

ARM 2017 Features Since ARM 9.2014.8



Gylling Data Management, Inc.



Statistical Handbook 3rd Edition



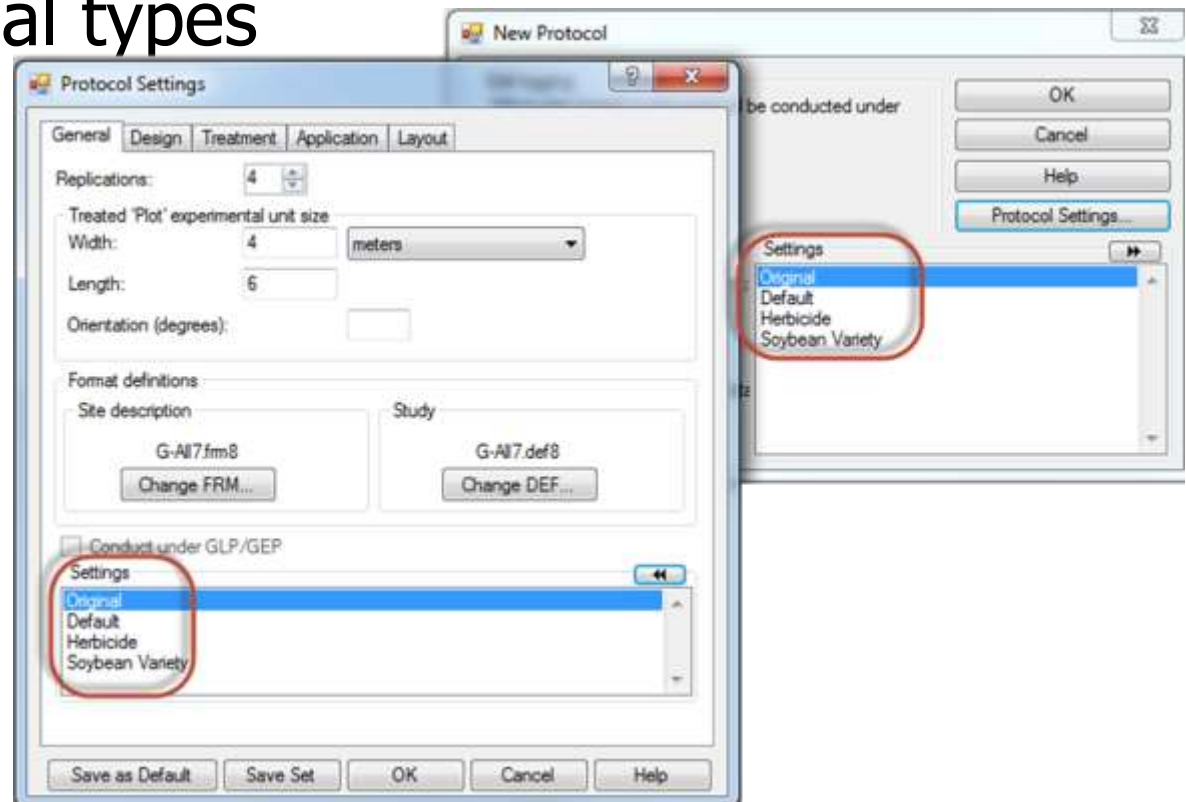
A Statistical Handbook for Agricultural Field Trials Specialists: A handy companion for use with ARM data management tools

Available as an eBook from:

- Amazon: <https://www.amazon.com/Statistical-Handbook-Agricultural-Trials-Specialists-ebook/dp/B01KIHJRWQ/> also offered in Print
- Kobo: <https://store.kobobooks.com/en-us/ebook/a-statistical-handbook-for-agricultural-field-trials-specialists>

"New Protocol" Option Sets

- "Save Set" button to create appropriate defaults for different trial types
- Select set in New Protocol dialog or General tab of Protocol Settings



Automatic Mix Size Calculator

On Settings - Application tab, to calculate mix for all plots of 1 liquid treatment application select:

1. Volume unit
2. Mix unit
3. Overage to fill applicator lines per treatment + before/after plot

Trial Settings

General Design Treatment Application Layout

Application volume: 200 L/ha 1

Mix size

| | |
|-----------------------|-------------|
| Treatments | 1 |
| Replications | 4 |
| 'Plot' EU size | 25 m2 |
| Application volume | 200 L/ha |
| Mix size unit | liters 2 |
| Minimum | 2 liters |
| Overage: | 150 mL 3 |
| Calculated mix size | 2.15 liters |
| User-defined mix size | 2.15 liters |

2 liters based on 1 trts; 4 reps; 25 m2 'Plot' size; 200 L/ha volume



Augmented Designs

- Augmented Randomized Complete Block
- Augmented Completely Random Design
- On Design tab of Settings dialog
- Typically used when:
 - Experimental material for test treatments is scarce so not possible to replicate in the design
 - Enough control material to replicate

Augmented Designs

Protocol Settings

General Design Treatment Application Layout

Augmented Randomized Complete Block (ARCB) ▾

Factors: 1 ▾

Treatments

A: Variety ▾ 39 ▾ Do not merge ▾

Extended design settings

| | | | |
|----------------------------|------|-----------------|-----|
| Unreplicated treatments: | 36 ▾ | Checks | |
| % Checks: | 25 ▾ | Treatments: | 3 ▾ |
| Ratio to check 'Plots': | 3 | Repeats (Reps): | 4 ▾ |
| Minimum number of 'Plots': | 48 | 'Plots': | 12 |

Tip: Select 'Automatic to approximate square replicate' on the Layout tab to have ARM generate a better quality randomization.



Power and Efficiency Planner, Plan Experiments to Have:

- A reasonable chance of distinguishing anticipated treatment differences
- The optimum number of replicates required to meet objectives
- An efficient experimental design and randomization for desired precision
- Cost-effective utilization of the available experimental area



Why is Planning Critical?

- Can reduce costs by selecting optimum number of replicates and samples
- Expected treatment differences are typically $< 10\%$, and frequently $< 5\%$, so small precision gains can help to:
 - Distinguish an actual treatment difference (reject null hypothesis H_0)
 - Strengthen evidence of no treatment diff.) (do not reject null hypothesis H_0)

Power and Efficiency Planner

Protocol Settings

General Design Treatment Application Layout

Randomized Complete Block (RCB)

Factors: 1

Treatments Merge Factor fields to

A: [] 5 [] Do not merge

B: [] [] Do not merge

C: [] [] Do not merge

The Treatment editor Type column (field) uses the factor description entered above as the default entry.

Clear

Power and Efficiency

CV 10.0 Reps 4 Power 80 α SL 5% % Mean Diff 10.0

Lock at

| CV | Reps | Power | α SL | % Mean Diff | Error DF | 'Plot' EUs |
|------|------|-------|-------------|-------------|----------|------------|
| 3.83 | 3 | 80 | 5% | 10 | 8 | 15 |
| 4.63 | 4 | | | | 12 | 20 |
| 5.3 | 5 | | | | 16 | 25 |
| 5.9 | 6 | | | | 20 | 30 |
| 6 | 7 | | | | 24 | 35 |
| 6.9 | 8 | | | | 28 | 40 |
| 8 | 11 | | | | 40 | 55 |
| 10 | 17 | | | | 64 | 85 |
| 12 | 24 | | | | 92 | 120 |
| 14 | 32 | | | | 124 | 160 |



Power and Efficiency Planner

- Help plan experiments that successfully detect expected treatment differences
- Available in both protocols and trials so:
 - Protocol writers can more effectively plan experiments
 - Trialists can verify whether CV expectations are realistic based on local experience for specified crop(s)

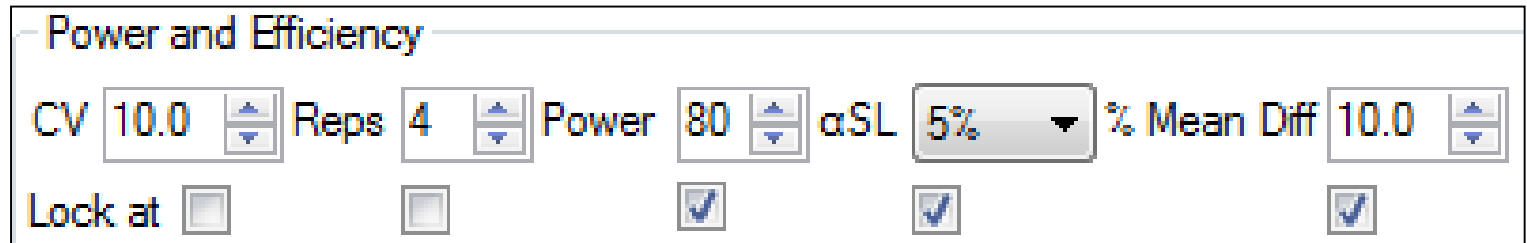


Power and Efficiency Planner

Calculates "power" based on:

- Estimated CV of key assessment (e.g. yield)
- Number of replicates
- Power = Level of certainty to detect "real" treatment effects (80% or 90%)
- Alpha Significance Level (e.g. 5%, 10%)
- % Mean Diff = estimated treatment effect, expressed as percentage of overall (grand) mean across treatments of key assessment

Power and Efficiency Planner



Power and Efficiency

CV 10.0 Reps 4 Power 80 α SL 5% % Mean Diff 10.0

Lock at

- "Lock at" to keep 3 columns constant
- Calculates table of possible values for "unlocked" columns (e.g. Rep or CV)
- Values entered by protocol writer are carried into trials created from protocol, conveying protocol expectations

Power and Efficiency Planner

Compare effect of significance level on minimum replicates for CV=6% vs. 10%

Power and Efficiency

CV 10.0 Reps 4 Power 80 **αSL 5%** % Mean Diff 10.0

Lock at

| CV | Reps |
|------|------|
| 4.37 | 3 |
| 5.05 | 4 |
| 5.64 | 5 |
| 6.2 | 6 |
| 7.14 | 8 |
| 6 | 6 |
| 8 | 11 |
| 10 | 16 |
| 12 | 23 |
| 14 | 31 |

Power and Efficiency

CV 10.0 Reps 4 Power 80 **αSL 10%** % Mean Diff 10.0

Lock at

| CV | Reps | Power | αSL | % Mean Diff |
|------|------|-------|-----|-------------|
| 4.93 | 3 | | | |
| 5.7 | 4 | | | |
| 6.36 | 5 | | | |
| 7 | 6 | | | |
| 8.04 | 8 | | | |
| 6 | 5 | 80 | 10% | 10 |
| 8 | 8 | | | |
| 10 | 13 | | | |
| 12 | 18 | | | |
| 14 | 25 | | | |

Power and Efficiency Planner

Consider impact of Replicates on precision to detect treatment differences

Power and Efficiency

CV 5.0 Reps 4 Power 80 α SL 5% % Mean Diff 5.0

Lock at

| CV | Reps | Power | α SL | % Mean Diff | Error DF | 'Plot' EUs |
|----|------|-------|-------------|-------------|----------|------------|
| 5 | 3 | 80 | 5% | 13 | 8 | 15 |
| | 4 | | | 10.8 | 12 | 20 |
| | 5 | | | 9.4 | 16 | 25 |
| | 6 | | | 8.5 | 20 | 30 |
| | 8 | | | 7.26 | 28 | 40 |
| | 9 | | | 7 | 32 | 45 |
| | 12 | | | 6 | 44 | 60 |
| | 17 | | | 5 | 64 | 85 |
| | 26 | | | 4 | 100 | 130 |
| | 45 | | | 3 | 176 | 225 |

Click on column heading to sort



Randomization Quality Review

Goal is to improve experiment precision:

1. Arrange replicates as squares, not strips
2. Equalize treatment distribution
 - a. Balance average distance from all other treatments
 - b. Balance "Edge effect" across treatments
3. Randomize all replicates

Trial Map

75%

Properties

- Color by
 - Replicate
 - Treatment
 - Current Treatment
- Auto-select for move
 - Treatment
 - 'Plot' Experimental Unit
 - Replicate

Treatment

| Trt | Code | At Edge | Ave Dist. | StDev | Min | Max |
|-----|------|---------|-----------|-------|------|-----|
| 1 | CHK | 3 | 79 | 18.6 | 40.4 | 121 |
| 2 | | 3 | 96 | 26.2 | 40.4 | 128 |
| 3 | | 2 | 76.5 | 26.6 | 19.1 | 128 |
| 4 | | 3 | 86 | 24.6 | 46.8 | 138 |
| 5 | | 2 | 82 | 20.0 | 46.8 | 117 |
| 6 | | 2 | 69 | 21.0 | 38.3 | 106 |
| 7 | | 2 | 67 | 13.9 | 49 | 102 |
| 8 | | 2 | 68 | 18.2 | 27.6 | 102 |
| 9 | | 2 | 66 | 25.6 | 19.1 | 117 |
| 10 | | 2 | 64.7 | 23.2 | 25.5 | 117 |
| 11 | | 2 | 69 | 19.2 | 27.6 | 104 |
| 12 | | 2 | 66 | 21.8 | 25.5 | 106 |
| 13 | | 2 | 61 | 22.3 | 25.5 | 125 |
| 14 | | 2 | 56 | 17.6 | 21.3 | 89 |
| 15 | | 2 | 67 | 22.8 | 32 | 125 |
| 16 | | 2 | 64.7 | 22.3 | 27.6 | 123 |
| 17 | | 2 | 71.5 | 24.0 | 27.6 | 113 |
| 18 | | 2 | 67 | 25.0 | 27.6 | 110 |
| 19 | | 2 | 60.6 | 19.2 | 21.3 | 102 |
| 20 | | 2 | 63 | 24.2 | 27.6 | 125 |
| 21 | | 2 | 79 | 27.4 | 25.5 | 128 |
| 22 | | 2 | 69 | 27.0 | 14.9 | 121 |
| 23 | | 2 | 70 | 26.0 | 14.9 | 110 |
| 24 | REF | 3 | 27.7 | 38.3 | 138 | |

Options | Movement Arrows | Treatment Description | Comment | **Quality**

Suggested block size (*=optimum):

| Block Size | 6 | 8* | 12 | 24 |
|---------------|-------|--------|-------|-------|
| Rep Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Rep Length | 103 | 77 | 51 | 25 |
| Surface/Area | 0.059 | 0.056* | 0.059 | 0.090 |
| Trial Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Trial Length | 415 | 311 | 207 | 103 |
| Unused 'Plot' | 0 | 0 | 0 | 0 |

Replicate shape

Replicate 1 is defined as non-randomized. It is best statistical practice to randomize all replicates.

1

3

a

b

Settings... | Re-Randomize | Re-Number 'Plots' | | Cancel | Help

Arrange Replicates as Squares not Strips

"Optimum" is smallest surface-to-area ratio

| Options | Movement Arrows | Treatment Description | Comment | Quality |
|-----------------------------------|-----------------|--------------------------------------|---------|---------|
| Suggested block size (*=optimum): | | <input type="button" value="Apply"/> | | |
| Block Size | 6 | 8* | 12 | 24 |
| Rep Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Rep Length | 103 | 77 | 51 | 25 |
| Surface/Area | 0.059 | 0.056* | 0.059 | 0.090 |
| Trial Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Trial Length | 415 | 311 | 207 | 103 |

| Options | Movement Arrows | Treatment Description | Comment | Quality |
|-----------------------------------|-----------------|--------------------------------------|---------|---------|
| Suggested block size (*=optimum): | | <input type="button" value="Apply"/> | | |
| Block Size | 6 | 8* | 12 | 24 |
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| Trial Width | 50.5 | 67.5 | 101.5 | 203.5 |
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| Options | Movement Arrows | Treatment Description | Comment | Quality |
|-----------------------------------|-----------------|--------------------------------------|---------|---------|
| Suggested block size (*=optimum): | | <input type="button" value="Apply"/> | | |
| Block Size | 6 | 8* | 12 | 24 |
| Rep Width | 50.5 | 67.5 | 101.5 | 203.5 |
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| Options | Movement Arrows | Treatment Description | Comment | Quality |
|-----------------------------------|-----------------|--------------------------------------|---------|---------|
| Suggested block size (*=optimum): | | <input type="button" value="Apply"/> | | |
| Block Size | 6 | 8* | 12 | 24 |
| Rep Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Rep Length | 103 | 77 | 51 | 25 |
| Surface/Area | 0.059 | 0.056* | 0.059 | 0.090 |
| Trial Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Trial Length | 415 | 311 | 207 | 103 |

Equalize Treatment Distribution

"Undesirable" layout of 7 treatments and 5 replicates in Randomized Complete Block:

- Trt. 6 in middle 3 columns of all reps
- Trt. 5 in right 2 cols for all but one plot

| | | | | | | |
|----|----|----|----|----|----|----|
| 2e | 4e | 7e | 1e | 6e | 3e | 5e |
| 1d | 7d | 3d | 4d | 6d | 2d | 5d |
| 7c | 5c | 4c | 6c | 2c | 3c | 1c |
| 2b | 1b | 3b | 6b | 7b | 5b | 4b |
| 7a | 2a | 6a | 3a | 4a | 1a | 5a |

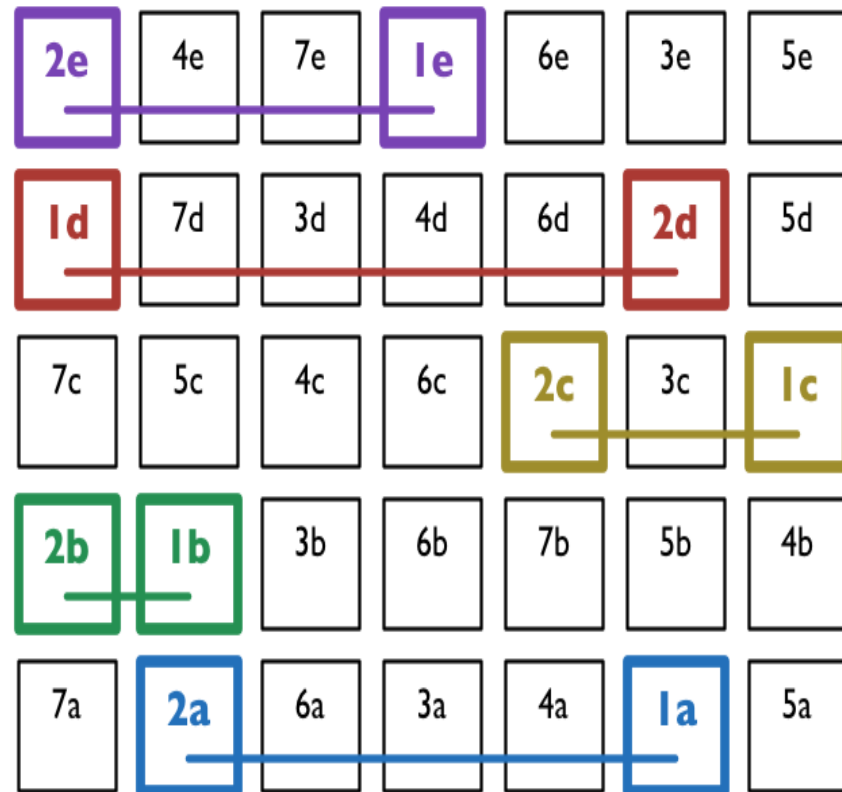


Uses "Average Distance of Treatment" Comparison (ADTC)

- van Es and van Es, "Spatial Nature of Randomization and Its Effect on the Outcome of Field Experiments", *Agronomy Journal*, 85:420-428 (1993).
- Comparison between treatments 1 and 2 is taken from 5 plots for each treatment.
- Measure the plot-to-plot distance for each plot containing treatment 1 to the paired plot within replicate containing treatment 2, for a total of 5 distances.
- ADTC for the treatment pair 1-2 is the average of the 5 distances.

