



ARM 2020.2 Data Review Quick Guide

Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

- Tablet Data Entry
- Tablet Image
- Tablet Read GPS
- Header
- Treatments
- Site Description
 - General Trial
 - Objectives/Conclusions
 - Contacts
 - Crop Description
 - Pest Description
 - Site and Design
 - Maintenance
 - Soil
 - Weather
 - Application
 - Crop Stage at Appl.
 - Pest Stage at Appl.
 - Appl. Equipment
 - Treatment Appl. Comments
 - Notes
 - Deviations
 - SE Definitions
 - Protocol Instructions
- Assessment Data**
- Trial Map
- Schedule Tasks
- Calendar
- Comments
- Attachments

Assessment Data - Line 11

Column Number	1	
Pest Type	D	Disease
Pest Code	ZZYYFY	
Crop Type, Code	C	TRZAW
BBCH Scale	BCER	
Crop Variety		
Rating Date	Jul-15-2018	
SE Name		
SE Description		
Part Rated	LEAGRE	P
Rating Type	AREA	
Rating Unit	%AREA	
Sample Size	5	LEAF
Collection Basis		
Reporting Basis		

Sub	Rep	Blk	Col	Plot	Tit	1
1	1	1	1	101	3	10.00
1	1	1	2	102	1	15.00
1	1	1	3	103	4	20.00
1	1	1	4	104	2	10.00
1	1	1	5	105	5	0.00
1	2	2	1	201	2	5.00
1	2	2	2	202	3	10.00
1	2	2	3	203	5	65.00
1	2	2	4	204	4	20.00
1	2	2	5	205	1	10.00
1	3	3	1	301	3	5.00
1	3	3	2	302	2	0.00

Properties

Assessment View

View Options...

Visible Col 1/1

Refresh

Hidden: Row

Views - Default view

Original

All fields

Default view

Tools

Tablet Data Entry

AQV Means Table

Box-Whisker

Assessment Map

Merge from Study...

Display current treatment

Assessment (Plot 102, Col 1)

Comment:

Barcode:

Set GPS

Damaged

Image:

Attach

Remove

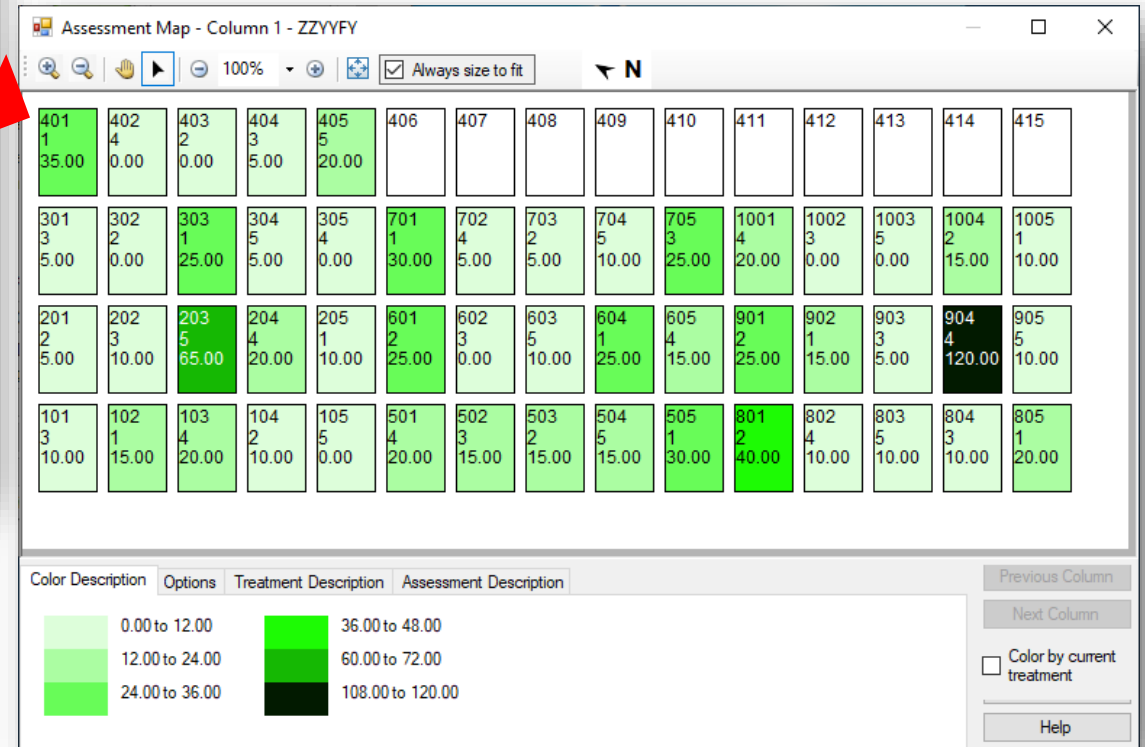
Rename

Display by

100%

Properties: Assessment Map

- Reduce transcription errors
- Identify potential outliers (rogue values)
- Investigate spatial/edge effects



Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

- Tablet Data Entry
- Tablet Image
- Tablet Read GPS
- Header
- Treatments
- Site Description
 - General Trial
 - Objectives/Conclusions
 - Contacts
 - Crop Description
 - Pest Description
 - Site and Design
 - Maintenance
 - Soil
 - Weather
 - Application
 - Crop Stage at Appl.
 - Pest Stage at Appl.
 - Appl. Equipment
 - Treatment Appl. Comments
 - Notes
 - Deviations
 - SE Definitions
 - Protocol Instructions
- Assessment Data**
- Trial Map
- Schedule Tasks
- Calendar
- Comments
- Attachments

Assessment Data - Line 11

Column Number	1	
Pest Type	D	Disease
Pest Code	ZZYYFY	
Crop Type, Code	C	TRZAW
BBCH Scale	BCER	
Crop Variety		
Rating Date	Jul-15-2018	
SE Name		
SE Description		
Part Rated	LEAGRE	P
Rating Type	AREA	
Rating Unit	%AREA	
Sample Size	5	LEAF
Collection Basis		
Reporting Basis		

+	Sub	Rep	Blk	Col	Plot	Tit	
	1	1	1	1	101	3	10.00
	1	1	1	2	102	1	15.00
	1	1	1	3	103	4	20.00
	1	1	1	4	104	2	10.00
	1	1	1	5	105	5	0.00
	1	2	2	1	201	2	5.00
	1	2	2	2	202	3	10.00
	1	2	2	3	203	5	65.00
	1	2	2	4	204	4	20.00
	1	2	2	5	205	1	10.00
	1	3	3	1	301	3	5.00
	1	?	?	?	302	?	0.00

Properties

Assessment View

View Options...

Visible Col 1/1

Refresh

Hidden: Row

Views - Default view

Original

All fields

Default view

Tools

Tablet Data Entry

AQV Means Table

Box-Whisker

Assessment Map

Merge from Study...

Display current treatment

Assessment (Plot 102, Col 1)

Comment:

Barcode:

Set GPS

Damaged

Image:

