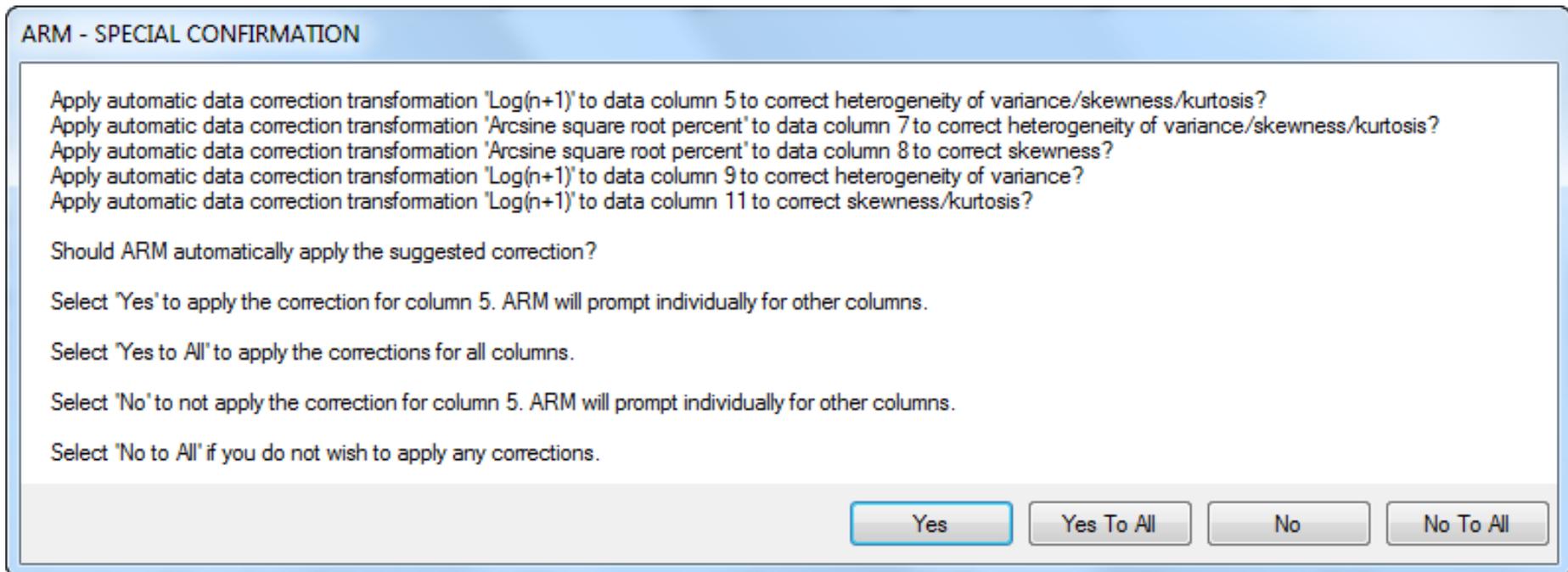
Fields To Print...

Apply automatic transformations or treatment exclusions to data columns that violate assumptions of AOV   Prompt ▾

☑ Print selected replicates

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- When 'Prompt' a confirmation dialog identifies violation(s) and asks:

ARM - SPECIAL CONFIRMATION

Apply automatic data correction transformation 'Log(n+1)' to data column 5 to correct heterogeneity of variance/skewness/kurtosis?
Apply automatic data correction transformation 'Arcsine square root percent' to data column 7 to correct heterogeneity of variance/skewness/kurtosis?
Apply automatic data correction transformation 'Arcsine square root percent' to data column 8 to correct skewness?
Apply automatic data correction transformation 'Log(n+1)' to data column 9 to correct heterogeneity of variance?
Apply automatic data correction transformation 'Log(n+1)' to data column 11 to correct skewness/kurtosis?

Should ARM automatically apply the suggested correction?

Select 'Yes' to apply the correction for column 5. ARM will prompt individually for other columns.