Distances, Treatments 1-2

Average distance = 3 plots = 24 feet
for 8 foot
wide plots



Unequal Treatment Distribution

- Average distance from 17.9 to 24.6
- Ranges from 11.9(T3,T6) to 34(T2,T5)
- Error variances for treatments may not be homogeneous



| Trt | At Edge | Ave Dist. | StDev | Min | Max |
|-----|---------|-----------|-------|------|------|
| 1 | 4 | 24.4 | 6.24 | 13.6 | 32.3 |
| 2 | 3 | 24.6 | 5.56 | 17 | 34 |
| 3 | 2 | 19.8 | 5.66 | 11.9 | 25.5 |
| 4 | 3 | 21.3 | 3.18 | 17 | 25.5 |
| 5 | 3 | 27 | 5.83 | 20.4 | 34 |
| 6 | 2 | 17.9 | 3.53 | 11.9 | 22 |
| 7 | 3 | 23.8 | 4.3 | 18.7 | 29 |

Unbalanced "Edge effect"

Treatment 1 occurs at edge 4 times,
T2 and T3 at edge only 2 times

| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| 501 7 | 502 2 | 503 6 | 504 3 | 505 4 | 506 1 | 507 5 |
| 401 2 | 402 1 | 403 3 | 404 6 | 405 7 | 406 5 | 407 4 |
| 301 7 | 302 5 | 303 4 | 304 6 | 305 2 | 306 3 | 307 1 |
| 201 1 | 202 7 | 203 3 | 204 4 | 205 6 | 206 2 | 207 5 |
| 101 2 | 102 4 | 103 7 | 104 1 | 105 6 | 106 3 | 107 5 |

| Trt | At Edge | Ave Dist. | StDev | Min | Max |
|-----|---------|-----------|-------|------|------|
| 1 | 4 | 24.4 | 6.24 | 13.6 | 32.3 |
| 2 | 3 | 24.6 | 5.56 | 17 | 34 |
| 3 | 2 | 19.8 | 5.66 | 11.9 | 25.5 |
| 4 | 3 | 21.3 | 3.18 | 17 | 25.5 |
| 5 | 3 | 27 | 5.83 | 20.4 | 34 |
| 6 | 2 | 17.9 | 3.53 | 11.9 | 22 |
| 7 | 3 | 23.8 | 4.3 | 18.7 | 29 |

Properties

Color by

- Replicate
- Treatment
- Current Treatment

Auto-select for move

- Treatment
- 'Plot' Experimental Unit
- Replicate

Balanced Treatment Distribution and Edge Effect

- Average distance from 21.3 to 24.4
- Distances range from 18.7 to 27.2
- "Edge effect" is balanced



| | | | | | | |
|----------|----------|----------|----------|----------|----------|----------|
| 501 3 | 502 4 | 503 7 | 504 6 | 505 5 | 506 1 | 507 2 |
| 401 2 | 402 6 | 403 4 | 404 1 | 405 7 | 406 3 | 407 5 |
| 301 7 | 302 1 | 303 2 | 304 3 | 305 4 | 306 5 | 307 6 |
| 201 4 | 202 5 | 203 1 | 204 7 | 205 6 | 206 2 | 207 3 |
| 101 1 | 102 3 | 103 6 | 104 5 | 105 2 | 106 4 | 107 7 |

| Trt | At Edge | Ave Dist. | StDev | Min | Max |
|-----|---------|-----------|-------|------|------|
| 1 | 2 | 22 | 2.15 | 20.4 | 25.5 |
| 2 | 3 | 23.8 | 3.57 | 18.7 | 27.2 |
| 3 | 3 | 24.4 | 1.76 | 22 | 27.2 |
| 4 | 3 | 22.4 | 3.47 | 18.7 | 25.5 |
| 5 | 3 | 22 | 3.4 | 18.7 | 27.2 |
| 6 | 3 | 21.3 | 2.58 | 18.7 | 25.5 |
| 7 | 3 | 22.7 | 2.56 | 18.7 | 25.5 |

Randomize All Replicates

- This frame displays when a non-randomized replicate is defined in Settings
- Select "Randomize All Replicates" to follow recommended statistical practice

Options Movement Arrows Treatment Description Comment Quality

Suggested block size (*=optimum):

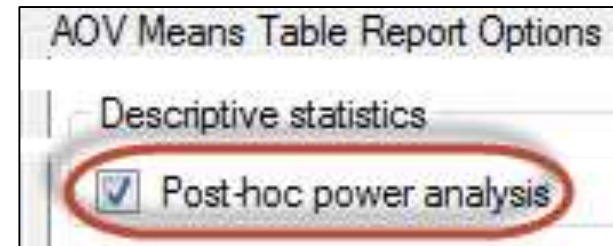
| | | | | |
|--------------|-------|-----------|-------|-------|
| Block Size | 6 | 8* | 12 | 24 |
| Rep Width | 50.5 | 67.5 | 101.5 | 203.5 |
| Rep Length | 103 | 77 | 51 | 25 |
| Surface/Area | 0.059 | 0.056* | 0.059 | 0.090 |

Replicate shape

Replicate 1 is defined as non-randomized. It is best statistical practice to randomize all replicates.

Post-hoc Power Analysis

- Optional descriptive statistic on AOV Means Table report
- Lists, for each assessment column, the minimum number of replicates required to statistically separate treatment means based on Treatment P(F) and current significance level
- Use for planning future trials



Post-hoc Power Analysis

- In example, LSD can distinguish 25% mean difference (largest existing difference is 18%)
- Current AOV Trt P(F) is 0.2979, so use 0.30+ significance level to separate treatment means
- Need 8+ replicates to reject null hypothesis at 0.05 significance

| Crop Variety | CEZANNE |
|---------------------------------------|--------------|
| Trt No. | 24 |
| | 2 85.33 a |
| | 3 81.67 a |
| | 4 98.00 a |
| | 5 95.33 a |
| LSD P=.05 (% mean diff) | 21.808 (25%) |
| Standard Deviation | 10.915 |
| CV | 12.12 |
| Grand Mean | 90.083 |
| Minimum Replicates (power = 80) | 8 |
| Largest Mean Difference (% mean diff) | 16.333 (18%) |
| Treatment F | 1.541 |
| Treatment Prob(F) | 0.2979 |

'Create this Trial' in Protocol

- Right-click on row of trial to create in planned trials grid of protocol
- Creates each trial using listed trial ID, opens in separate ARM sessions

The screenshot shows a software window titled 'Protocol Description'. It has several tabs: 'Trial Establishment Guidelines', 'Crop/Pest Description', 'Soil', 'Application', and 'Crop St...'. The 'Trial Establishment Guidelines' tab is active, displaying a table with the following data:

| Trial ID | Responsible | Number of Trials | Sit |
|---------------|--------------------------------|------------------|-------------------------------------|
| G-All7_Ins1-3 | SPAIN <input type="checkbox"/> | 3 | |
| G-All7_Ins4-5 | ITALY <input type="checkbox"/> | 2 | <input checked="" type="checkbox"/> |

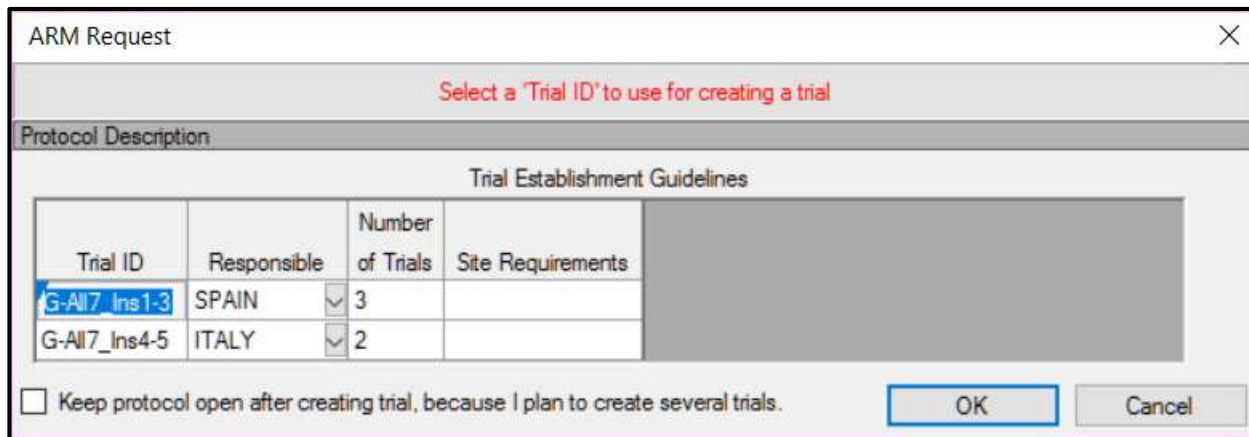
Below the table, there are input fields for 'Total Trials: 5' and 'Trial Cost:'. There are also dropdown menus for 'Conduct Under GLP: N' and 'Conduct Under GEP: N', and a checkbox for 'Officially Recognized'. At the bottom, there is a table with the following data:

| No. | Guideline | |
|-----|--------------------------------------|-----------------------------|
| 1. | PP 1/135(3) <input type="checkbox"/> | Phytotoxicity assessment |
| 2. | PP 1/152(3) <input type="checkbox"/> | Design and analysis of effi |

At the bottom left, there is a label 'Objectives:'. A context menu is open over the table, with the 'Create this Trial' option highlighted. The menu items include: 'Insert Repeating Section...', 'Delete Repeating Section...', 'Save Repeating Section It...', 'Load Repeating Section Se...', 'Hide Current Field', 'Display All Fields', 'Display Hidden Fields with', 'Set As Default', 'Protocol Description View', 'Tile Protocol Description a', 'Show Validation List...', 'Accept All Changes', 'Create this Trial', and 'Show Tooltip'.

Create Trial

- Displays planned trials grid in protocol
- Click in grid row to select trial(s) to create
- Creates each trial using listed Trial ID, opens in separate ARM sessions
- Option to keep protocol open when finished



ARM Request

Select a 'Trial ID' to use for creating a trial

Protocol Description

Trial Establishment Guidelines

| Trial ID | Responsible | Number of Trials | Site Requirements |
|--------------|-------------|------------------|-------------------|
| G-AI7_Ins1-3 | SPAIN | 3 | |
| G-AI7_Ins4-5 | ITALY | 2 | |

Keep protocol open after creating trial, because I plan to create several trials.

OK Cancel

'Create Trial' Checks Plot Size

- Prompts if Treated Plot Width and Length in protocol description is different than in Settings

Protocol Description


Trial Establishment Guidelines | Crop/Pest Description | Soil | Application | Crop Stage at Appl.

Treated Plot Width: 3 m Country: FRA

Treated Plot Length: 8 m Climate Zone: EPOI

Treated Plot Area: 24 m² Experimental Unit: 1

ARM - WARNING

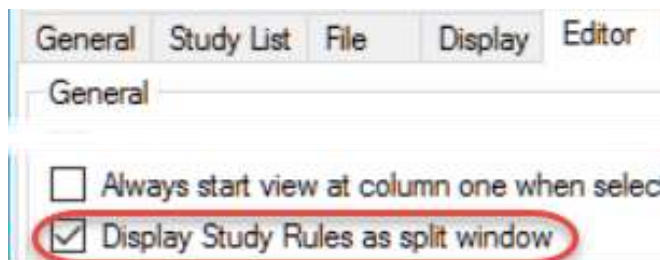
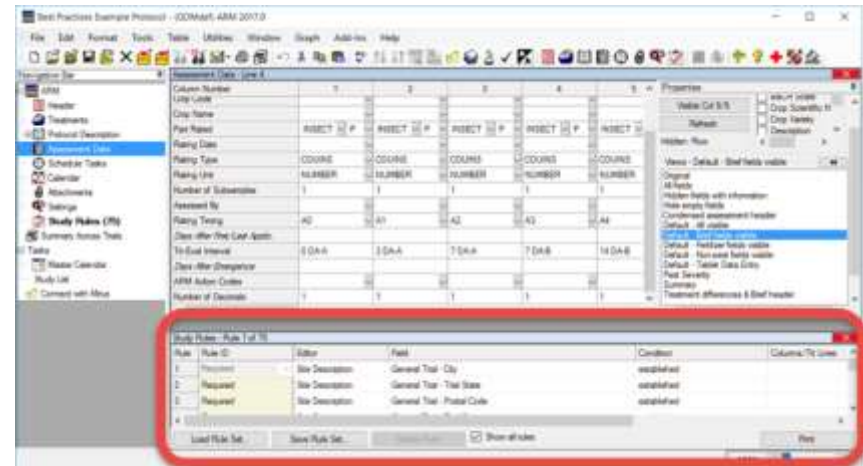
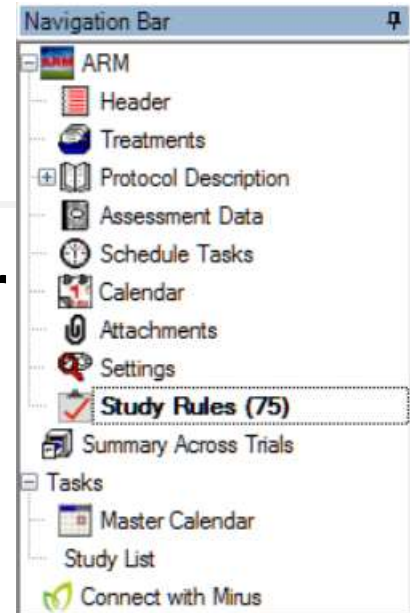
 The treated 'Plot' size 3 by 8 m entered in protocol description differs from Settings. Do you wish to continue creating the trial?