Attach

Remove

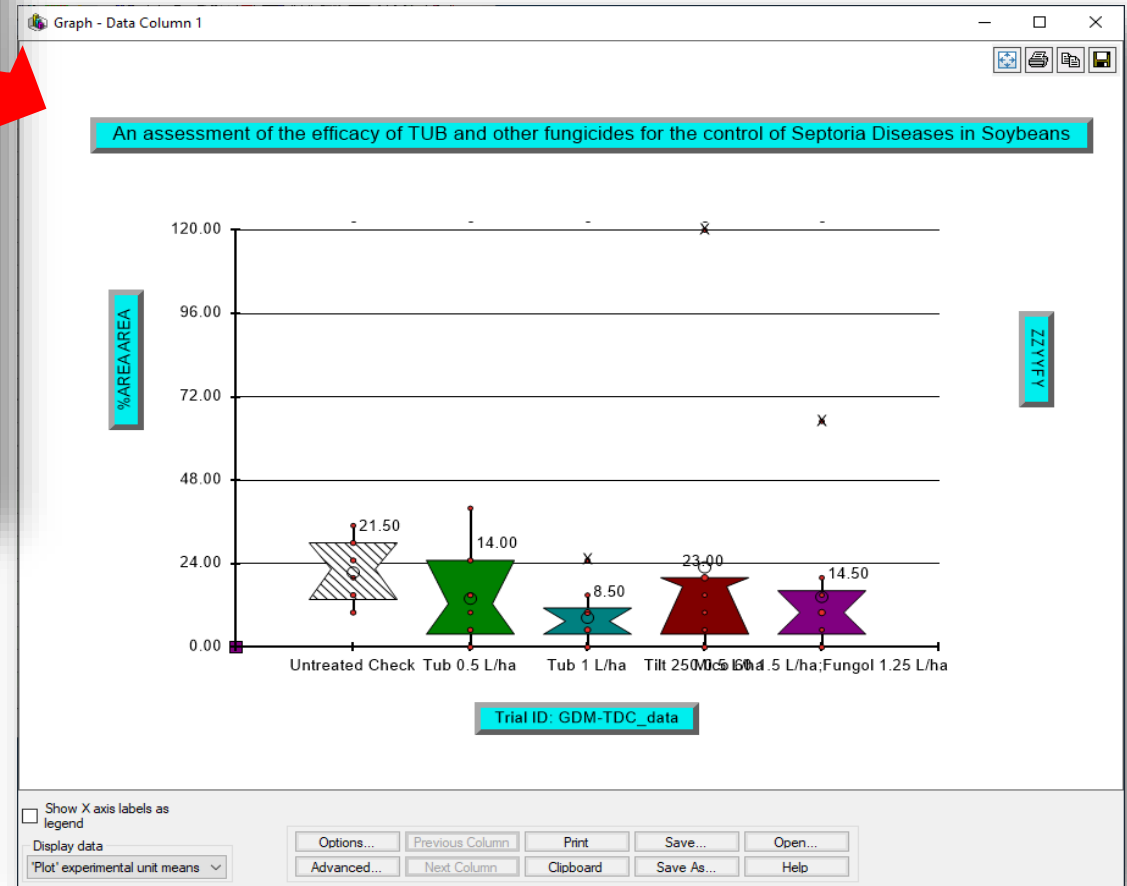
Rename

Display by

100%

Properties: Box-Whisker plot

- Reduce transcription errors
- Review treatment variance
- Assess potential outliers' effects on distribution



Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

- Tablet Data Entry
- Tablet Image
- Tablet Read GPS
- Header
- Treatments
- Site Description
 - General Trial
 - Objectives/Conclusions
 - Contacts
 - Crop Description
 - Pest Description
 - Site and Design
 - Maintenance
 - Soil
 - Weather
 - Application
 - Crop Stage at Appl.
 - Pest Stage at Appl.
 - Appl. Equipment
 - Treatment Appl. Comments
 - Notes
 - Deviations
 - SE Definitions
 - Protocol Instructions
- Assessment Data
- Trial Map
- Schedule Tasks
- Calendar
- Comments
- Attachments

Assessment Data - Line 431

Column Number	1
Pest Type	D Disease
Pest Code	ZZYYFY
Crop Type, Code	C TRZAW
BBCH Scale	BCER
Crop Variety	
Rating Date	Jul-15-2018
SE Name	
SE Description	
Part Rated	LEAGRE P
Rating Type	AREA
Rating Unit	%AREA
Sample Size	5 LEAF
Collection Basis	
Reporting Basis	

	Sub	Rep	Blk	Col	Plot	Trt	
	1	8	1	14	804	3	10.00
	1	8	1	15	805	1	20.00
	1	9	2	11	901	2	25.00
	1	9	2	12	902	1	15.00
	1	9	2	13	903	3	5.00
	1	9	2	14	904	4	120.00
	1	9	2	15	905	5	10.00
	1	10	3	11	1001	4	20.00
	1	10	3	12	1002	3	0.00
	1	10	3	13	1003	5	0.00
	1	10	3	14	1004	2	15.00

Properties

Assessment View

View Options...

Visible Col 1/1

Refresh

Hidden: Row

Views - Default view

Original

All fields

Default view

Tools

AQV Means Table

Box-Whisker

Assessment Map

Tablet Data Entry

Display current treatment

Assessment (Plot 904, Col 1)

Comment:

Barcode:

Set GPS

Damaged

Image:

Attach

Remove

Rename

Display by

100%

Properties: 'Damaged' checkbox

- If an invalid entry is identified (i.e. human error, unexpected event in the field, etc.) it may be marked as 'damaged'
- The damaged value remains in the assessment data but it is excluded from the statistical analysis carried out within ARM

	Sub	Rep	Blk	Col	Plot	Trt	1
	1	8	1	14	804	3	10.00
	1	8	1	15	805	1	20.00
	1	9	2	11	901	2	25.00
	1	9	2	12	902	1	15.00
	1	9	2	13	903	3	5.00
	1	9	2	14	904	4	120.00
	1	9	2	15	905	5	10.00
	1	10	3	11	1001	4	20.00
	1	10	3	12	1002	3	0.00
	1	10	3	13	1003	5	0.00
	1	10	3	14	1004	2	15.00
	1	10	3	15	1005	1	10.00

Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

Tablet Data Entry
Tablet Image
Tablet Read GPS
Header
Treatments
Site Description
General Trial
Objectives/Conclusions
Contacts
Crop Description
Pest Description
Site and Design
Maintenance
Soil
Weather
Application
Crop Stage at Appl.
Pest Stage at Appl.
Appl. Equipment
Treatment Appl. Comments
Notes
Deviations
SE Definitions
Protocol Instructions
Assessment Data
Trial Map
Schedule Tasks
Calendar
Comments
Attachments

Assessment Data - Line 431

Column Number	1
Pest Type	D Disease
Pest Code	ZZYYFY
Crop Type, Code	C TRZAW
BBCH Scale	BCER
Crop Variety	
Rating Date	Jul-15-2018
SE Name	
SE Description	
Part Rated	LEAGRE P
Rating Type	AREA
Rating Unit	%AREA
Sample Size	5 LEAF
Collection Basis	
Reporting Basis	