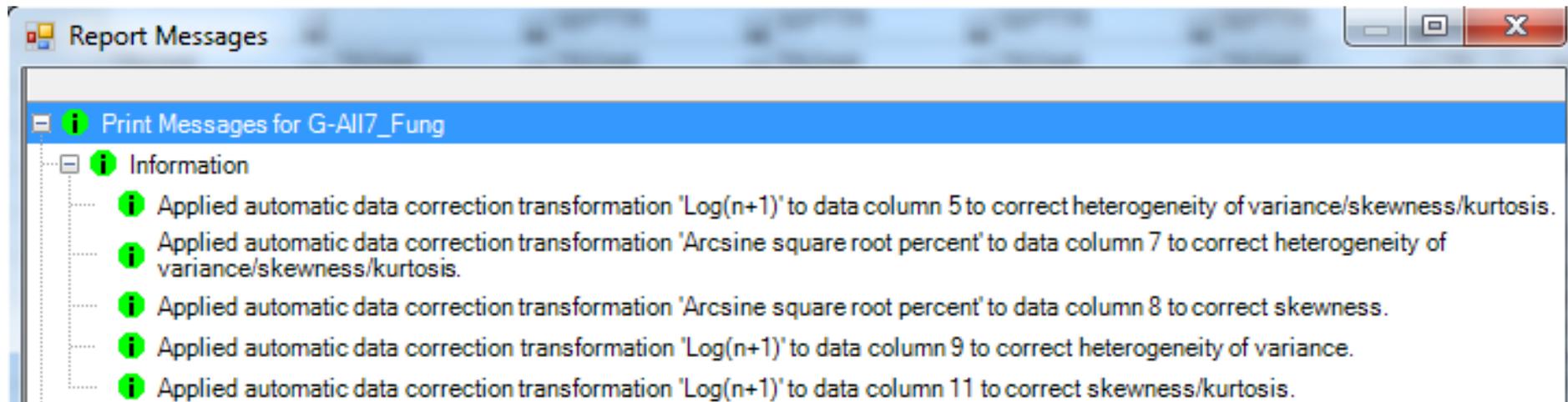Select 'Yes to All' to apply the corrections for all columns.

Select 'No' to not apply the correction for column 5. ARM will prompt individually for other columns.

Select 'No to All' if you do not wish to apply any corrections.

| Yes | Yes To All | No | No To All |

Heterogeneity/Skewness/ Kurtosis on Summary Reports

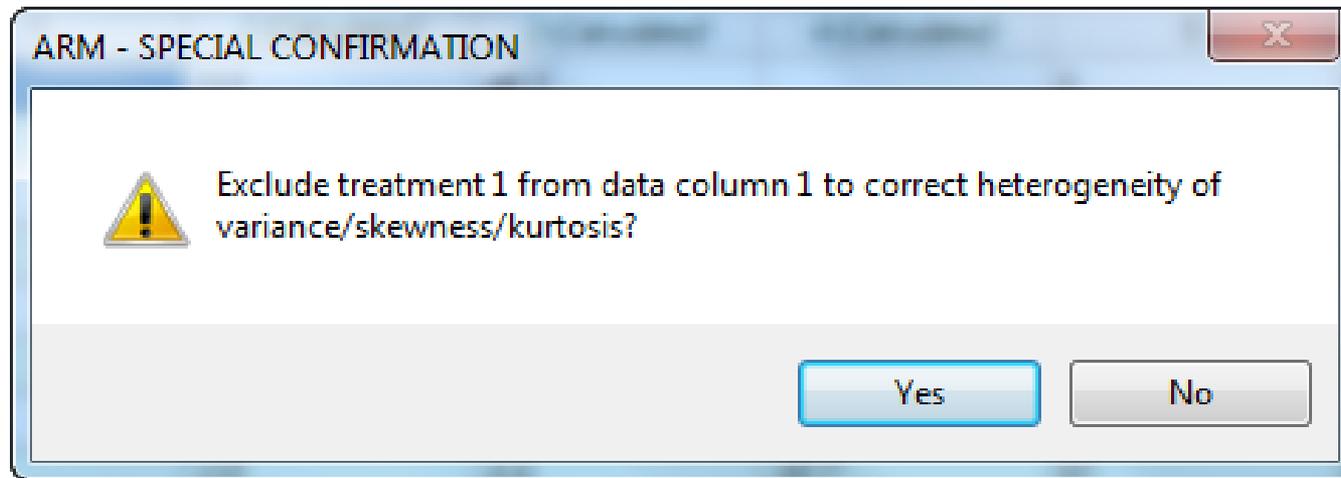- When 'Yes' or 'Prompt' the applied actions are listed in Report Messages

Report Messages

- Print Messages for G-All7_Fung
  - Information
    - Applied automatic data correction transformation 'Log(n+1)' to data column 5 to correct heterogeneity of variance/skewness/kurtosis.
    - Applied automatic data correction transformation 'Arcsine square root percent' to data column 7 to correct heterogeneity of variance/skewness/kurtosis.
    - Applied automatic data correction transformation 'Arcsine square root percent' to data column 8 to correct skewness.
    - Applied automatic data correction transformation 'Log(n+1)' to data column 9 to correct heterogeneity of variance.
    - Applied automatic data correction transformation 'Log(n+1)' to data column 11 to correct skewness/kurtosis.