Select 'Yes' to create trial using 2.5 by 5 meters in Settings
Select 'No' to cancel trial creation

Yes No

Study Rules

- Displays as separate study editor
- When a study contains rules:
 - Rule count lists on Navigation Bar
 - Rules panel opens as lower split window
 - New Editor option to hide





Study Rules

- Selectively hide protocol or site description fields according to person who opens study (based on ARM license information):
 - From everyone else
 - From everyone who is not in my company

| Condition | |
|----------------------|---|
| If not in my company | ▼ |
| If not me | |
| If not in my company | |



Study Rules

- Lock protocol or site description fields (such as Trial ID), to prevent modifying information in those fields by:
 - Everyone else
 - Everyone who is not in my company
- Display "All" for an assessment rule that applies to all data columns

| Rule ID | Editor | Field | Condition | Columns/Trt Lines | Permissions |
|-------------------|-----------------|-------------|-----------|-------------------|---------------------|
| Strict Validation | Assessment Data | Rating Type | Always | All | All protocol owners |
| Strict Validation | Assessment Data | Rating Unit | Always | All | All protocol owners |

Study Rules

'Lock Treatment line to prevent edits' will prevent changing an individual Treatment field or line: use to ***protect key treatment information***

| Trt Line | Trt No. | Type | Treatment Name | Form Conc | Form Unit | Form Type | Rate | Rate Unit |
|----------|---------|------|----------------|-----------|-----------|-----------|------|-----------------|
| 1 | 1 | CHK | Untreated | | | | | |
| 2 | 2 | FUNG | Cyprodinil | 750 | G/KG | WG | 0.20 | kg/10000 m2 LWA |
| 3 | 3 | FUNG | Cyprodinil | 750 | G/KG | WG | 0.30 | kg/10000 m2 LWA |

| | |
|-------------------|---------------------------------------|
| Required | Lock Field to prevent edits |
| Recommended | Lock Treatment lines to prevent edits |
| Hidden Field | Lock Treatment to prevent edits |
| Strict Validation | |
| Load Rule Set... | |

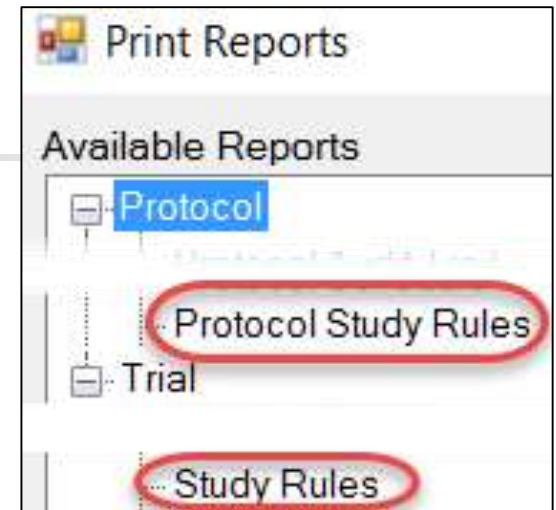
Study Rules

- Examples of new study rules:

| Rule | Rule ID | Editor | Field | Condition |
|------|-----------------------------|------------------------|--|-----------------------------|
| 1 | Required | Header | Trial Number | Lock field to prevent edits |
| 2 | Limit validation list | Assessment Data Header | Crop & Pest in Site Description | Always |
| 3 | Lock Trial ID as position 1 | Assessment Data | Image Attachments | Always |
| 4 | Strict Validation | Treatments | | |
| 5 | Required | Trial | Image Attachments | One or more Plots |
| 6 | Hidden Field | Protocol Description | Trial Establishment Guidelines - Responsible | If not in my company |

Study Rules

- New Protocol and Trial 'Study Rules' reports on the Print Reports dialog



| Study Rules | | | | | |
|-------------|----------|------------|----------------|--------------------------------------|---------------------|
| Rule | Rule ID | Editor | Field | Condition | Permissions |
| 1 | Required | Treatments | Rate | Lock Treatment line to prevent edits | All protocol owners |
| 2 | Required | Treatments | Rate Unit | Lock Treatment line to prevent edits | All protocol owners |
| 3 | Required | Treatments | Treatment Name | Lock Treatment line to prevent edits | All protocol owners |
| 4 | Required | Treatments | Form Conc | Lock Treatment line to prevent edits | All protocol owners |
| 5 | Required | Treatments | Form Unit | Lock Treatment line to prevent edits | All protocol owners |
| 6 | Required | Treatments | Form Type | Lock Treatment line to prevent edits | All protocol owners |

Study Rules

- Asks if Study Rules should be copied to the new protocol after changing the protocol ID field (a method often used to create a similar protocol)
- Drop-down fields automatically display the choice list when clicked with mouse

Study Rules

| Rule | Rule ID |
|------|-----------------------|
| 4 | Required |
| 5 | Recommended |
| 6 | Strict Validation |
| 7 | Hidden Field |
| 8 | Create GUID |
| 8 | Lock Trial ID as pos |
| 9 | Limit validation list |
| 10* | |

Left clicking mouse into blank rule field displays the choices

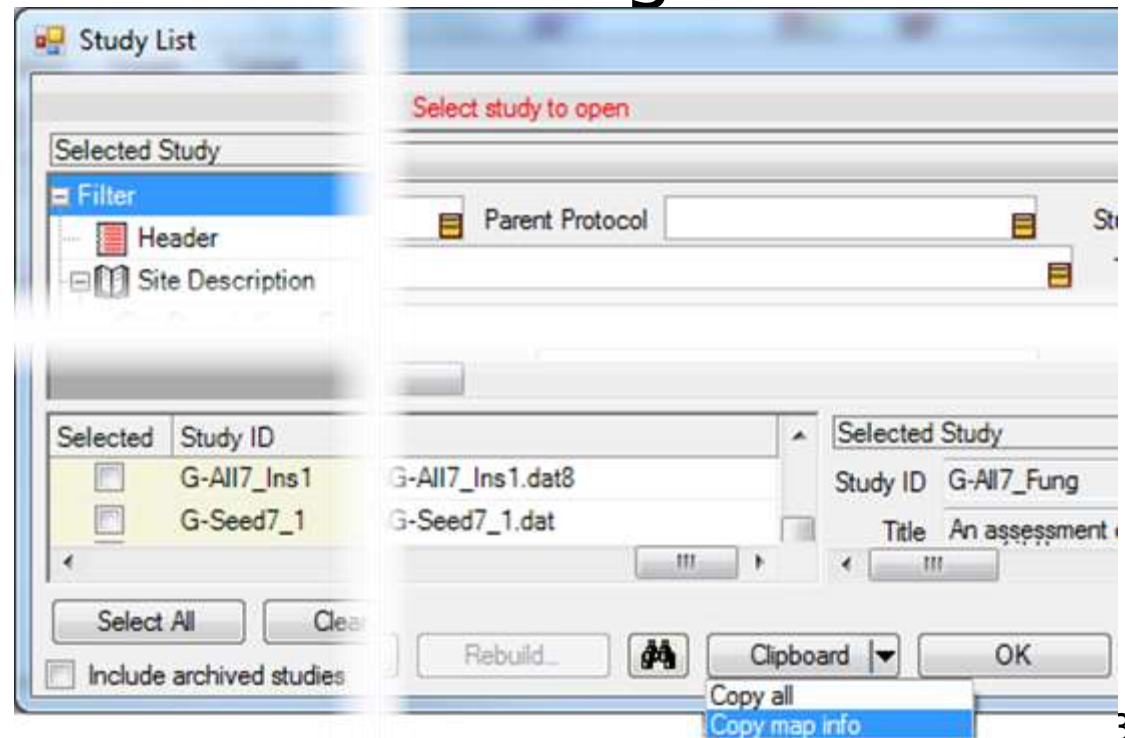


Study Rules

- Entire trial revalidates after adding new study rules to a validated trial
- Improved messages for invalid study rules, so it is clearer which fields need to be corrected
- Delete Rule button now removes a marked block of rules
- More right-click menus to add rules

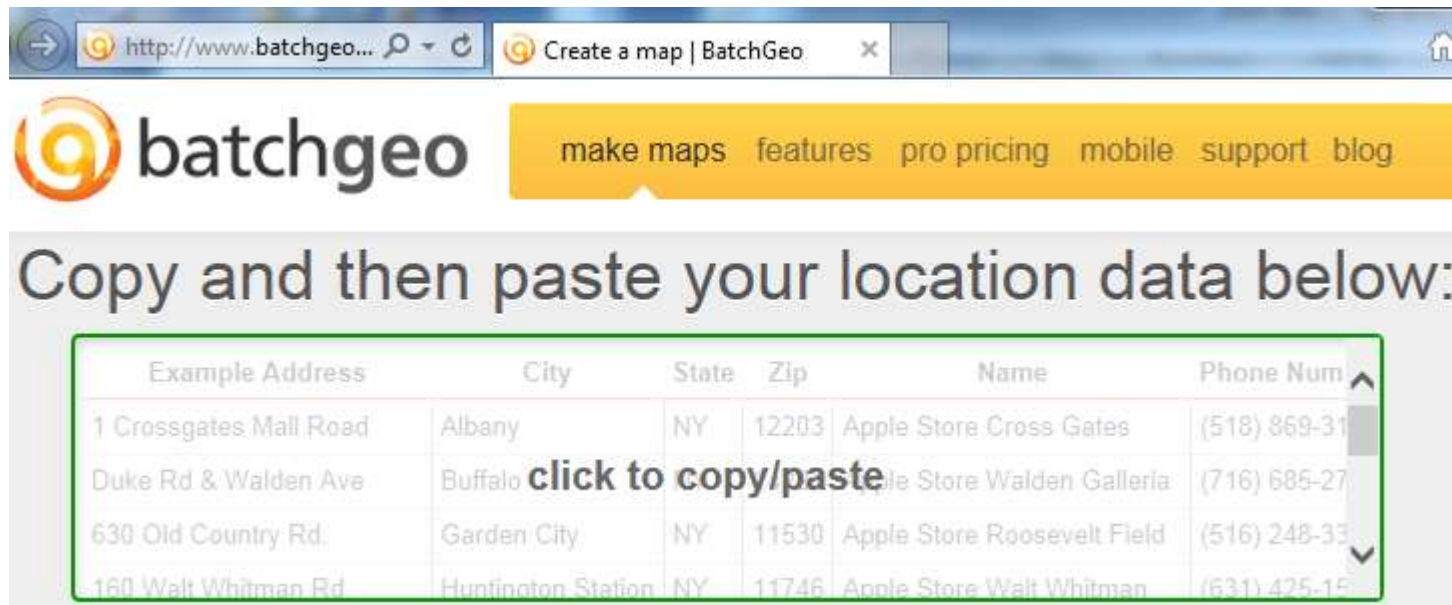
Map Trials from Study List 1 of 3

- Select trials of interest
- Copy map latitude and longitude to clipboard



Map Trials from Study List 2 of 3

- ARM opens batchgeo.com website
- Right-click in batchgeo.com location grid, and then paste



The screenshot shows a web browser window with the URL <http://www.batchgeo.com>. The page header includes the batchgeo logo and navigation links: make maps, features, pro pricing, mobile, support, and blog. Below the header, the text reads "Copy and then paste your location data below:". A table with a green border is displayed, containing location data. The table has columns for Example Address, City, State, Zip, Name, and Phone Num. The text "click to copy/paste" is overlaid on the table.

| Example Address | City | State | Zip | Name | Phone Num |
|------------------------|--------------------|-------|-------|-----------------------------|--------------|
| 1 Crossgates Mall Road | Albany | NY | 12203 | Apple Store Cross Gates | (518) 869-31 |
| Duke Rd & Walden Ave | Buffalo | NY | 14203 | Apple Store Walden Galleria | (716) 685-27 |
| 630 Old Country Rd. | Garden City | NY | 11530 | Apple Store Roosevelt Field | (516) 248-33 |
| 160 Walt Whitman Rd. | Huntington Station | NY | 11746 | Apple Store Walt Whitman | (631) 425-15 |

Map Trials from Study List 3 of 3

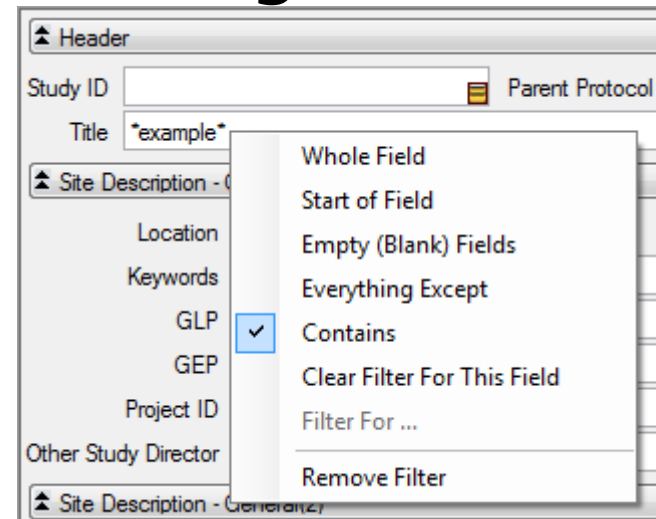
- Select "Map Now" button

Map Now



Study List Filter Form

- Clicking into a field on filter form automatically scrolls lower grid to the matching column
- Right-click menu
- Automatically save Study List filters the client has applied



Study List Filter Form

■ Right-click menu

The screenshot displays the 'Study List Filter Form' interface. The form is divided into sections: 'Header', 'Site Description - General(1)', and 'Site Description - General(2)'. The 'Header' section includes fields for 'Study ID', 'Parent Protocol', and 'Title' (containing 'example'). The 'Site Description - General(1)' section includes fields for 'Location', 'Keywords', 'GLP', 'Investigator', 'GEP', 'Study Director', 'Project ID', and 'Other Study Director'. The 'Site Description - General(2)' section includes fields for 'Technician', 'Other Investigator', and 'Trial Location City'.

A right-click context menu is open over the 'Title' field. The menu options are:

- Whole Field
- Start of Field
- Empty (Blank) Fields
- Everything Except
- Contains
- Clear Filter For This Field
- Filter For ...
- Remove Filter

Below the menu, there are radio buttons for 'All', 'Trials' (selected), and 'Protocols'. A 'When was it modified?' dropdown menu is set to 'Don't remember'. Below that, there are radio buttons for the same filter options as the menu, with 'Contains' selected. At the bottom, there are 'From:' and 'To:' input fields.

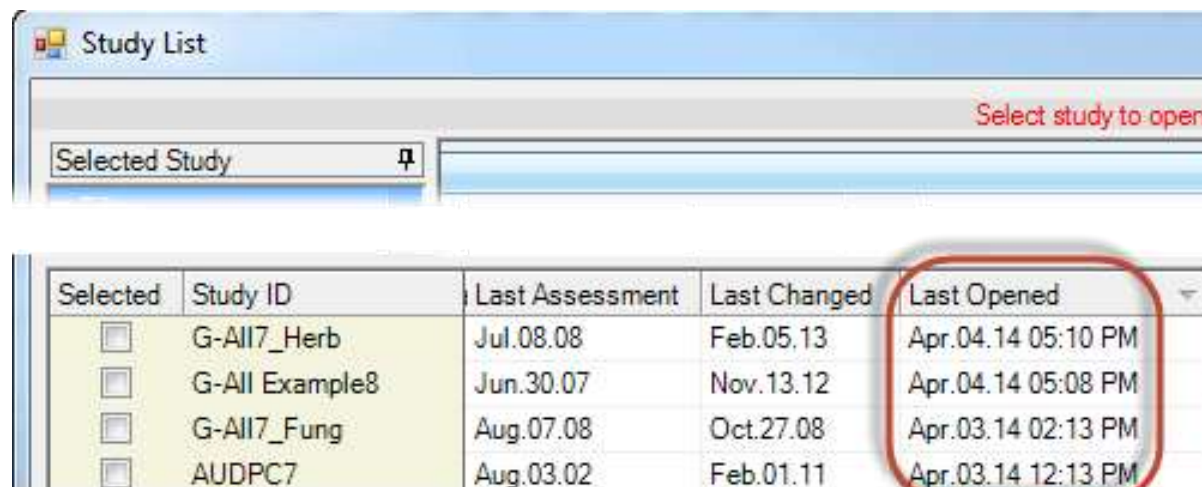
At the bottom of the form, the 'Active Filter (19):' section shows the current filter configuration:

- Active Studies
- Study Type is 'Trial'
- Title contains 'example'

A red arrow points from the 'Title' field to the 'Contains' option in the right-click menu.

Study List, Recently Changed

- 'Last Opened' column in study list includes time
- Most recent study is always the top row until default sort order is changed



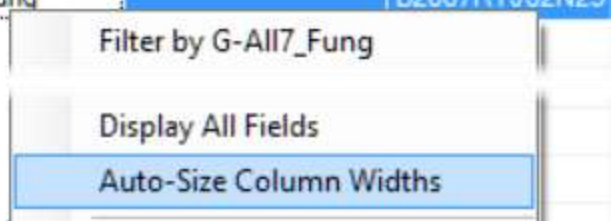
The screenshot shows a window titled 'Study List' with a search bar and a table. The table has five columns: 'Selected', 'Study ID', 'Last Assessment', 'Last Changed', and 'Last Opened'. The 'Last Opened' column is circled in red. The table contains four rows of data.

| Selected | Study ID | Last Assessment | Last Changed | Last Opened |
|--------------------------|----------------|-----------------|--------------|--------------------|
| <input type="checkbox"/> | G-All7_Herb | Jul.08.08 | Feb.05.13 | Apr.04.14 05:10 PM |
| <input type="checkbox"/> | G-All Example8 | Jun.30.07 | Nov.13.12 | Apr.04.14 05:08 PM |
| <input type="checkbox"/> | G-All7_Fung | Aug.07.08 | Oct.27.08 | Apr.03.14 02:13 PM |
| <input type="checkbox"/> | AUDPC7 | Aug.03.02 | Feb.01.11 | Apr.03.14 12:13 PM |

Study List Grid

- 'Auto-Size Column Widths' right-click menu item sizes grid columns based on contents

| Selected | Study ID | Parent Protocol | Project ID | Official Trial ID |
|--------------------------|-------------|-----------------|------------|-------------------|
| <input type="checkbox"/> | G-AI17_Fung | G-AI17_Fung | | B2007RTJ02N25 |



- Filter by G-AI17_Fung
- Display All Fields
- Auto-Size Column Widths

Study List

- Guidelines in study list are now listed separately in dropdown selection list, to more easily find suitable trials
- More indexed fields:
 - Trial Address
 - GEP Accreditation Link
 - Interval to Prev. Appl.
 - Crop Stage Majority
 - Artificial Population

Selected Study

Filter

- Header
- Treatment
- Site Description
- Site Description - Gene
- Site Description
- Site Description

Latitude Longitude

Climate Zone

GLP GEP

Official Trial ID

Guideline

Include Exclude OK Range

- (All)
- CEB 189
- PP 1/135(2)
- PP 1/135(3)
- PP 1/152(2)
- PP 1/152(3)
- PP 1/181(3)
- PP 1/26(3)
- PP 1/49(2)
- PP 1/49(3)

| Selected | Study ID |
|--------------------------|----------|
| <input type="checkbox"/> | G-All7_F |
| <input type="checkbox"/> | Fung Do |
| <input type="checkbox"/> | G-All_Sp |
| <input type="checkbox"/> | G-All_Sp |
| <input type="checkbox"/> | G-All_Sp |
| <input type="checkbox"/> | G-All7_F |
| <input type="checkbox"/> | G-All7_H |
| <input type="checkbox"/> | NEPDS016 |

General Trial

GEP Accreditation Link:

Study List

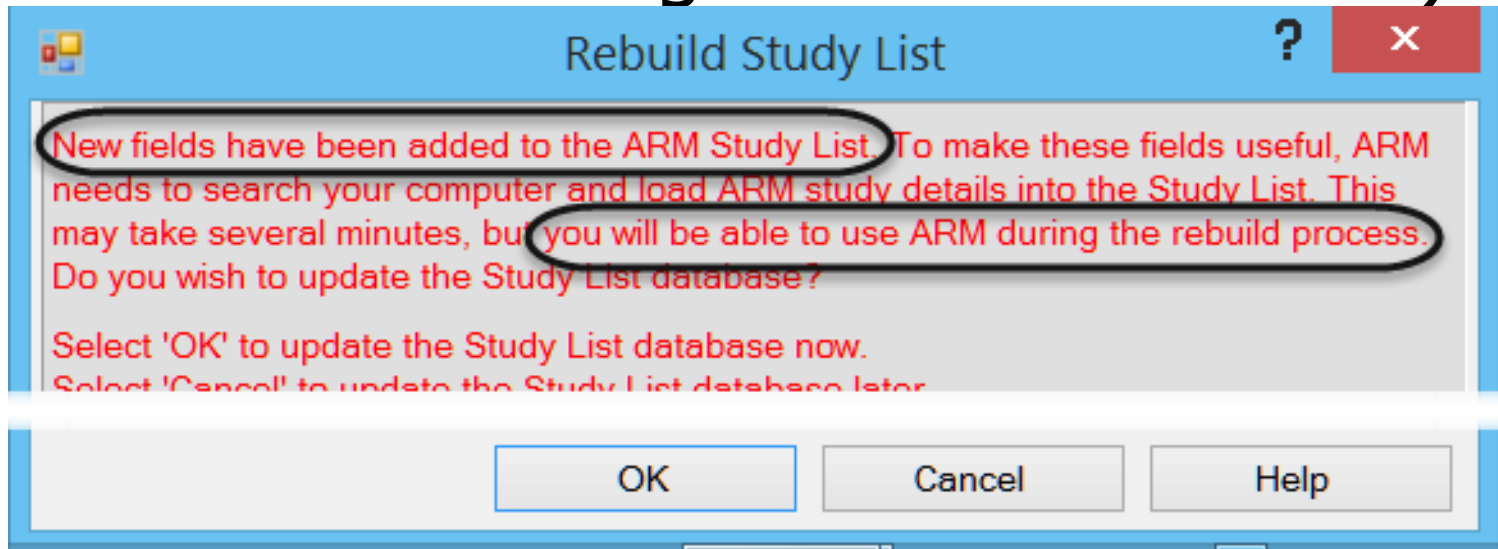
- Previous Filters list shows recent queries for locating studies of interest, to easily find and re-use past searches

The screenshot shows the 'Study List' application window. The main window contains a list of studies with checkboxes, dates, and partial dates. Below the list are buttons for 'Select All', 'Clear All', and 'Remove Filter', along with checkboxes for 'Include archived studies' and 'Tutorial'. A 'Previous Filters' dialog box is open, displaying a table of recent filters.

| Previous Filters: | |
|-------------------|--|
| Last Used | Study List Filter |
| 1 Jan-5-2016 | Study Type is 'Trial', Exclude Latitude is (Blank) |
| 2 Jan-4-2016 | Study Type is 'Trial' |
| 3 Jan-4-2016 | Study Type is 'Protocol', Treatment Name is 'Accord' |
| 4 Jan-4-2016 | Study Type is 'Trial', Treatment Name is 'Accord' |
| 5 Jan-4-2016 | Study Type is 'Trial', Study ID is 'G-All7_Fung' |
| 6 Dec-2-2015 | Study Type is 'Trial' |
| 7 Dec-2-2015 | Study ID contains 'herb' |
| 8 Dec-1-2015 | File Name contains 'renea' |

Study List

- Asks to rebuild study list after installing an ARM update with new indexed fields
- Can continue using ARM during rebuild (which runs in a background ARM session)



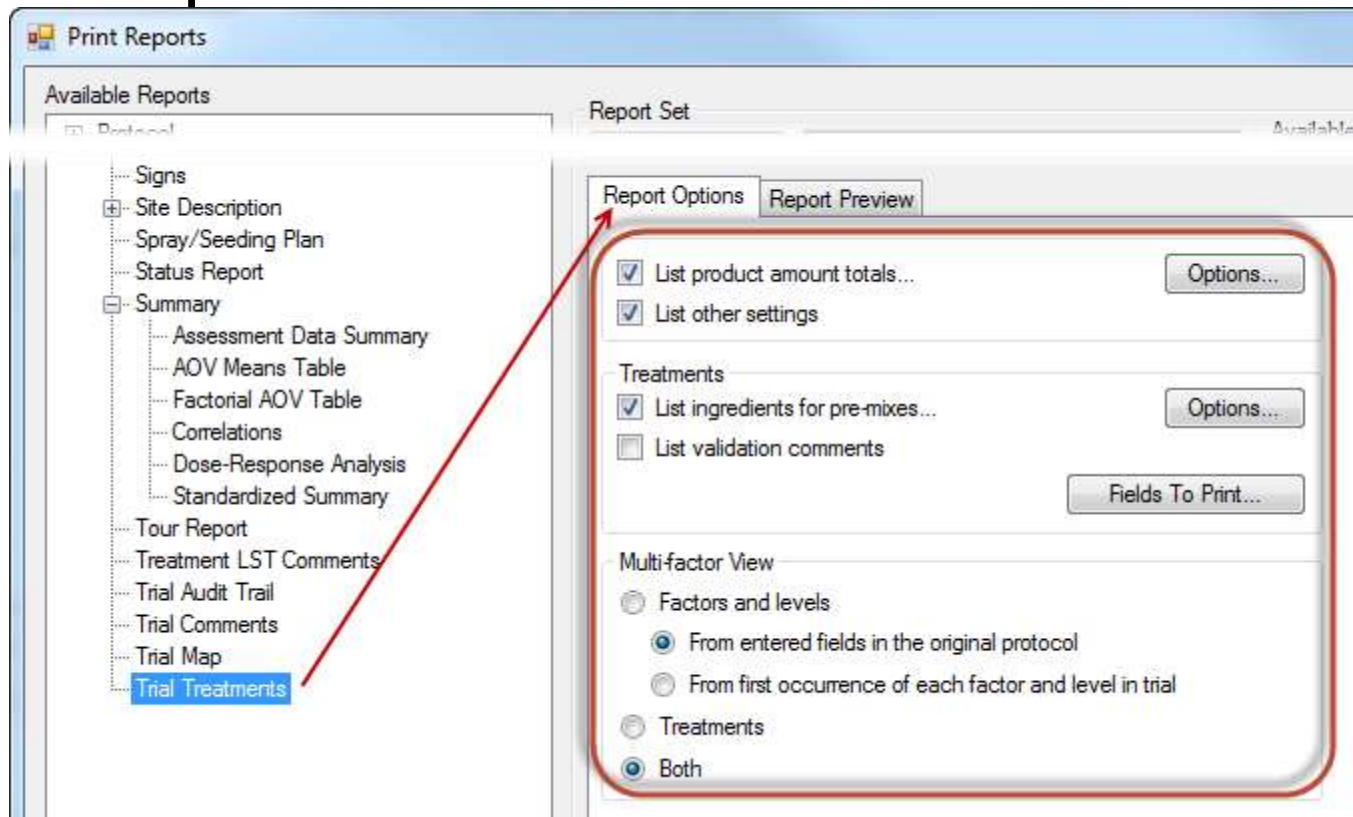


New Study List Fields

- Treatment Type (TTT)
- Treatment Form. Type (TFD)
- Treatment Growth Stage (TGI)
- Assessment Part Rated (ECP)
- Assessment Rating Type (EDT)
- Assessment Rating Unit (ERU)
- Crop Group (KF)
- Pest Type (~P)
- Pest Stage Majority (PS)
- Previous Crop (PC)
- Trial Region (~R)
- Reliability (TQ)
- Official Trial ID (OT)
- Climate Zone (VC)
- Study Design (ED)
- Trial Usage/Type (VU)
- Application Soil Moisture (SM)
- Rainfall/Irrigation Type (RT)
- Application Equipment (SZ)
- Nozzle Type (NT)
- Carrier (DC)
- Propellant (TP)

Report Options

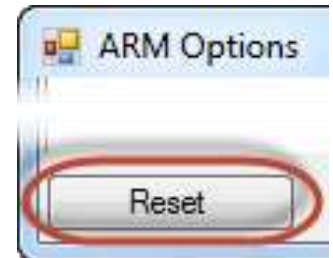
- Directly set report options on option tab - simple and intuitive



Separate Option Reset Buttons

Separate "Reset" buttons for ARM Options and Report Options:

- Tools – Options: Reset program options to default settings without affecting your report changes
- Reset report options to default settings without changing other ARM program options



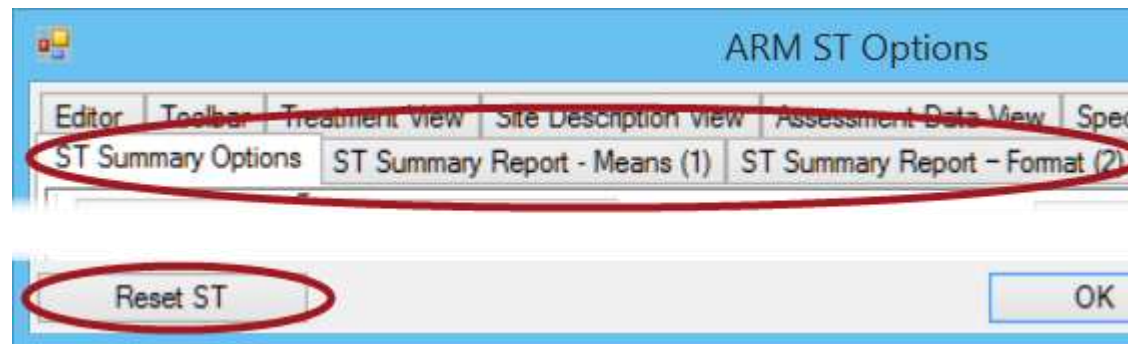
More Option Reset Buttons

Additional "Reset" buttons to restore original default options

- Graph:

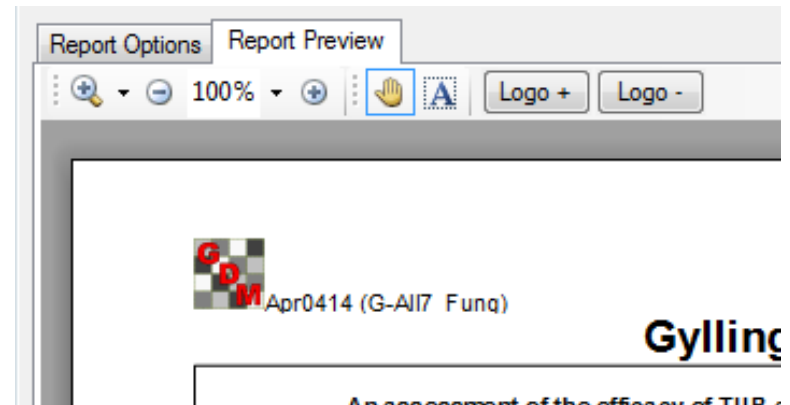


- ST:



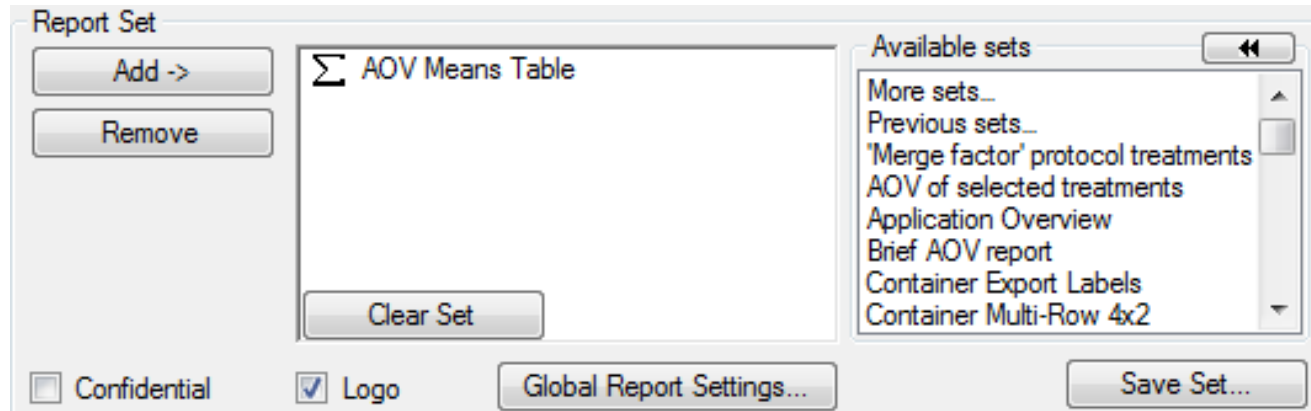
Report Preview

- Report Preview tab stays open
 - One-click preview of reports
 - Zoom in/out
 - Adjust logo size
 - Quickly find a label by clicking through list of available labels



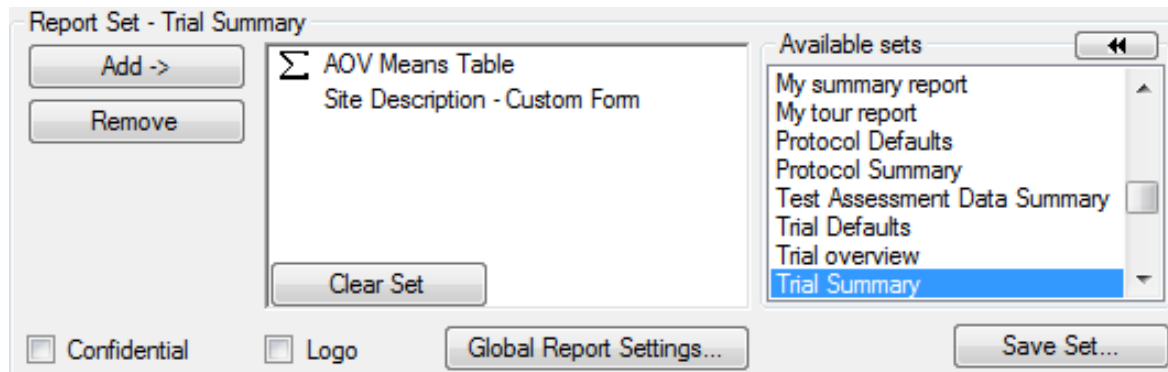
Report Sets

- New list box displays available sets
 - Click once to select a set from list
 - "More sets" to browse
 - Shows lists across all language subfolders