Column 1 Properties

Previous Next

Column Flags: Original
Min/Max entry: 0 100
Low/High value: 0.00 120.00
Descriptive Statistics Refresh

LSD P= .05: 11.383
Standard Deviation: 12.538
CV: 88.396
Grand Mean: 14.18
Levene's Prob(F): 0.799
P(Friedman's X2): 0.102
Skewness: 1.6427
Kurtosis: 4.6975
Replicate Prob(F): 0.7160
Treatment Prob(F): 0.2470

Does not meet assumptions of AOV: data has skewness/kurtosis

Fix

Outliers

☒ > +/- 3 standard deviations from grand mean
☐ > +/- 2 standard deviations from grand mean
☐ Box-Whisker

☐ Skip damaged assessments
☒ Based on subsample values

Find Next

Sub	Rep	Blk	Col	Plot	Tit	1
1	8	1	15	805	1	20.00
1	9	2	11	901	2	25.00
1	9	2	12	902	1	15.00
1	9	2	13	903	3	5.00
1	9	2	14	904	4	120
1	9	2	15	905	5	10.00
1	10	3	11	1001	4	20.00
1	10	3	12	1002	3	0.00
1	10	3	13	1003	5	0.00
1	10	3	14	1004	2	15.00
1	10	3	15	1005	1	10.00

100%

Column Properties: Outliers

- Identify potential outliers within the assessment column (may skip 'damaged' observations or not)
- Options to check from most extreme outliers (+/- 3SD) to lesser outliers (Box-Whisker)

Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

Tablet Data Entry
Tablet Image
Tablet Read GPS
Header
Treatments
Site Description
General Trial
Objectives/Conclusions
Contacts
Crop Description
Pest Description
Site and Design
Maintenance
Soil
Weather
Application
Crop Stage at Appl.
Pest Stage at Appl.
Appl. Equipment
Treatment Appl. Comments
Notes
Deviations
SE Definitions
Protocol Instructions
Assessment Data
Trial Map
Schedule Tasks
Calendar
Comments
Attachments

Assessment Data - Line 71

Column Number	1
Pest Type	D Disease
Pest Code	ZZYYFY
Crop Type, Code	C TRZAW
BBCH Scale	BCER
Crop Variety	
Rating Date	Jul-15-2018
SE Name	
SE Description	
Part Rated	LEAGRE P
Rating Type	AREA
Rating Unit	%AREA
Sample Size	5 LEAF
Collection Basis	
Reporting Basis	

Column 1 Properties

Previous Next

Column Flags: Original
Min/Max entry: 0 100
Low/High value: 0.00 120.00
Descriptive Statistics Refresh

LSD P= .05: 11.383
Standard Deviation: 12.538
CV: 88.396
Grand Mean: 14.18
Levene's Prob(F): 0.799
P(Friedman's X2): 0.102
Skewness: 1.6427
Kurtosis: 4.6975
Replicate Prob(F): 0.7160
Treatment Prob(F): 0.2470

Does not meet assumptions of AOV: data has skewness/kurtosis

Fix

Outliers

☐ > +/- 3 standard deviations from grand mean
☒ > +/- 2 standard deviations from grand mean
☐ Box-Whisker

☒ Skip damaged assessments
☒ Based on subsample values

Find Next

Sub	Rep	Blk	Col	Plot	Tit	1
1	1	1	4	104	2	10.00
1	1	1	5	105	5	0.00
1	2	2	1	201	2	5.00
1	2	2	2	202	3	10.00
1	2	2	3	203	5	85
1	2	2	4	204	4	20.00
1	2	2	5	205	1	10.00
1	3	3	1	301	3	5.00
1	3	3	2	302	2	0.00
1	3	3	3	303	1	25.00
1	3	3	4	304	5	5.00

100%

Data-Confirmation Trial - (GDMdef) ARM 2020.2

File Edit Format Tools Table Utilities Window Graph Tablet Help

Navigation Bar

ARM

- Tablet Data Entry
- Tablet Image
- Tablet Read GPS
- Header
- Treatments
- Site Description
- General Trial
- Objectives/Conclusions
- Contacts
- Crop Description
- Pest Description
- Site and Design
- Maintenance
- Soil
- Weather
- Application
- Crop Stage at Appl.
- Pest Stage at Appl.
- Appl. Equipment
- Treatment Appl. Comme...
- Notes
- Deviations
- SE Definitions
- Protocol Instructions
- Assessment Data**
- Trial Map
- Schedule Tasks
- Calendar
- Comments
- Attachments
- Settings
- Study Rules
- Field Map Layout
- Tasks
- Master Calendar
- Study List
- Import Weather Data