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- Corrections added to ARM Action Codes
  - AL=Automatic Log
  - AA=Automatic Arcsine Square Root Percent (only tested for 0-100 data)
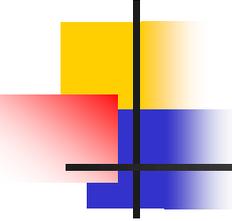 - AS=Automatic Square Root

15 DA-B AL 2	15 DA-B TAB[5] 2	29 DA-B AA 2	29 DA-B AA TAB[7] 2	11 DA-C AL 2
5	6	7	8	9
7.82 a	0.00 b	15.28 a	0.00 c	2.31 b

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- Exclude check treatment
  - EC=Exclude Check

4 DE-1	EC
	1
	1
	962.8
	30.8 a
	30.8 a
	36.3 a
	34.5 a

ARM - SPECIAL CONFIRMATION

Exclude treatment 1 from data column 1 to correct heterogeneity of variance/skewness/kurtosis?

[Yes] [No]

Heterogeneity/Skewness/ Kurtosis on Summary Reports

- ARM cannot automatically exclude a non-check treatment number, since there is no special ARM Action Code defined for this task

- GDM plans to define a 'ETn' code, such as ET8 to exclude treatment number 8, so non-check treatments can also be automatically excluded

Report Sets

- Report set = selected reports plus all options for those reports
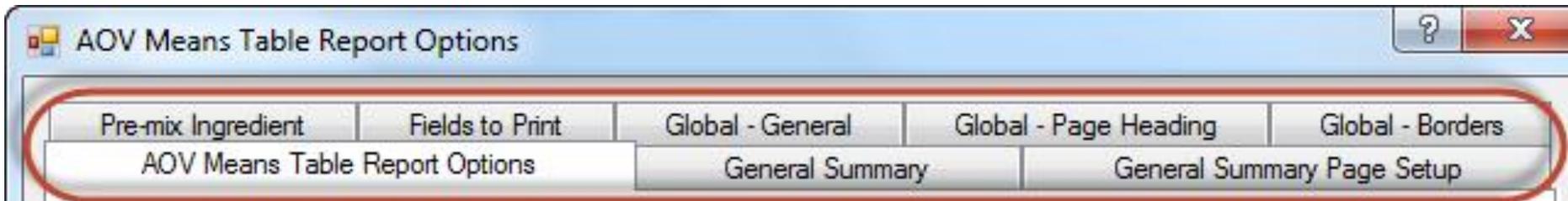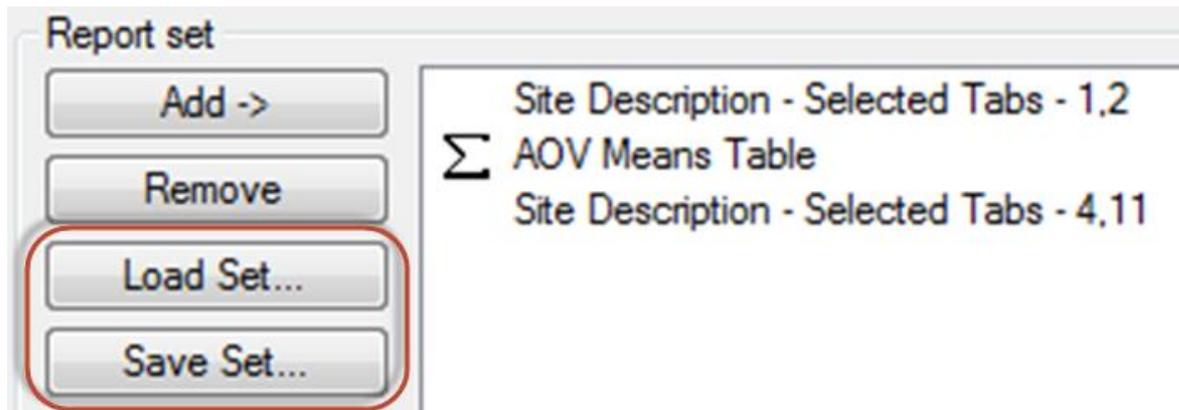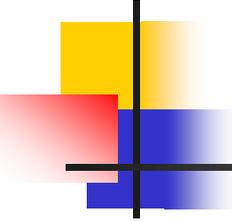
Report Sets

- Report sets save your preferred options to easily use again later.