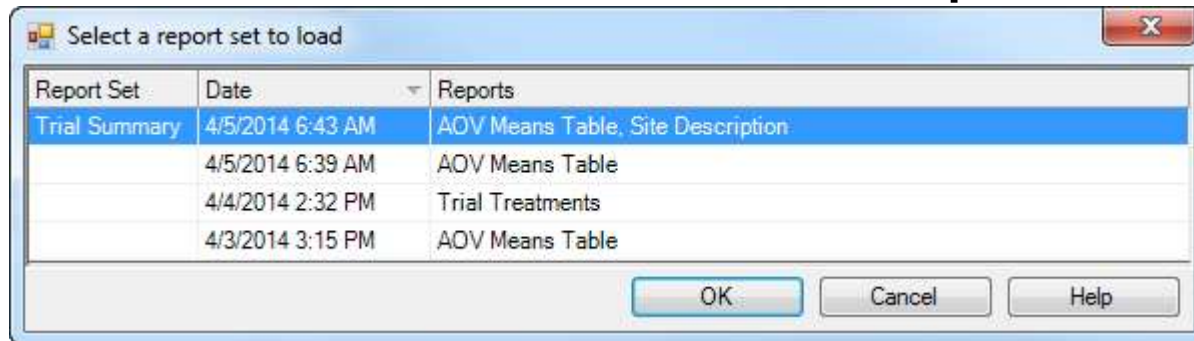


Report Sets

- Last selected set highlighted by default

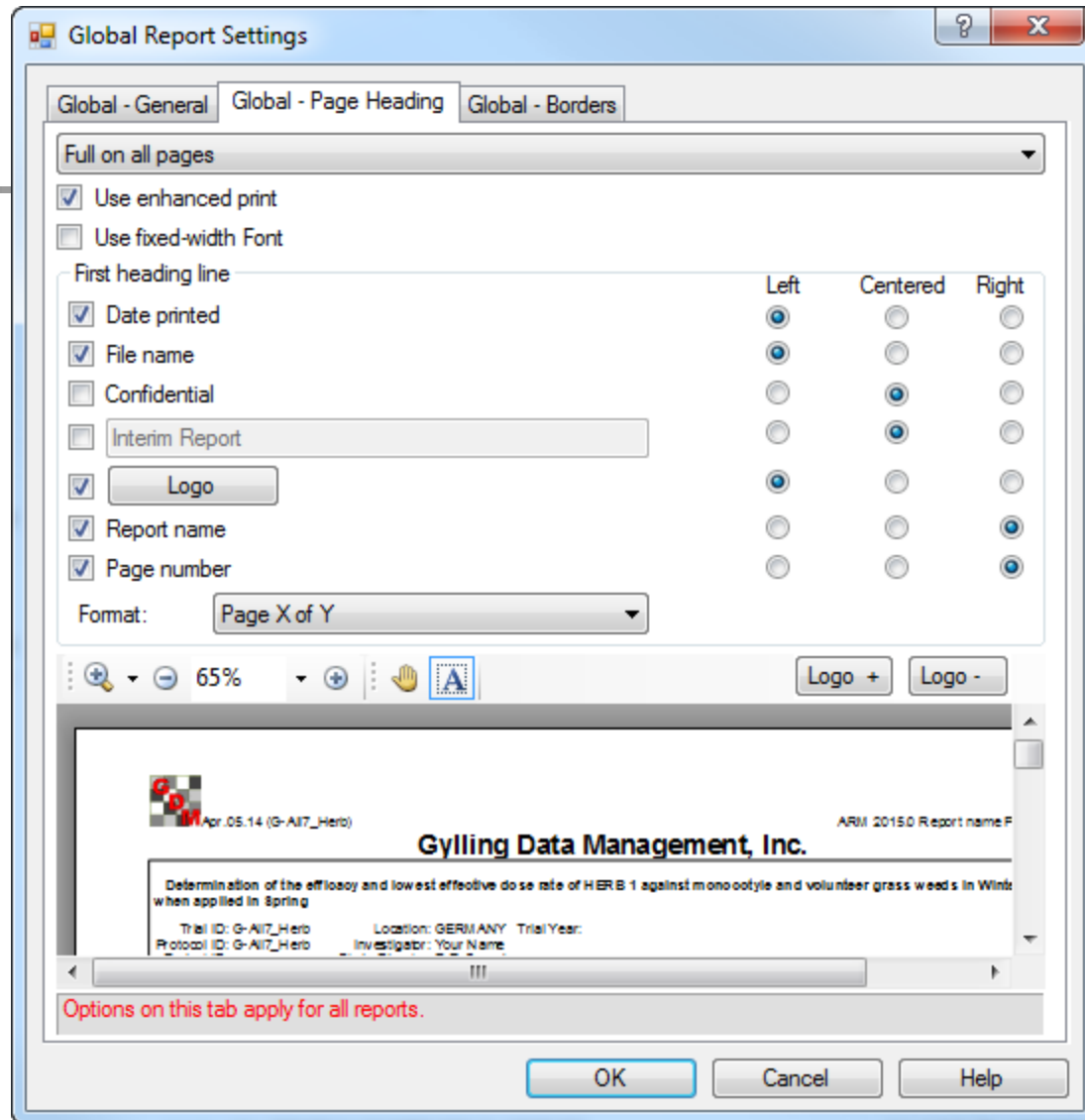


- "Previous sets" shows the report history



Page Heading

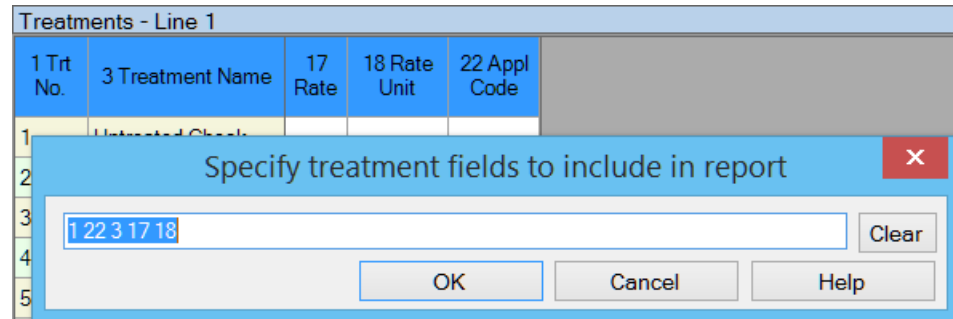
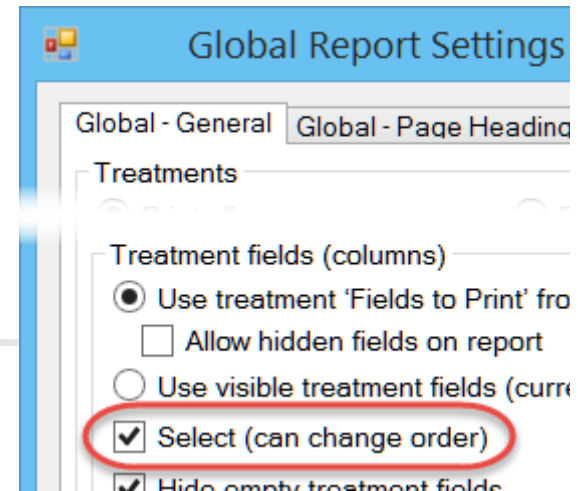
- Customize arrangement
- Simple way to add a logo and adjust logo size and position on report



Reports

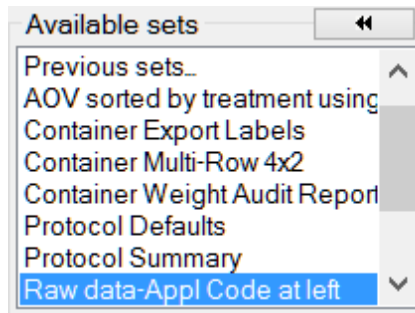
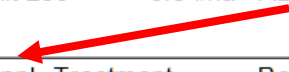
Option to:

- Change the order of treatment fields on reports, and
- Save this order into report sets, to easily use the same treatment order in future reports



| Trt No. | Treatment Name | Rate | Appl Code | Rate Unit | Plot | |
|---------|----------------|----------|-----------|-----------|------|------|
| 4 | Tilt 250 | 0.5 l/ha | ABC | 103 | | 50.0 |

| Trt No. | Appl Code | Treatment Name | Rate | Rate Unit | Plot | |
|---------|-----------|----------------|----------|-----------|------|------|
| 4 | ABC | Tilt 250 | 0.5 l/ha | 103 | | 50.0 |



Summary Reports

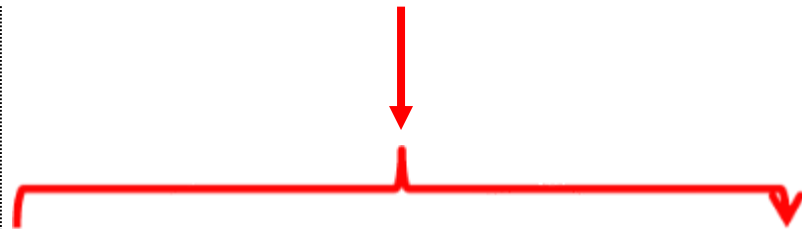
Option to merge assessment data headers over columns having the same information

General Summary Report Options

Fields to Print: Global - General, Global - Page Heading

Assessment data header rows

Merge data headers across columns with identical entries



| | | | | | Speckled leaf blotch of wheat | | | |
|------------------|------|-----------|-----------|---------|-------------------------------|--------|-------------|------|
| | | | | | Winter wheat | | | |
| LEAF C | | PLANT C | | LEAF3 P | | | | |
| | | | | | Jul-15-2014 | | May-13-2014 | |
| PHYGEN | | VIGOR | | | | PESSEV | | |
| | | | | | % | | %UNCK | |
| | | | | | 91 7 | | 28 28 | |
| | | | | | 7 DA-C | | 28 DA-A | |
| ARM Action Codes | | | | | TAB[3] | | | |
| Trt | Appl | Treatment | Rate | | 1 | 2 | 3 | 4 |
| No. | Code | Name | Rate Unit | Plot | | | | |
| 4 | ABC | Tilt 250 | 0.5 l/ha | 102 | 0.0 | 100.0 | 5.00 | 0.00 |
| | | | | 205 | 0.0 | 100.0 | 4.10 | 0.00 |
| | | | | 303 | 0.0 | 100.0 | 4.60 | 0.00 |
| | | | | 401 | 0.0 | 100.0 | 4.50 | 0.00 |
| | | | | Mean = | 0.0 | 100.0 | 4.55 | 0.00 |

AOV Means Table Report

Prints range of LSD values used to compare the largest and smallest **non-zero** means for any log, arcsine SQR %, or square root transformed data (are **non-linear** transformations)

| | | | |
|-------------------------------|-----------------------|---------------|---------------|
| Pest Code | | SEPTTR | SEPTTR |
| Part Rated | | LEAF3 P | LEAF2 P |
| Rating Date | | Jun-18-2014 | Jul-2-2014 |
| Rating Type | | PESSEV | PESSEV |
| Rating Unit | | % | % |
| Days After First/Last Applic. | | 64 15 | 78 29 |
| ARM Action Codes | | AL | AA |
| Trt Treatment | Rate | | |
| No. Name | Rate Unit | 5* | 7* |
| 1 Untreated Check | | 6.89 a | 15.14 a |
| 2 Tub | 0.5 l/ha | 1.28 b | 1.23 bc |
| 3 Tub | 1 l/ha | 1.04 b | 0.40 c |
| 4 Tilt 250 | 0.5 l/ha | 1.60 b | 1.51 bc |
| 5 Mico 60 Fungal | 1.5 l/ha 1.25 l/ha | 1.19 b | 3.09 b |
| LSD P=.05 | | 1.878 - 3.785 | 1.218 - 4.299 |
| CV | | 39.69t | 23.81t |

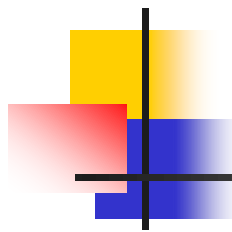
AOV Means Table Report

Example using this log transform:

- Compare 6.89 vs. 1.60 using $LSD \approx 3.785$
(largest mean vs. next largest)
- Compare 1.04 vs. 1.19 using $LSD \approx 1.878$
(smallest mean vs. next smallest)

| Rating Type | PESSEV |
|------------------------|---------------|
| Rating Unit | % |
| ARM Action | AL |
| Trt Treatment No. Name | 5* |
| 1 Untreat | 6.89 a |
| 2 Tub | 1.28 b |
| 3 Tub | 1.04 b |
| 4 Tilt 250 | 1.60 b |
| 5 Mico 60 Fungol | 1.19 b |
| LSD P=.05 | 1.878 - 3.785 |



Help for AOV Means Table



New "Interactive AOV Means Table Report" help topic shows which options control various parts of the report

Interactive AOV Means Table Report

[How does this work?](#)

| Aug-1-2014 (InteractiveAOV)  ARM 2015.0 AOV Means Table Page 1 of 3 Gylling Data Management, Inc. | | | | | | | | |
|--|-----------------|--|--------------|---------------------------------|--------------|---|---------|---------|
| An assessment of the efficacy of TUB and other fungicides for the control of Septoria Diseases in winter wheat | | | | | | | | |
| Trial ID: InteractiveAOV Protocol ID: Interactive Project ID: | | Location: Gembloux Investigator: Your Name Study Director: R.E. Search | | Trial Year: Sponsor Contact: | |  | | |
| Pest Type | | D Disease | D Disease | D Disease | D Disease | | | |
| Pest Code | TRZAW | SEPTTR | SEPTTR | ZZXXEE | ZZXXEE | TRZAW | | |
| Crop Code | TRZAW | TRZAW | TRZAW | TRZAW | TRZAW | TRZAW | | |
| Crop Name | Winter wheat | Winter wheat | Winter wheat | Winter wheat | Winter wheat | Winter wheat | | |
| Part Rated | LEAF2 P | LEAF2 P | LEAF2 P | LEAGRE P | LEADIS - | GRAIN C | | |
| Rating Date | May-2-2008 | Jul-2-2008 | Jul-2-2008 | Jul-15-2008 | Aug-7-2008 | Aug-7-2008 | | |
| Rating Type | PESSEV | PESSEV | PESSEV | AREA | AREA | YIELD | | |
| Rating Unit | % | % | %UNCK | %AREA | %AREA | KG | | |
| Number of Subsamples | 1 | 1 | 1 | 1 | 1 | 1 | | |
| ARM Action Codes | | | TAB[2] | AL | ET1 | | | |
| Number of Decimals | 1 | 2 | 2 | 2 | 2 | 2 | | |
| Trt No. | Treatment Name | Rate | Rate | Rate | Rate | Rate | | |
| | | Unit | | | | | | |
| 1 | Untreated Check | | 11.7 - | 15.51 a | 0.00 c | 2.31 b | 32.88 | 7.55 b |
| 2 | TUB | 0.5 l/ha | 11.6 - | 1.74 b | 88.74 ab | 21.58 a | 4.53 bc | 8.20 a |
| 3 | TUB | 1 l/ha | 12.2 - | 0.83 b | 95.62 a | 28.98 a | 3.93 c | 8.16 a |
| 4 | TILT 250 | 0.5 l/ha | 12.1 - | 2.35 b | 85.11 ab | 27.82 a | 8.59 a | 8.20 a |
| 5 | MICO 60 FUNGOL | 1.5 l/ha 1.25 l/ha | 12.5 - | 3.88 b | 74.08 b | 11.46 a | 5.13 b | 8.16 a |
| LSD (P=.05) | | | 1.46 | 3.146 | 12.747 | 0.435t | 0.830 | 0.360 |
| Standard Deviation | | | 0.95 | 2.042 | 8.273 | 0.282t | 0.509 | 0.233 |
| CV | | | 7.86 | 42.0 | 12.04 | 23.91 | 9.19 | 2.9 |
| Bartlett's X2 | | | 8.56 | 10.194 | 6.96 | 6.687 | 4.22 | 2.316 |
| P(Bartlett's X2) | | | 0.073 | 0.037* | 0.073 | 0.153 | 0.239 | 0.678 |
| Skewness | | | 2.0681* | 1.7361* | -1.3261* | -0.7822 | 1.2312* | 0.1737 |
| Kurtosis | | | 5.3045* | 2.3213* | 0.1148 | -0.6432 | 0.3684 | -0.5835 |
| Replicate F | | | 0.945 | 4.361 | 2.117 | 0.673 | 0.842 | 22.649 |
| Replicate Prob(F) | | | 0.4494 | 0.0270 | 0.1515 | 0.5849 | 0.5083 | 0.0001 |
| Treatment F | | | 0.695 | 35.181 | 89.772 | 8.017 | 67.461 | 5.873 |
| Treatment Prob(F) | | | 0.6094 | 0.0001 | 0.0001 | 0.0022 | 0.0001 | 0.0074 |

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
 t=Mean descriptions are reported in transformed data units, and are not de-transformed.
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
 Missing data estimates are included in columns:Yates=5

Help for AOV Means Table

For example, click on treatments in help topic for options on treatments and treatments fields on report

Jan. 2017

Interactive AOV Means Table Report

[How does this work?](#)

Aug-1-2014 (Inter

An assessment

Trial ID: Inter
Protocol ID: Inter
Project ID:

Pest Type
Pest Code
Crop Code
Crop Name
Part Rated
Rating Date
Rating Type
Rating Unit
Number of Subst
ARM Action Code
Number of Decim

| Trt | Treatment No. | Name |
|-----|----------------|------|
| 1 | Untreated C | |
| 2 | TUB | |
| 3 | TUB | |
| 4 | TILT 250 | |
| 5 | MICO 60 FUNGOL | |

LSD (P=.05)
Standard Deviat
CV
Bartlett's X2
P(Bartlett's X2)
Skewness
Kurtosis

Replicate F
Replicate Prob(F
Treatment F
Treatment Prob(f

Means followed b
t=Mean descripti
Mean comparisor
Missing data estim

Can I print only certain treatments?

When the **Print Selected** option on the **Global - General** settings dialog is selected, ARM will prompt the user to specify which treatment numbers to include when printing one or more reports. From the **Print Reports** dialog, select the **Global Report Settings** button in the **Report set** section to display this dialog.

Global Report Settings

Global - General Global - Page Heading Global - Borders

Treatments

Print all Print selected

Identify when selected treatments are summarized

Print rate units in lower case

Print active ingredient rate units as 'AI'

Force Form Conc to %AW/W basis (requires density)

Synonym number: 0

Alternatively, there are a couple of [ARM Action Codes](#) available to exclude a particular treatment from analysis, while still reporting the treatment mean on the AOV Means Table report.

- The code ES will remove the untreated check treatment, as specified in the Untreated treatments setting on the [Treatment tab](#) of the Settings dialog, from the analysis.
- The code ETn will remove treatment n from the analysis, while still reporting the treatment mean on the report.

See Also

- See [Global Report Settings - General Tab](#) for more information about the General Global report settings.
- See [Selecting Treatments](#) for information about selecting treatments when printing a report in ARM.
- See [ARM Action Codes](#) for information about the non-analyzable data action codes.

Assessment Data Summary Report

New options for displaying extended 'plot' experimental unit description on report

Assessment Data Summary Report Options

Report Options **General Summary** Report Preview

Average subsamples

Include 'Plot' experimental unit number

Display extended 'Plot' experimental unit description information

Extended assessment data information

Comment


Barcode

GPS

Image

Width:

"Damaged" plot value - handled as missing data during analysis

| | |
|----------------|---|
| Appl Code Plot | 2 |
| ABC 103 | 50.0 |
| | Animal damage to plot |
| |  |
| 204 | 100.0 |
| 305 | 100.0 |
| 404 | 100.0 |
| Mean = | 100.0 |

Factorial AOV Report Options

- "Analysis method" options:
 - Least squares analysis (like SAS GLM)
 - Print adjusted means (if missing data)

Factorial AOV Table Report Options

Report Options | General Summary | Report Preview

Mean comparison test

Test: Tukey's HSD

Significance or alpha level: 5%

Only when significant AOV treatment P(F)

Symbol indicating no significant difference between treatment means: -

Adjusted treatment mean

Use adjusted mean as primary mean

Descriptive statistics for each factor mean section

LSD (or HSD if Tukey's)

Standard Deviation

Coefficient of Variation

AOV tables to print

Complete

Pooled error

Both

Analysis method

Traditional AOV

Least square estimation

Factorial AOV Report Options

"Include descriptive statistics for each Factor means section" adds Descriptive statistics under each "Table of X" section:

- LSD (or Tukey's HSD)
- Standard Deviation
- CV

| | | |
|---------------------------------|----------------|-------------------|
| Rating Date | Apr-22-2014 | |
| Rating Type | CONTRO | |
| Rating Unit | % | |
| Trt-Eval Interval | 7 DA-A | |
| Trt No. | Treatment Name | Rate Rate Unit |
| | | 1 |
| TABLE OF A (Herbicide) MEANS | | |
| 1 | Accord | 53.5 b |
| 2 | Brominal PLUS | 72.0 a |
| 3 | Cannon | 51.3 c |
| LSD P=.05 | | 0.76 |
| Standard Deviation | | 0.76 |
| CV | | 1.29 |
| TABLE OF B (Rate) MEANS | | |
| 1 | Rate 1 | 1 LB A/A 45.0 b |
| 2 | Rate 2 | 1.5 LB A/A 61.8 a |
| 3 | Rate 3 | 2 LB A/A 70.0 a |
| LSD P=.05 | | 12.74 |
| Standard Deviation | | 15.05 |
| CV | | 25.54 |
| TABLE OF A (Herbicide) B (Rate) | | |
| 1 | Accord | 26.9 a |
| 1 | Rate 1 | 1 LB A/A |
| 2 | Brominal PLUS | 61.3 a |
| 3 | Rate 3 | 2 LB A/A |
| 3 | Cannon | 55.8 a |
| 3 | Rate 3 | 2 LB A/A |
| LSD P=.05 | | 22.07 |
| Standard Deviation | | 15.05 |
| CV | | 25.54 |