Assessment Data - Line 1

Column Number	1	
SE Description		
Part Rated	LEAGRE	P
Rating Type	AREA	
Rating Unit	%AREA	
Sample Size	5	LEAF
Collection Basis		
Reporting Basis		
Number of Subsamples	1	
Crop Stage Scale	BBCH	
Crop Stage Majority/Min/Max	84	
Crop Density		
Pest Stage Majority/Min/Max		
Pest Density	1.75	PERCENT
Footnote Number	2	
Rating Timing	4	
Days After First/Last Applic.	91	7
Trt-Eval Interval	11 DAC	
Plant-Eval Interval	273 DP-1	
Days After Emergence		
ARM Action Codes	AS	
Number of Decimals	2	

Column 1 Diagnostics

Diagnostics

☐ Include spatial models

AS Graphs

Show... Layout: 2 X 2

Statistics (P)	Raw	IID	EX	AL	AS	AA	AR
N	50	50	50	50	50	50	50
Unique	10	47	48	49	49	49	49
Analyzed	49	49	49	49	49	49	49
Missing	0	0	0	0	0	0	0
Empty	0	0	0	0	0	0	0
Damaged	1	1	1	1	1	1	1
MinRep	9	9	9	9	9	9	9
MaxRep	10	10	10	10	10	10	10
Treatments	5	5	5	5	5	5	5
Levene's	0.799	0.715	0.182	0.8	0.721	0.739	
ShapiroWilks	0	0.001	0.095	0.012	0.261	0.292	
Skewness	0	0.0	0.108	0.056	0.235	0.249	
Kurtosis	0	0	0.668	0.817	0.998	0.765	
MaxStdRes		3.4	2.242	1.975	2.414	2.503	3.357
logLik		-185.193	-167.164	-91.885	-85.13	18.273	-188.893
ModelDF		13	13	13	13	13	9
ResDF		35	34	35	35	35	39
AIC		400.386	364.328	213.771	200.26	-6.546	399.786
BIC		428.763	392.396	242.148	228.637	21.832	420.596

Recommendations

Basis: Assessment Values

IID Graphs

Show... Layout: 2 X 2

	Code	Test Statistic	Value	Comment
1	IID	Levene's	0.529	Does not fail test of homogeneity of variances among treatments
2	AA	ShapiroWilks	0.904	Analyze transformed assessments to improve normality of residuals
3	AA	Skewness	4.177	Select action code to reduce skewness of residuals
4	AS	Kurtosis	5.981	Select action code to reduce kurtosis of residuals