- Can standardize reports in your group.

- Save report Set to keep your options.

- Load Set to use these options later.

- Recommend creating sets for each part of research season (map, spray/seeding plan, labels, tour report, summary, etc.)
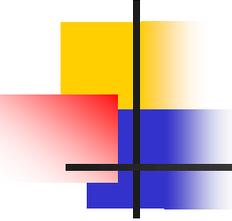
Steps to Save Report Set

- Select report components to include.
- Set desired options for each report in set, such as whether to print only completed fields (hide blank fields).
- Arrange reports in desired order in set (highlight a report, press and hold Shift, press up/down arrow to move report).
- Select Save Set button.
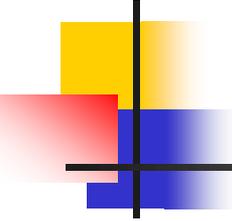
Use Views with Reports

- All Summary reports include options to use "Current View"

  - Select for data columns and/or data header rows as desired.

  - Use "View" button in Summary Report options to display current Assessment Data View dialog settings.
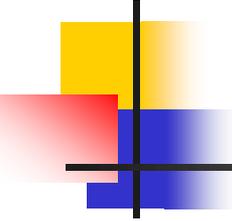
Apply Sort to Data Columns

- Sort data columns by applying sorts on View Options. For example, to sort by Pest then Date within Pest:
    - Click Clear button below Sort column.
    - Enter   1   in Sort column of Pest Code.
    - Enter   2   in Sort column of Rating Date.
    - Select "Display sort as tabs" to have each Pest Code on separate tab in editor.

Apply Sort to Data Columns

- Results in sorted tabs:

Apply Sort to Data Columns

- ARM supports defining any number of sort fields (continue entering sort priority number).

- To define an arbitrary sort order:
  - Enter terms to sort by in "Sort Order for View" header field.
 - Define "Sort Order for View" as sort field 1.

Assessment Data View Options

- Display only data columns that contain a desired field entry by defining Match in View Options.
  - Click into Match column, select term to match from dropdown.

Prompt	Match	Sort
Rating Date	(None) ▼	
Rating Type	(None)	
Rating Unit	4/18/2009	
Sample Size, Unit	4/24/2009 5/10/2009 7/8/2009 4/11/2009	

Assessment Data View Options

■ Use "Data origin" to show only Original or Calculated columns.
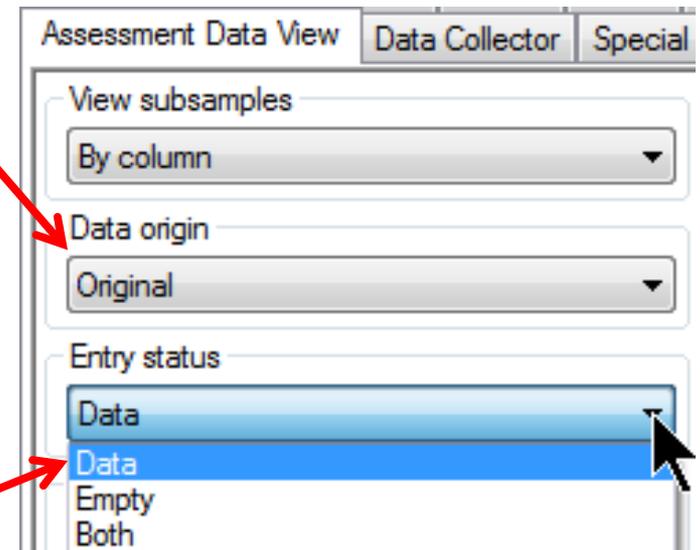
■ Use "Entry status" to show only columns with Data.

"Current View" on Summaries

- All Summary reports have "Current View" for data columns, header rows.
- "View" button changes current view.