Spray/Seeding Plan Report

Prints Settings Spray Volume and Mix Size for treatments lines where not specified:

| Trt Line | Trt No. | Type | Treatment Name | Form Conc | Form Unit | Form Type | Rate | Rate Unit | Appl Code | Spray Volume | Volume Unit | Mix Size | Mix Unit |
|----------|---------|------|----------------|-----------|-----------|-----------|------|-----------|-----------|--------------|-------------|----------|----------|
| 2 | 2 | FUNG | Tub | 250 | G/L | EC | 0.5 | L/ha | ABC | | | | |
| 3 | 3 | FUNG | Tub | 250 | G/L | EC | 1 | L/ha | ABC | | | | |
| 4 | 4 | FUNG | Tilt 250 | 250 | G/L | EC | 0.5 | L/ha | ABC | | | | |
| 5 | 5 | FUNG | Mico 60 | 600 | G/L | EC | 1.5 | L/ha | AB | 250 | L/HA | 2.65 | Liters |

Reps: 4 Appl Code: A Plots: 2.5 by 10 meters

| Trt No. | Treatment Name | Form Conc | Form Unit | Form Type | Rate | Rate Unit | Appl Code | Spray Volume | Mix Size | Amt Product to Measure | Rep 1 | Rep 2 | Rep 3 | Rep 4 |
|---------|-----------------|-----------|-----------|-----------|------|-----------|-----------|--------------|-------------|------------------------|-------|-------|-------|-------|
| 3 | Tub | 250 | G/L | EC | 1 | l/ha | ABC | 200 L/ha | 2.15 liters | 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 | 200 L/ha | 2.15 liters | 5.375 ml/mx | 103 | 204 | 305 | 404 |
| 2 | Tub | 250 | G/L | EC | 0.5 | l/ha | ABC | 200 L/ha | 2.15 liters | 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 |



Spray/Seeding Plan Report

Canopy height rates

- Mix size printed for canopy height treatments is now multiplied by canopy height entered in Site Description
- Calculated mix size in the table heading is corrected for canopy height treatments

Spray/Seeding Plan Report

Product Amount is bold font when unit is:

- Scaled differently: **ml** vs. μl
- Has a different unit basis: /4 **pl** vs. /**mx**

Reps: 4 Appl
 Spray vol: 200 L/ha

| Trt No. | Treatment Name | Rate | Mix | Product to Measure | 3 | 4 |
|---------|----------------|-------|-----|--|-----|---------|
| 3 | Tub | /ha | ers | 1.2 ml/4 pl | 103 | 301 402 |
| 4 | Tilt 250 | /ha | ers | 0.6 ml/4 pl | 103 | 305 404 |
| 2 | Tub | /ha | ers | 0.6 ml/4 pl | 104 | 302 403 |
| 5 | Fungol NIS | /ha 2 | ers | 6.0 μl/4 pl 10.75 ml/mx | 103 | 304 405 |



Product Amount Totals

Form Unit also differentiates products in the Product Amount Totals table

| Amount* | Unit | Treatment Name | Form Conc | Form Unit | Form Type | Lot Code |
|---------|------|----------------|-----------|-----------|-----------|----------|
| 2.805 | ml | Banvel 720 | 350 | gA/L | L | |
| 4.740 | ml | FallowMaster | 250 | gA/L | SC | |
| 2.814 | ml | Marksman | 385 | gA/L | F | |
| 0.584 | ml | Clarity | 58 | % | SC | |



Labels Report

- Adjusted margin defaults for Avery 3451, 5160, 5161, 5163, L6103, L6105 to better fit label sheets
- Added Avery 5162 and 5735 labels
- Single-click now loads label defaults
- Force right and bottom margins to 0 when printing
- Metric label margins are more accurate
- Last label row on page not skipped for labels with vertical buffer between rows



Print Reports

- Trial Status and Protocol Data Headers reports no longer print blank rows
- Technician license can print Data Collection, Map, and Trial Map reports
- Site Description Named View and Selected Tabs reports can be previewed using Report Preview tab



Print Reports

- Option to:
 - Include median with treatment mean on single trial AOV report, and
 - Also include median on multi-trial ST (Summary Across Trials) AOV reports
- Median helps identify when a single value is "distorting" the mean

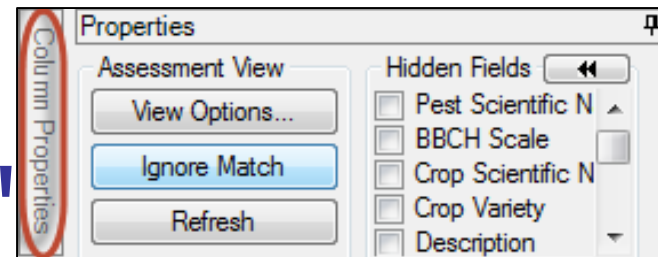


Mean vs. Median Example

- Phytotoxicity data set: 0 0 0 5 20
Mean 5
Median 0
- % control data set: 50 90 90 90 95
Mean 83
Median 90
- "Balanced data set": 5 10 15 20 25
Mean 15
Median 15

Assessment Data "Column Properties"

- New editor panel
- Presents analysis of the current data column
- Fix violations of AOV assumptions
- Find statistical outliers



| Descriptive Statistics | |
|------------------------|--------|
| LSD P=.05: | 2.598 |
| Standard Deviation: | 1.686 |
| CV: | 54.387 |
| Grand Mean: | 3.1 |
| P(Bartlett's X2): | 0.004 |
| P(Friedman's X2): | 0.078 |
| Skewness: | 1.8499 |
| Kurtosis: | 2.6407 |
| Replicate Prob(F): | 0.6123 |
| Treatment Prob(F): | 0.0004 |

Assessment Data

"Column Properties"

- Column navigation
- Column description
- Min, Max, Range
- Transformation formula description
- Click "Refresh" to update after changing current data column

| Column 5 Properties | |
|---|--|
| <input type="button" value="Previous"/> <input type="button" value="Next"/> | |
| Column ID: | 5 |
| Column Flags: | Original, Changed, ARM action code changed |
| Min/Max entry: | 0 100 |
| Low/High value: | 0.00 15.00 |
| Formula AL: | LOG([5]+ 1) |
| <input type="button" value="Refresh"/> | |

Assessment Data

"Column Properties"

- Descriptive statistics from full AOV of data
- Displays violations of AOV assumptions
- "Fix" prompts if can resolve violations

| | |
|---------------------|--------|
| LSD P=.05: | 2.598 |
| Standard Deviation: | 1.686 |
| CV: | 54.387 |
| Grand Mean: | 3.1 |
| P(Bartlett's X2): | 0.004 |
| P(Friedman's X2): | 0.078 |
| Skewness: | 1.8499 |
| Kurtosis: | 2.6407 |
| Replicate Prob(F): | 0.6123 |
| Treatment Prob(F): | 0.0004 |

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

Fix

ARM - SPECIAL CONFIRMATION

⚠ Apply automatic data correction transformation 'Log(n+1)' to data column 5 to correct ?

Yes No Help

Assessment Data

"Column Properties"

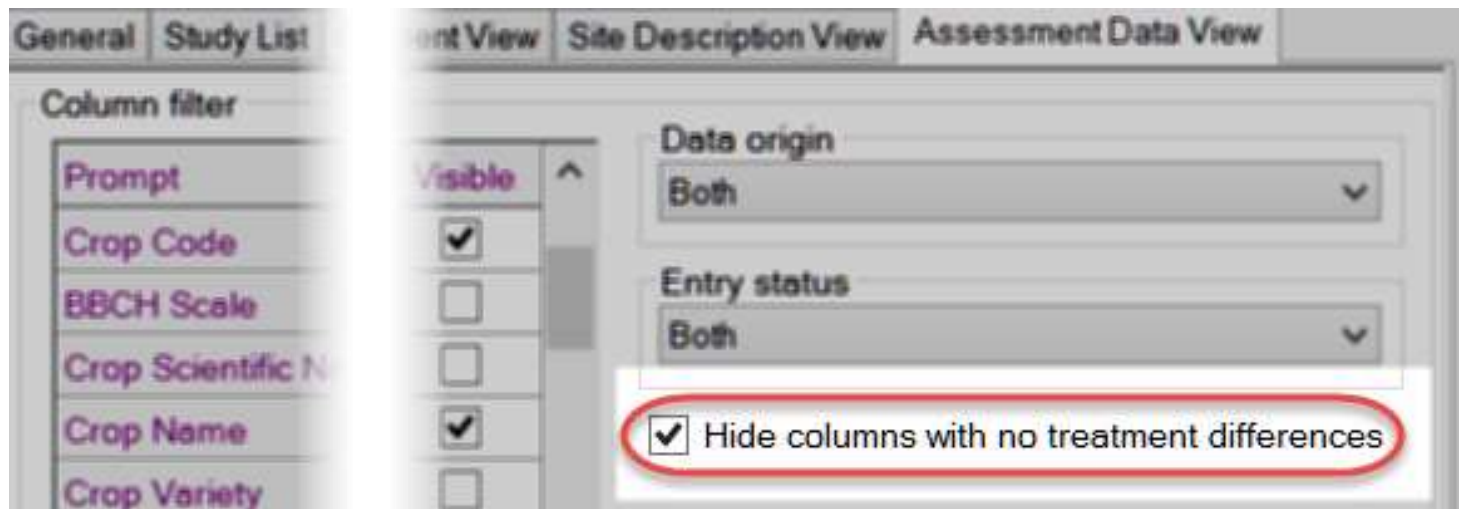
- Search for outliers in current data column using a standard outlier test
- "Find Next" locates each statistical outlier
- "Damaged" drop from outlier test and AOV

The screenshot displays a software interface for data analysis. On the left, a column of data is shown with the value 9.5 highlighted in blue. The other values in the column are 15.00, 10.00, 8.00, 5.50, 7.90, 8.00, 7.00, 12.00, 15.00, and 1.90. To the right of the data column, a warning message states: "Does not meet assumptions of AOV: data has heterogeneity of variance/skewness/kurtosis". Below this message is a "Fix" button. Further down, the "Outliers" section is visible, with three radio button options: "Box-Whisker", "> +/- 2 standard deviations from grand mean", and "> +/- 3 standard deviations from grand mean". The third option is selected. There are also two checkboxes: "Skip damaged assessments" (checked) and "Based on subsample values" (unchecked). A "Find Next" button is located at the bottom of the outlier options. On the far right, there is an "Assessment Map" section with a "Treatment" dropdown menu, a "Display current treatment" checkbox, and a "Comment:" text field. Below that is a "Barcode:" field and a "GPS:" field with a "Damaged" checkbox.

| 5 |
|-------|
| 9.5 |
| 15.00 |
| 10.00 |
| 8.00 |
| 5.50 |
| 7.90 |
| 8.00 |
| 7.00 |
| 12.00 |
| 15.00 |
| 1.90 |

Assessment Data Editor

Assessment Data view to hide data columns in which there are no differences between treatments



Assessment Data Editor

Before:

| | 1 | 2 | 3 | 4 |
|--|-------------|-------------|-------------|-------------|
| | LEAF | PLANT | SEPTTR | SEPTTR |
| | Jul-15-2014 | Jul-15-2014 | May-13-2014 | Jun-18-2014 |
| | PHYGEN | VIGOR | PESSEV | PESSEV |
| | % | % | % | % |

| Plot | Trt | 1 | 2 | 3 | 4 |
|------|-----|---|-----|-------|------|
| 101 | 3 | 0 | 100 | 1.00 | 0.80 |
| 102 | 1 | 0 | 100 | 10.00 | 7.70 |
| 103 | 4 | 0 | 50 | 1.00 | 1.10 |
| 104 | 2 | 0 | 100 | 0.00 | 1.20 |
| 105 | 5 | 0 | 100 | 10.00 | 1.70 |
| 201 | 2 | 0 | 100 | 0.00 | 1.20 |
| 202 | 3 | 0 | 100 | 2.00 | 0.90 |
| 203 | 5 | 0 | 100 | 0.00 | 3.30 |
| 204 | 4 | 0 | 100 | 5.00 | 1.70 |
| 205 | 1 | 0 | 100 | 3.00 | 9.50 |

After:

| | 3 | 4 | 5 |
|--|-------------|-------------|------------|
| | SEPTTR | SEPTTR | SEPTTR |
| | May-13-2014 | Jun-18-2014 | Jul-2-2014 |
| | PESSEV | PESSEV | PESSEV |
| | % | % | % |

| Plot | Trt | 3 | 4 | 5 |
|------|-----|-------|------|-------|
| 101 | 3 | 1.00 | 0.80 | 0.40 |
| 102 | 1 | 10.00 | 7.70 | 9.90 |
| 103 | 4 | 1.00 | 1.10 | 1.60 |
| 104 | 2 | 0.00 | 1.20 | 0.00 |
| 105 | 5 | 10.00 | 1.70 | 7.40 |
| 201 | 2 | 0.00 | 1.20 | 1.20 |
| 202 | 3 | 2.00 | 0.90 | 0.10 |
| 203 | 5 | 0.00 | 3.30 | 2.90 |
| 204 | 4 | 5.00 | 1.70 | 3.00 |
| 205 | 1 | 3.00 | 9.50 | 16.00 |

Properties

Assessment

View Options...

Visible Col 8/10

Refresh

Hidden: 2 Col, Row

All values the same or missing/blank (50 in column 2 is "damaged" so is missing)

Assessment Data Editor

| | 3 | 4 | 5 | |
|--|---|---|---|-----|
| | SEPTTR <input type="checkbox"/> | SEPTTR <input type="checkbox"/> | SEPTTR <input type="checkbox"/> | ZZ |
| | LEAF3 <input type="checkbox"/> P <input type="checkbox"/> | LEAF3 <input type="checkbox"/> P <input type="checkbox"/> | LEAF2 <input type="checkbox"/> P <input type="checkbox"/> | LE |
| | May-13-2014 <input type="checkbox"/> | Jun-18-2014 <input type="checkbox"/> | Jul-2-2014 <input type="checkbox"/> | Jul |
| | PESSEV <input type="checkbox"/> | PESSEV <input type="checkbox"/> | PESSEV <input type="checkbox"/> | AR |
| | % <input type="checkbox"/> | % <input type="checkbox"/> | % <input type="checkbox"/> | %A |

Properties

Assessment

View Options...

Visible Col 8/10

Refresh

Hidden: 2 Col, Row

Click this "Visible Col" button to choose between displaying:

- All data columns, or
- A view that temporarily hides some columns

| Plot ~ | Trt | 3 | 4 | 5 | |
|--------|-----|-------|------|------|------|
| 101 | 3 | 1.00 | 0.80 | 0.40 | 20.0 |
| 102 | 1 | 10.00 | 7.70 | 9.90 | 10.0 |
| 103 | 4 | 1.00 | 1.10 | 1.60 | 10.0 |
| 104 | 2 | 0.00 | 1.20 | 0.00 | 80.0 |
| 105 | 5 | 10.00 | 1.70 | 7.40 | 0.00 |
| 201 | 2 | 0.00 | 1.20 | | |
| 202 | 3 | 2.00 | 0.90 | | |
| 203 | 5 | 0.00 | 3.30 | | |
| 204 | 4 | 5.00 | 1.70 | | |
| 205 | 1 | 3.00 | 9.50 | | |

Column filter

| Prompt | Match | Sort | Visible |
|-------------------|--------|------|-------------------------------------|
| Part Rated | (All) | | <input checked="" type="checkbox"/> |
| Rating Date | (All) | | <input checked="" type="checkbox"/> |
| Rating Time | (All) | | <input type="checkbox"/> |
| Rating Type | PESSEV | | <input checked="" type="checkbox"/> |
| Rating Unit | (All) | | <input checked="" type="checkbox"/> |
| Sample Size, Unit | (All) | | <input type="checkbox"/> |

Display sort as tabs

Data origin: Original

Entry status: Data

Hide columns with no treatment differences

Ignore match

Assessment Data Editor

SUMSUB ARM Action Code *sums* instead of *averages* subsamples when viewing 1 value per plot on editor or reports:

5 subsamples

| Assessment Data - Line 8 | | | | | | | |
|--------------------------|----------------------------------|-----|-----|--------|-----|-------|--|
| Column Number | 2 | | | | | | |
| Part Assessed | FRUIT <input type="checkbox"/> P | | | | | | |
| Assessment Date | 05/17/2014 | | | | | | |
| Assessment Type | COUINS | | | | | | |
| Assessment Unit | NUMBER | | | | | | |
| Number of Subsamples | 5 | | | | | | |
| Trt-Eval Interval | 3 DA-A | | | | | | |
| ARM Action Codes | | | | | | | |
| + Sub | Rep | Blk | Col | Plot ~ | Trt | 2 | |
| 1 | 1 | 1 | 1 | 101 | 2 | 108.0 | |
| 2 | 1 | 1 | 1 | 101 | 2 | 65.0 | |
| 3 | 1 | 1 | 1 | 101 | 2 | 48.0 | |
| 4 | 1 | 1 | 1 | 101 | 2 | 93.0 | |
| 5 | 1 | 1 | 1 | 101 | 2 | 76.0 | |

First sub

| Assessment Data - Line 8 | | | | | | | |
|--------------------------|----------------------------------|-------|--|--|--|--|--|
| Column Number | 2 | | | | | | |
| Part Assessed | FRUIT <input type="checkbox"/> P | | | | | | |
| Assessment Date | 05/17/2014 | | | | | | |
| Assessment Type | COUINS | | | | | | |
| Assessment Unit | NUMBER | | | | | | |
| Number of Subsamples | 5 | | | | | | |
| Trt-Eval Interval | 3 DA-A | | | | | | |
| ARM Action Codes | | | | | | | |
| Plot ~ | Trt | 2 | | | | | |
| 101 | 2 | 108.0 | | | | | |
| 102 | 1 | 165.0 | | | | | |
| 103 | 3 | 70.0 | | | | | |
| 104 | 4 | 55.0 | | | | | |
| 105 | 5 | 12.0 | | | | | |