Outliers

	plot	treatment	replicate	column	assessment1	IID
1	203	5	2	3	65	3.4

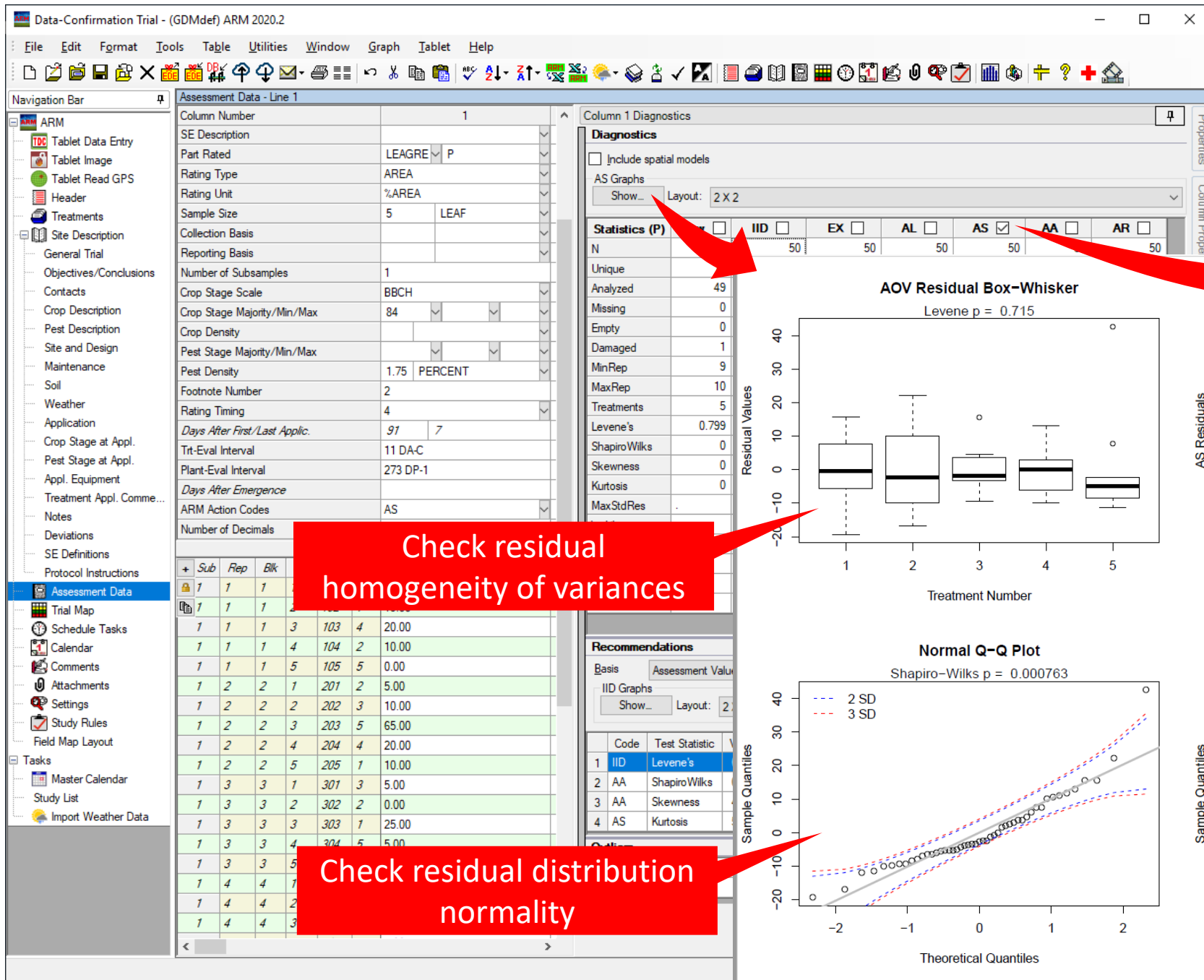
Save to RStudio

Previous Next

100%

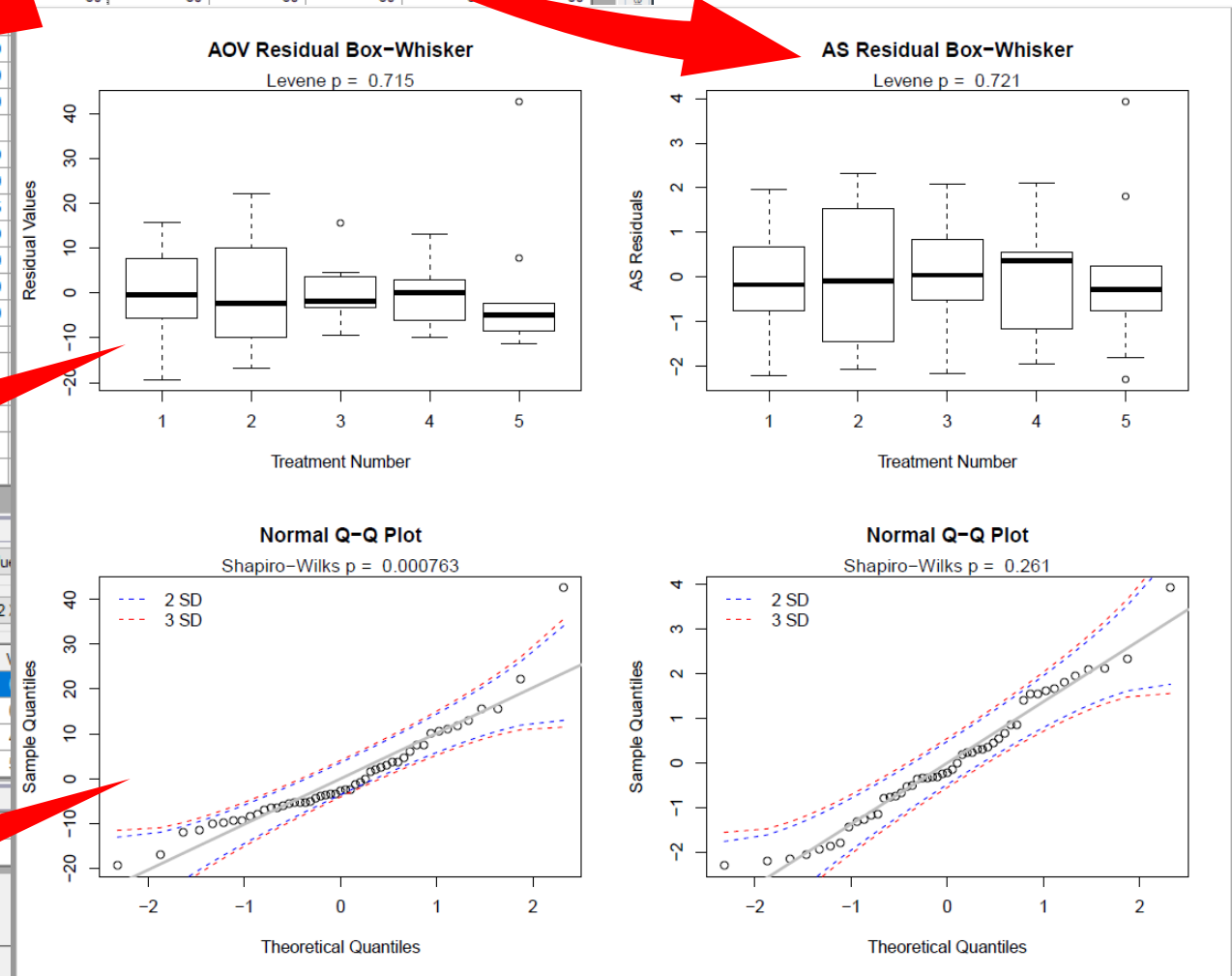
Column Diagnostics

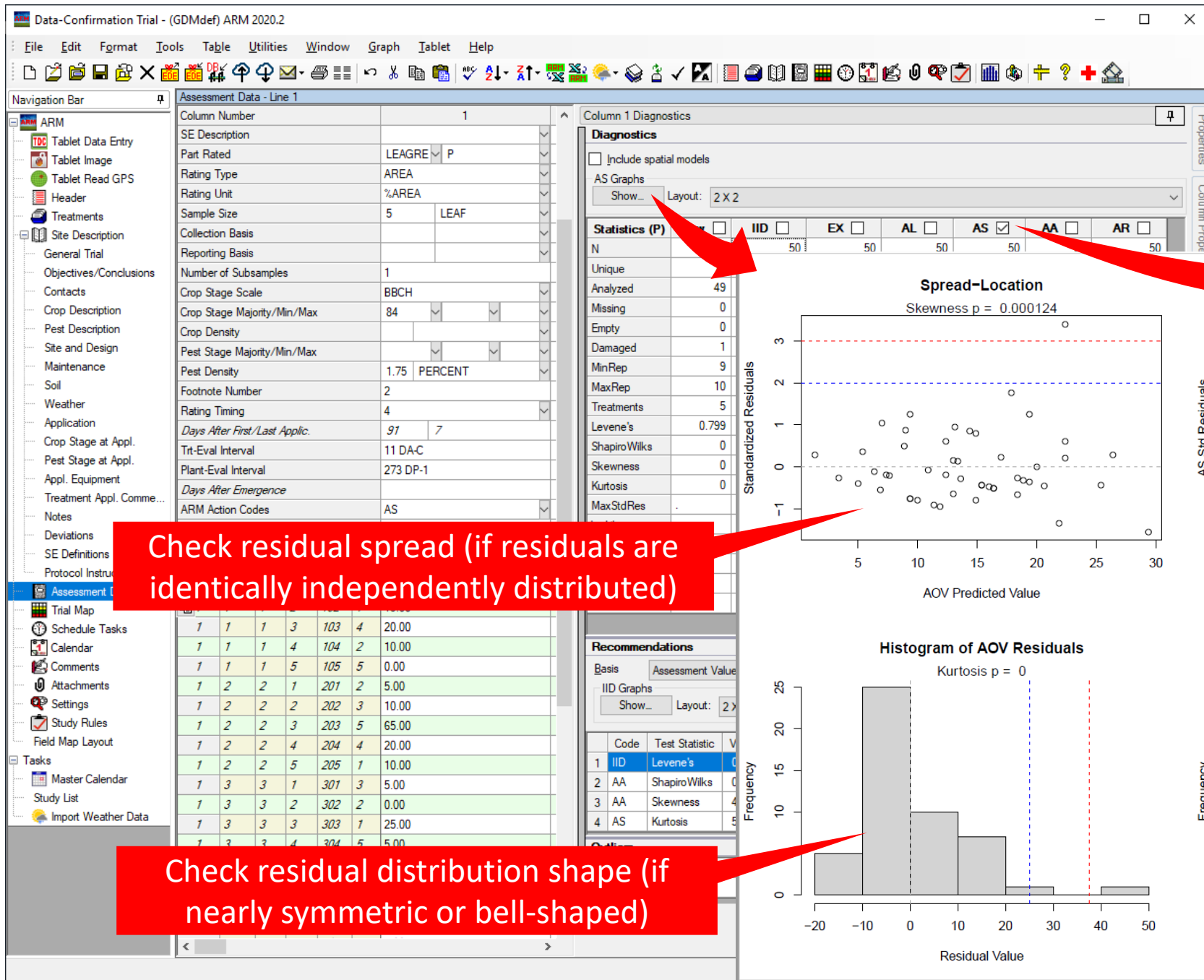
- Assessments descriptive statistics
- Analysis of Variance assumptions tests
- Model Goodness of Fit indicators
- Untransformed and transformed data comparison
- Appropriate data transformations recommendations
- Data transformation definitions can be found in the assessment header/ARM Action Codes drop-down
- Additional data transformation information can be found in the Help menu or also on GDM's website [here](#)