Sum of subs

| Assessment Data - Line 8 | | | | | | | |
|--------------------------|----------------------------------|-------|--|--|--|--|--|
| Column Number | 2 | | | | | | |
| Part Assessed | FRUIT <input type="checkbox"/> P | | | | | | |
| Assessment Date | 05/17/2014 | | | | | | |
| Assessment Type | COUINS | | | | | | |
| Assessment Unit | NUMBER | | | | | | |
| Number of Subsamples | 5 | | | | | | |
| Trt-Eval Interval | 3 DA-A | | | | | | |
| ARM Action Codes | SUMSUB | | | | | | |
| Plot ~ | Trt | 2 | | | | | |
| 101 | 2 | 390.0 | | | | | |
| 102 | 1 | 165.0 | | | | | |
| 103 | 3 | 70.0 | | | | | |
| 104 | 4 | 55.0 | | | | | |
| 105 | 5 | 12.0 | | | | | |

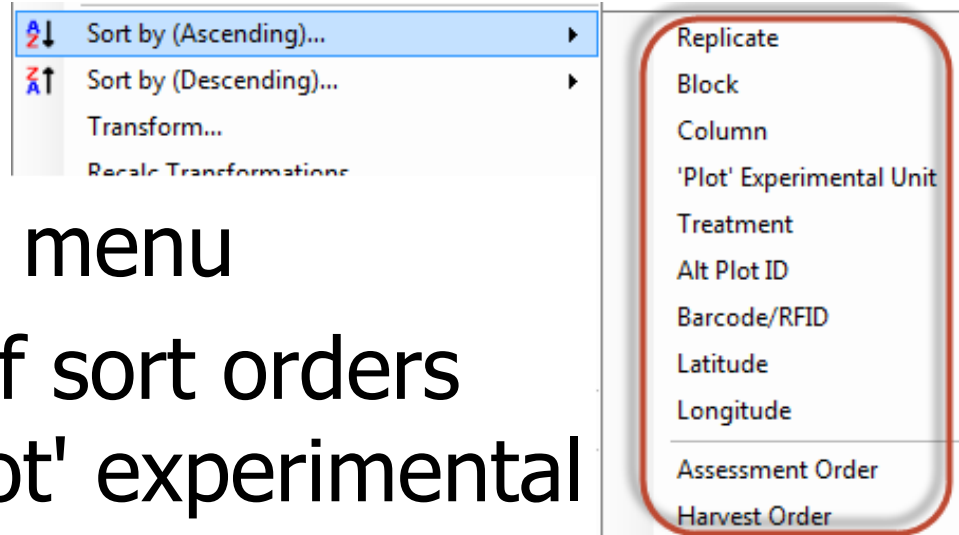
New Assessment Sorts

- Sort data by any 'plot' experimental unit description column
- Click heading once for ascending sort, click again for descending sort

| + Sub | Rp | Bk | Col | Plot | Tit | 3 |
|-------|----|----|-----|------|-----|-------|
| 1 | 4 | 4 | 5 | 405 | 5 | 10.00 |
| 1 | 4 | 4 | 4 | 404 | 4 | 0.00 |
| 1 | 4 | 4 | 3 | 403 | 2 | 3.00 |
| 1 | 4 | 4 | 2 | 402 | 3 | 0.00 |
| 1 | 4 | 4 | 1 | 401 | 1 | 0.00 |
| 1 | 3 | 3 | 5 | 305 | 4 | 3.00 |
| 1 | 3 | 3 | 4 | 304 | 5 | 0.00 |
| 1 | 3 | 3 | 3 | 303 | 4 | 0.00 |

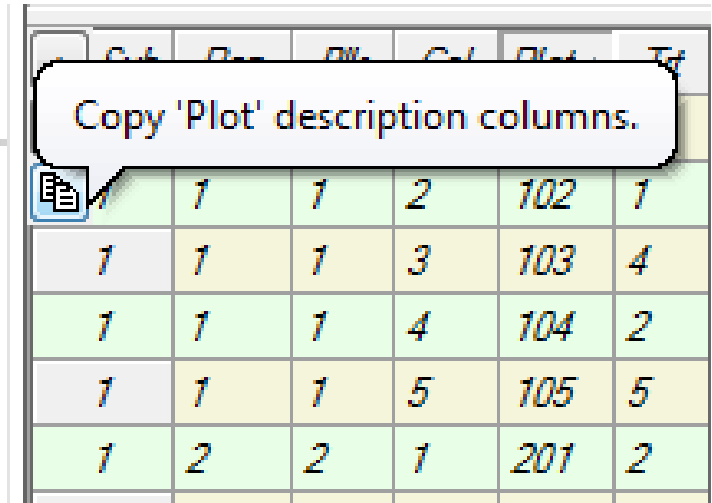
New Assessment Sorts

- New sorts are also on right-click menu
- Provides full list of sort orders from available 'Plot' experimental unit descriptors



Copy 'Plot' Assessment Unit Description

- New shortcut button in assessment editor
- Copies entire plot description, including column headings
- Simple transfer of ARM randomization to planting, application, or harvest software (shown pasted to Excel)



| | Col | Plot | Trt | | |
|---|-----|------|-----|-----|---|
| 1 | 1 | 1 | 2 | 102 | 1 |
| 1 | 1 | 1 | 3 | 103 | 4 |
| 1 | 1 | 1 | 4 | 104 | 2 |
| 1 | 1 | 1 | 5 | 105 | 5 |
| 1 | 2 | 2 | 1 | 201 | 2 |

| | A | B | C | D | E |
|---|-----|-----|-----|------|-----|
| 1 | Rep | Blk | Col | Plot | Trt |
| 2 | 1 | 1 | 1 | 101 | 3 |
| 3 | 1 | 1 | 2 | 102 | 1 |
| 4 | 1 | 1 | 3 | 103 | 4 |
| 5 | 1 | 1 | 4 | 104 | 2 |
| 6 | 1 | 1 | 5 | 105 | 5 |
| 7 | 2 | 2 | 1 | 201 | 2 |
| 8 | 2 | 2 | 2 | 202 | 3 |



Assessment Editor

- New 'Across columns within subsample' cursor order
- Tablet Data Entry mode: "Subsamples" data header label displays more columns
- Undo Assessment Comment, Barcode, GPS coordinate, and Damaged field changes
- Clear 'Damaged' flag from marked blocks
- Several outlier search panel fixes

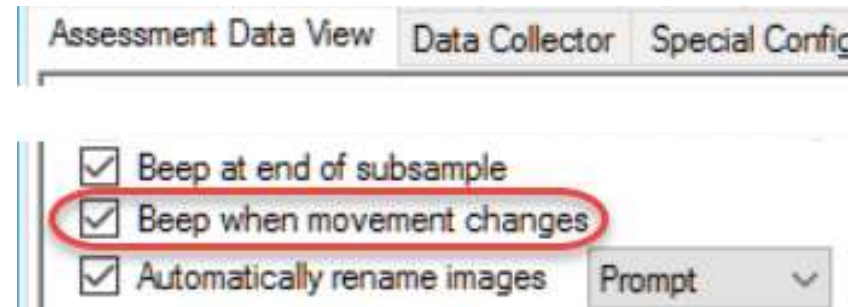


Assessment Editor

- When choose formula from ARM Action Code list, are now asked to select original column(s) to transform
- Range and Row columns are now copied when select Trial Map Plot Description copy button in range/row numbered trial
- New warning when cursor moves to top of a new column in current cursor order if a key press will overwrite existing data

Assessment Editor

- Warning when cursor moves to top of a new column in current cursor order if a key press will overwrite existing data
- Option to beep when cursor advances to a plot that changes movement direction for Assessment or Harvest sort order



Assessment Editor

AUDPC/SAUDPC calculates when all planned assessments are defined, yet only some contain data:

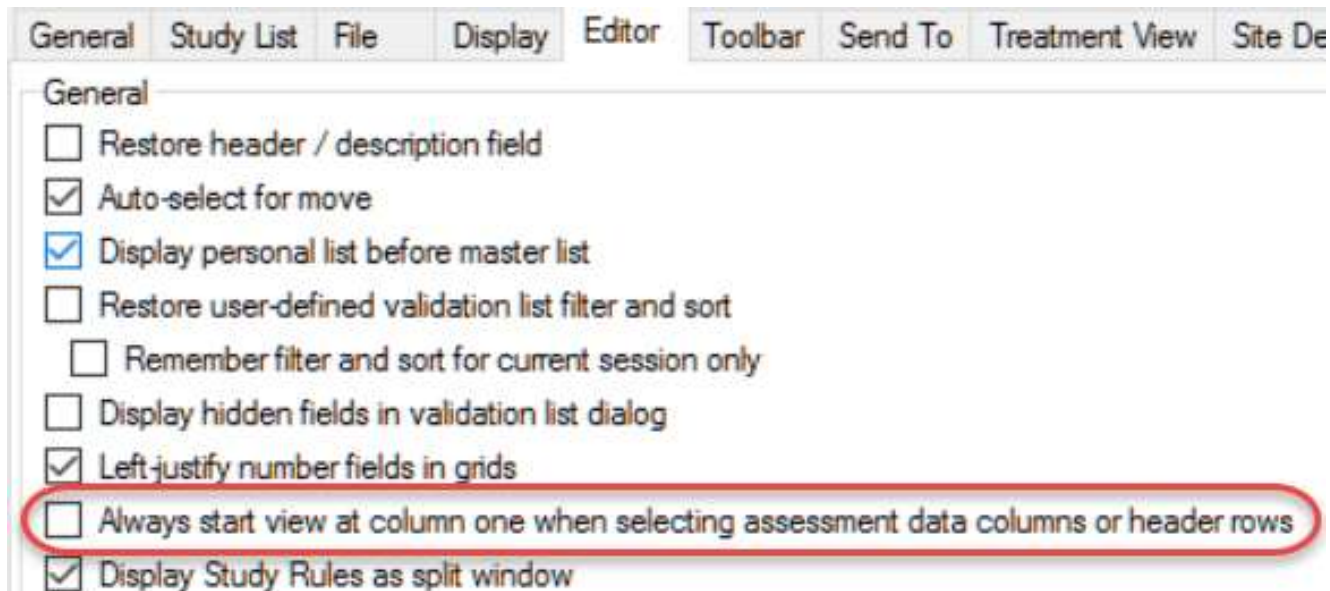
| Column Number | 1 | 2 | 3 | 4 | 5 | 6 (Calculated) |
|--------------------|---------------|---------------|---------------|---------------|---------------|----------------|
| Pest Name | Powdery milde | Powdery milde | Powdery milde | Powdery milde | Powdery milde | Powdery milde |
| Assessment Date | 06/08/2016 | 06/22/2016 | 07/05/2016 | | | |
| Assessment Type | COUDIS | COUDIS | COUDIS | COUDIS | COUDIS | |
| Assessment Unit | % | % | % | % | % | AUDPC |
| Trit-Eval Interval | 38 DA-A | 52 DA-A | 65 DA-A | 80 DA-A | 95 DA-A | |

| + Sub | Rep | Blk | Col | Plot | Trit | 1 | 2 | 3 | 4 | 5 | 6 (Calculated) |
|-------|-----|-----|-----|------|------|----|----|----|---|---|----------------|
| 1 | 1 | 1 | 1 | 101 | 1 | 10 | 30 | 45 | | | 767.5 |
| 1 | 1 | 1 | 2 | 102 | 2 | 0 | 40 | 60 | | | 930.0 |
| 1 | 1 | 1 | 3 | 103 | 3 | 0 | 25 | 40 | | | 597.5 |



Assessment Editor

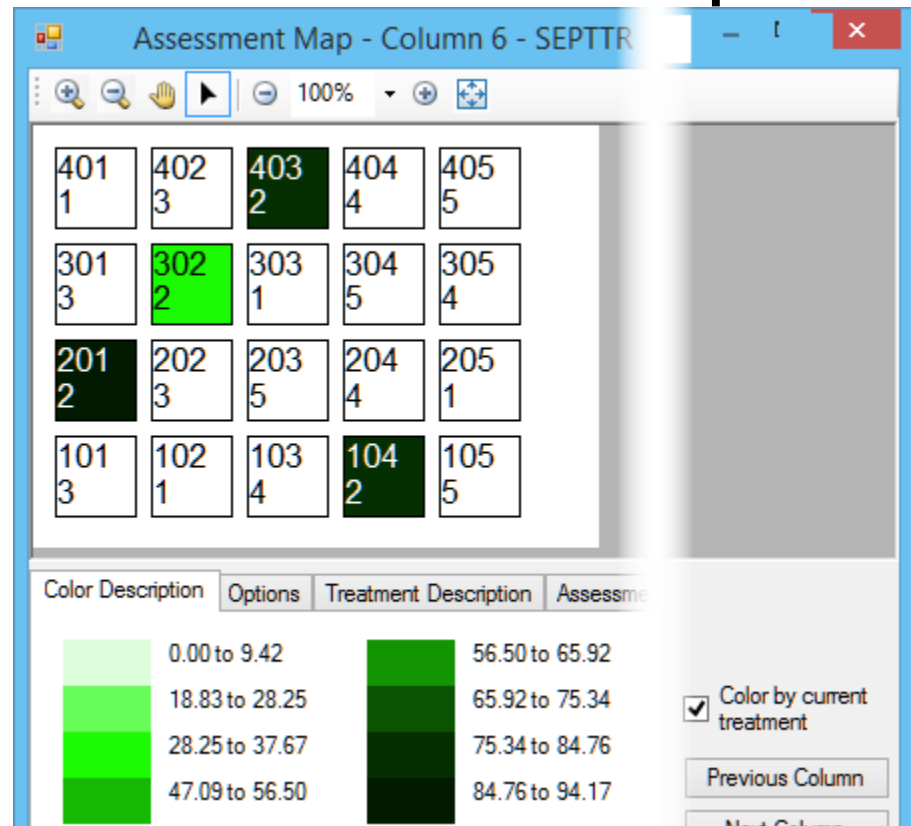
Editor option to always start at column or header row 1 when selecting data columns or header rows



Assessment Map

New 'Color by current treatment' option

- Easily review variation in each treatment
- Simpler to find position in each replicate for trial with many treatments



Convert Yield using Harvested Plot Length/Width per Plot 9.2014

Assessment Data - Line 15

| Column Number | 10 | 11 | 12 | 13 (Calculated) | 14 (Calculated) | 15 |
|---------------|--|---|---|---|---|----|
| Part Rated | PLOT <input type="checkbox"/> C <input type="checkbox"/> | GRAIN <input type="checkbox"/> C <input type="checkbox"/> | GRAIN <input type="checkbox"/> C <input type="checkbox"/> | GRAIN <input type="checkbox"/> C <input type="checkbox"/> | GRAIN <input type="checkbox"/> C <input type="checkbox"/> | |
| Rating Type | LENGTH <input type="checkbox"/> | YIELD <input type="checkbox"/> | MOICON <input type="checkbox"/> | YIELD <input type="checkbox"/> | YIELD <input type="checkbox"/> | |
| Rating Unit | m <input type="checkbox"/> | KG <input type="checkbox"/> | % <input type="checkbox"/> | T-MET <input type="checkbox"/> | %UNCK <input type="checkbox"/> | |

| Sub | Rep | Blk | Col | Plot # | Trt | |
|-----|-----|-----|-----|--------|-----|------|
| 1 | 1 | 1 | 1 | 101 | 3 | 9.00 |
| 1 | 1 | 1 | 2 | 102 | 7 | 9.00 |
| 1 | 1 | 1 | 3 | 103 | 4 | 9.00 |
| 1 | 1 | 1 | 4 | 104 | 2 | 9.00 |
| 1 | 1 | 1 | 5 | 105 | 5 | 9.00 |
| 1 | 2 | 2 | 1 | 201 | 2 | 8.50 |
| 1 | 2 | 2 | 2 | 202 | 3 | 8.50 |
| 1 | 2 | 2 | 3 | 203 | 5 | 8.50 |
| 1 | 2 | 2 | 4 | 204 | 4 | 8.50 |
| 1 | 2 | 2 | 5 | 205 | 7 | 8.50 |
| 1 | 3 | 3 | 1 | 301 | 3 | 9.00 |
| 1 | 3 | 3 | 2 | 302 | 2 | 9.00 |
| 1 | 3 | 3 | 3 | 303 | 7 | 9.00 |
| 1 | 3 | 3 | 4 | 304 | 5 | 9.00 |
| 1 | 3 | 3 | 5 | 305 | 4 | 9.00 |
| 1 | 4 | 4 | 1 | 401 | 7 | 9.00 |
| 1 | 4 | 4 | 2 | 402 | 3 | 9.00 |

Yield Conversion

Yield units
Current:
Desired:
For Bu/Ac only:
Test weight (pounds/bushel):
Conv:

Moisture adjustment
 Adjust to dry moisture percent =
Average moisture percent at harvest
 Use whole trial average percent =
 Use percent in data column number

Harvested plot size
Width:
 Use width in data column number
Length:
 Use length in data column number
Unit:

Conversion factor
Convert data column number:

Convert Yield Automations

- Column to Convert:
 - 'Current' unit auto-selected from Rating Unit
 - Sample size auto-filled with 1 PLOT if blank
- Sample size in Converted column auto-filled based on selected Desired unit



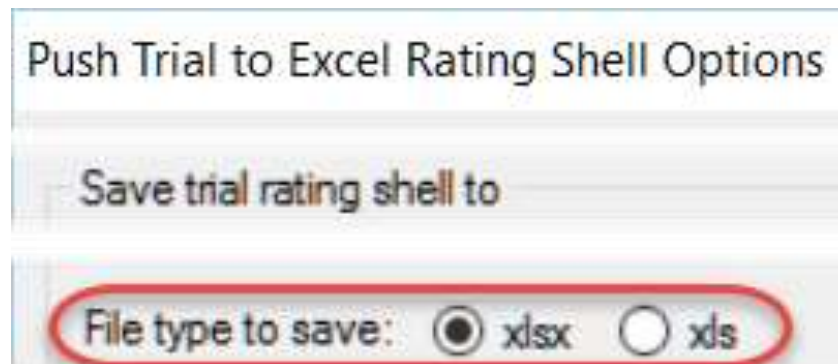
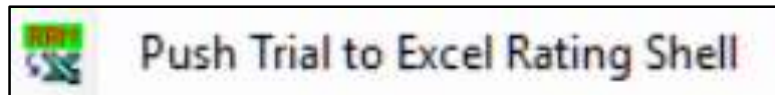