Column Diagnostics: Graphs

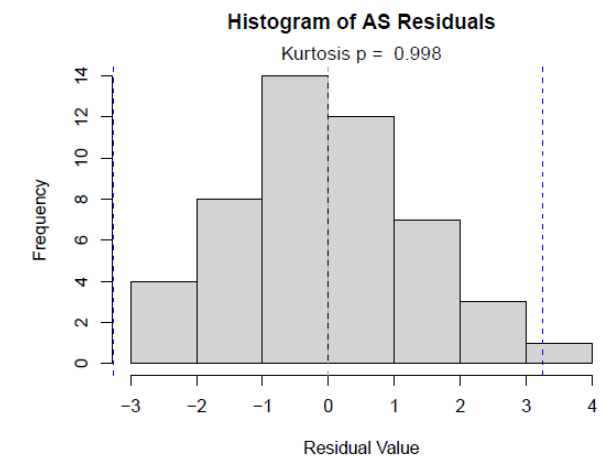
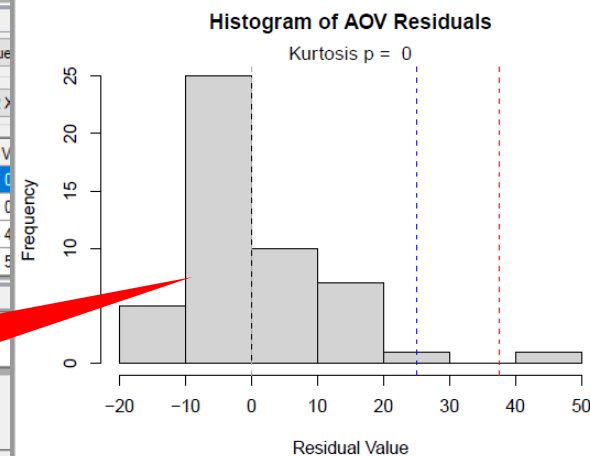
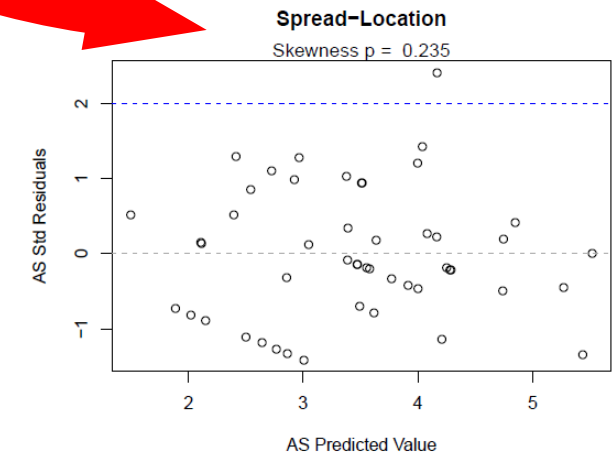
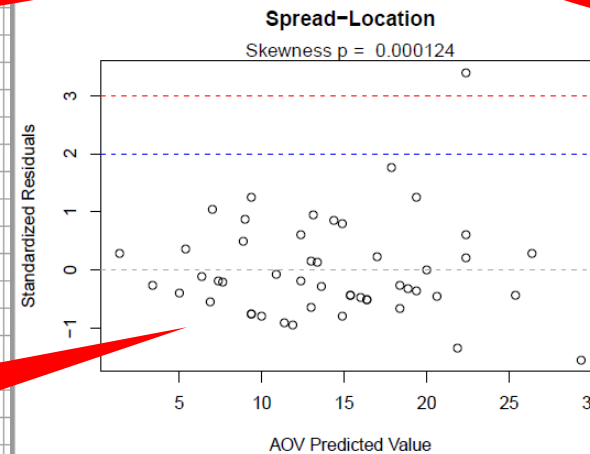
- Compare untransformed and transformed data prior to statistical analysis





Column Diagnostics: Graphs

- Compare untransformed and transformed data prior to statistical analysis



Additional Resources

GDM video tutorial:

[ARM Features: Column Diagnostics](#) (14 min)

GDM webinar series:

[ARM and Statistics webinar series – Day 1 – Overview](#) (53 min)

[ARM and Statistics webinar series – Day 2 – Data Confirmation](#) (59 min)

[ARM and Statistics webinar series – Day 3 – Data Review](#) (66 min)

[ARM and Statistics webinar series – Day 4 – Reporting](#) (66 min)

GDM resources:

[ARM Academy: training for ARM software](#)