Convert Yield

- Auto-fills 'Adjust to dry moisture percent' option from '% Standard Moisture' in Crop Description of the Site Description
- Converted yield is now 0 when original weight is 0 and adjusted moisture is missing

Excel Rating Shells

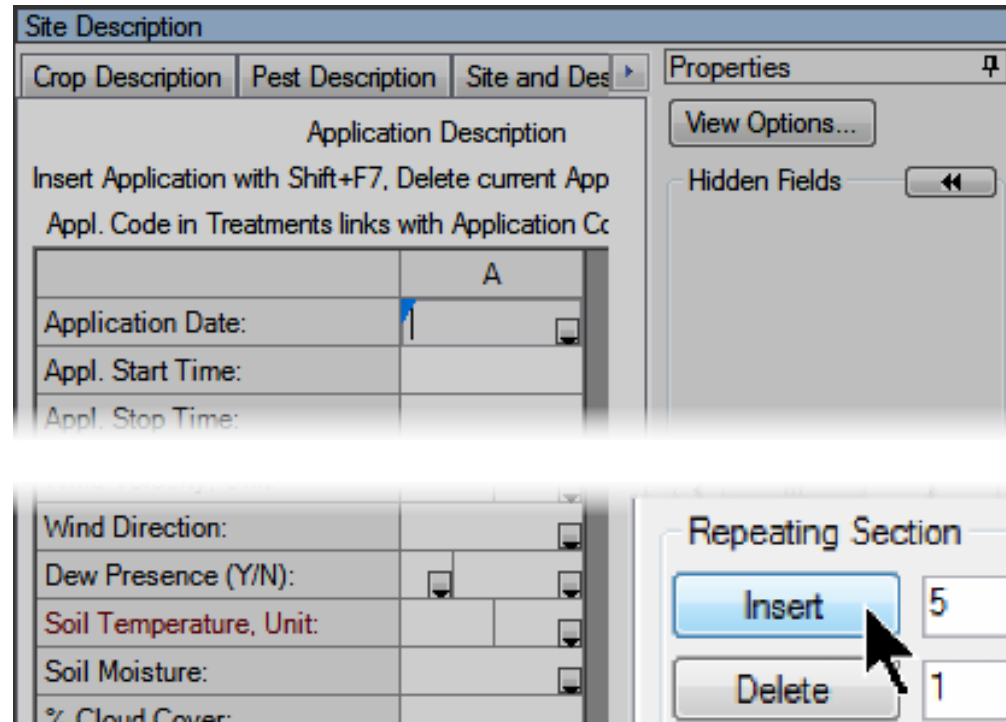
Can be Pushed and Pulled as Excel *.xlsx using 'File type to save' option:



Insert or Delete Multiple Repeating Sections at Once

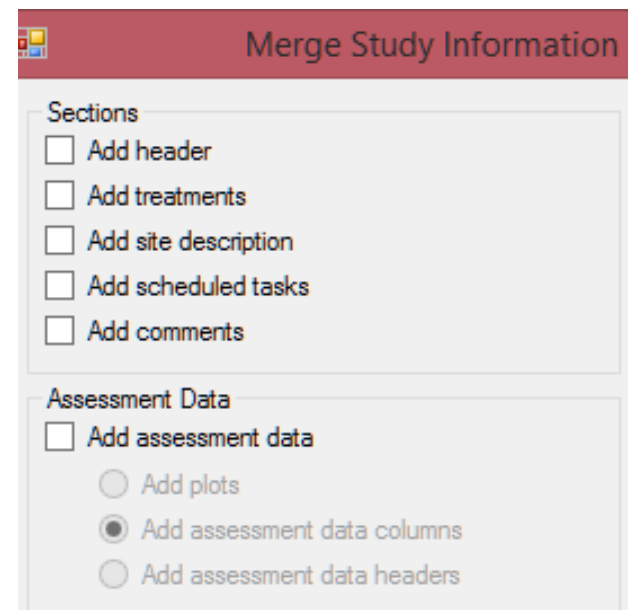
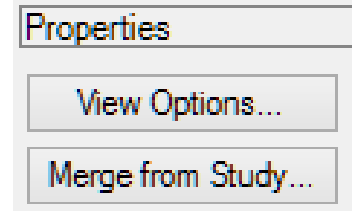
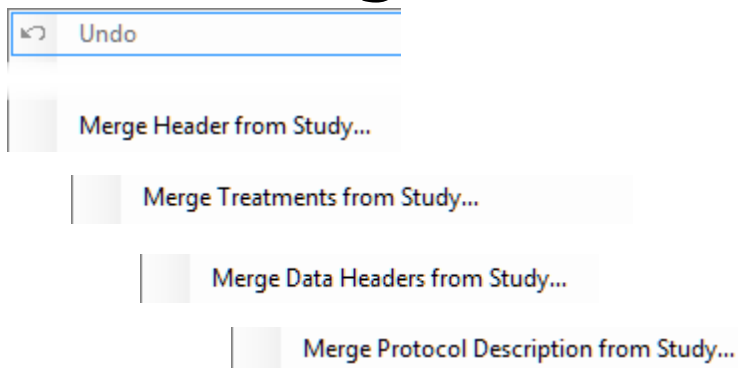
New option on Site/Protocol Description Properties panel

1. Define number to add or delete
2. Select 'Insert' or 'Delete' button



Merge from Study

- New button on properties panels
- Use to ***add*** matching information from another study into current study
- Also on right-click menus





Merge from Study - Use to:

- Build new protocol (trial plan) from a similar existing study
 - Even from a sponsor's customized protocol
- Add assessment headers (description)
- Add location, soil, and/or moisture from another trial in same field
- Combine 2+ identical trials at different locations into split-plot trial

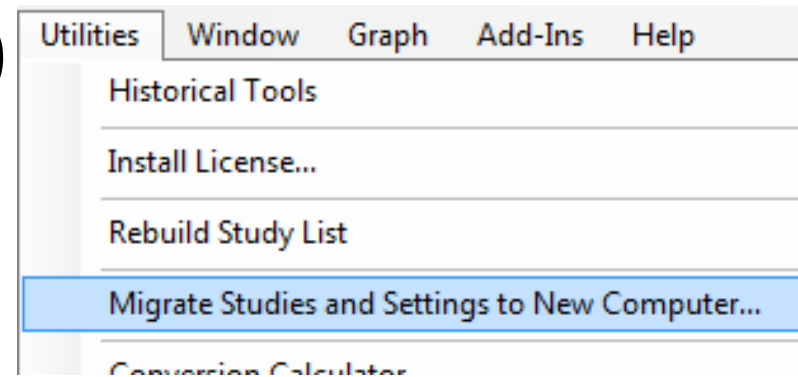


Merge Studies

- When merge protocol description, are now asked whether to update all merged dates to the current year
 - Simplifies using a previous year's protocol
- Select study to merge either from study list or by using Browse button

Assist Migration to a New PC

- Create migration package of original PC (in ARM 9.2014.2+) containing:
 - ARM studies
 - Personal lists
 - ARM and report options, report sets
 - ARMbackup folder contents (if package is stored on ARM's backup device)



Migration Wizard

- Select ARM version that will be installed on the new PC
- Select items to include in the package

Migrate Studies and Settings to New Computer

Are you migrating files to ARM 9 or ARM 2015?

ARM 9

ARM 2015 (or newer)

Note: Full migration is only supported for ARM 2015

Help Cancel < Back Next >

Migrate Studies and Settings to New Computer

Select which components to migrate to an ARM 2015 (or newer) computer.

Settings folder options

Personalization of study definition files

Study data files

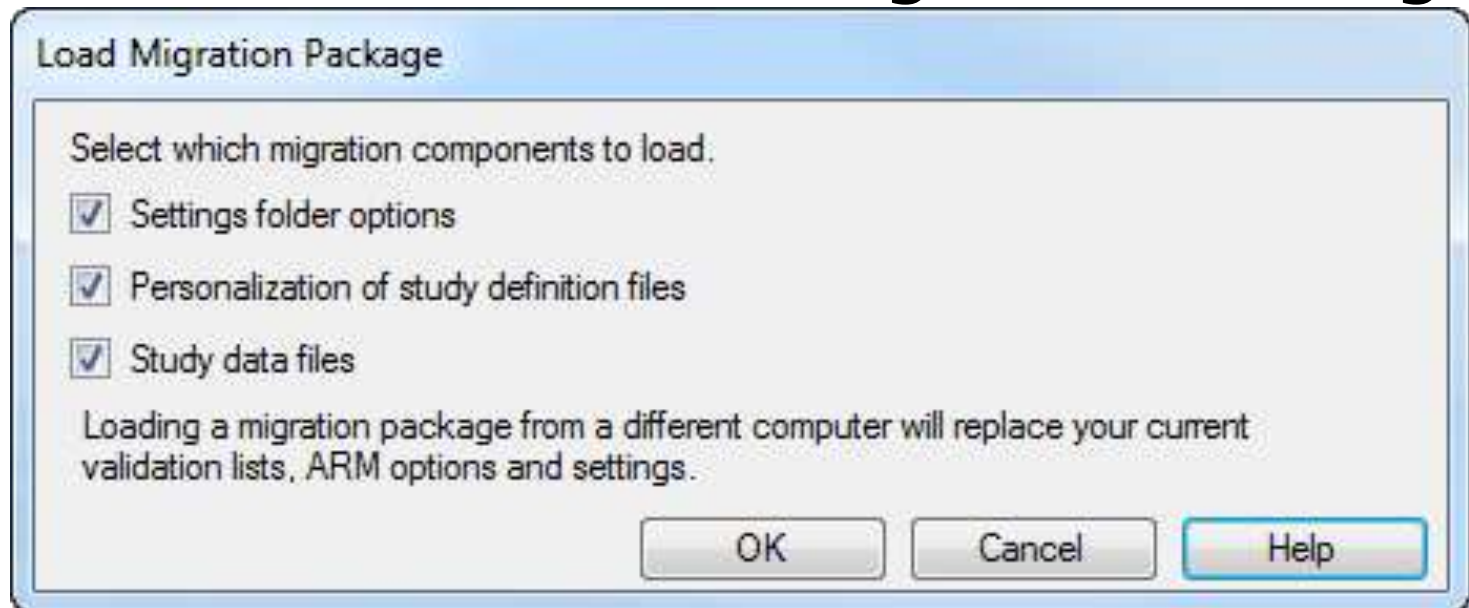
Migration files will be created in F:\ARMbackup\.

Help Cancel < Back Next > Finish

Import Migration in ARM

On the new PC with ARM, either:

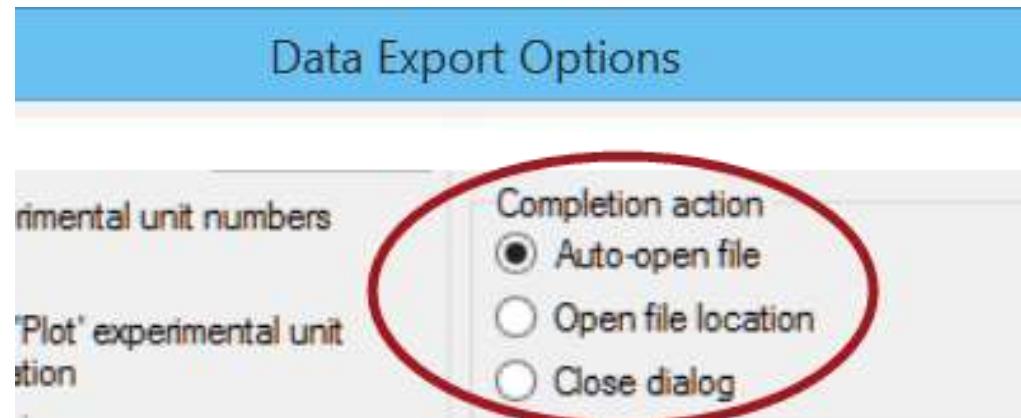
- Use migration package when installing ARM
- Use Utilities menu "Load Migration Package"



Data Export

New 'Completion action" options:



- Auto-open exported data in the registered Windows program for selected file type (such as Excel for *.csv exports)
- Auto-open in Windows Explorer the folder containing exported data





Data Export

Export extended 'Plot' description:

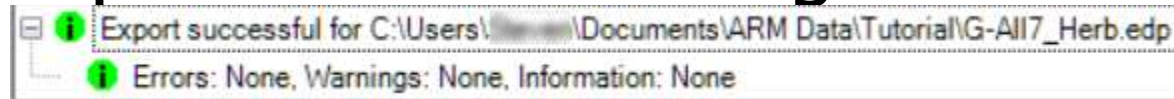
| - | Sub | Rep | Blk | Col | Plot | Trt | Alt Plot ID | Barcode/RFID | Lat | Long |
|---|-----|-----|-----|-----|------|-----|-------------|--------------|-----|------|
|  | 1 | 1 | 1 | 1 | 101 | 2 | | | | |
|  | 1 | 1 | 1 | 2 | 102 | 5 | | | | |

- New format option
- Use to include plot IDs and location information when exporting to other programs

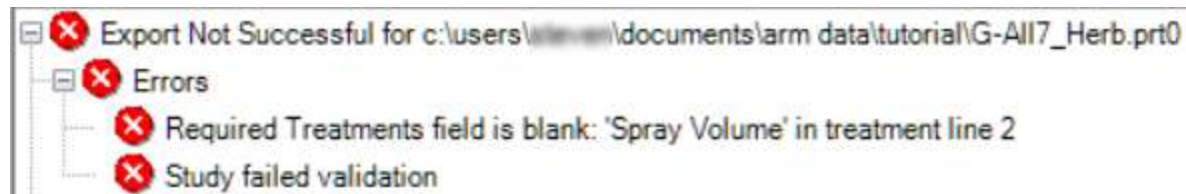
Export Success Messages

Message color indicates success

- 'Export Successful' is green



- 'Export not Successful' is red



Treatments

- Clearer message when trial treatments change will unbalance multi-factor trial:

| | | | | | | | | | | | | | | | | | | | | | |
|----|---|---------|----|----|---|---------|---|--|--|--|--|--|--|--|--|--|--|--|--|---|---|
| 13 | 7 | Hyvar X | 80 | WP | 4 | KG A/HA | A | | | | | | | | | | | | | A | |
| 14 | 7 | 1 MAP | | | | | | | | | | | | | | | | | | | E |
| 15 | 8 | Hyvar X | 80 | WP | 5 | KG A/HA | A | | | | | | | | | | | | | | A |
| 16 | 8 | 2 MAP | | | | | | | | | | | | | | | | | | | E |

ARM - ARM Request

Do you wish to change the 'Rate' for this treatment component across all occurrences of A 4?

Select 'Yes' to change the 'Rate' for this treatment component across all occurrences of A 4.

Select 'No' to change only the current field.

Select 'Cancel' to stop changes.

Yes No Cancel

ARM - SPECIAL CONFIRMATION

Should trial design be downgraded to Randomized Complete Block (RCB) because treatment level information is no longer consistent across factors?

Select 'Yes' to downgrade to Randomized Complete Block (RCB).
WARNING: Not recommended. Downgrade only when the original multifactor design is no longer applicable.

Select 'No' to keep the study as multi-factor.

Yes No

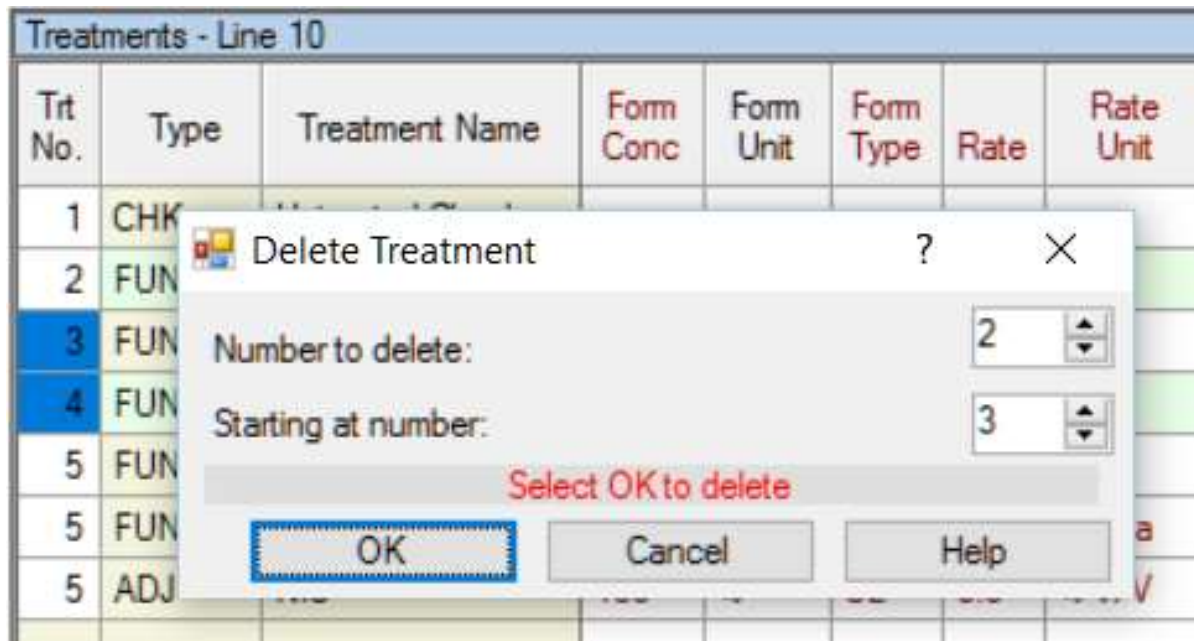


Treatments

- 'Mixed' formulation concentration unit for pre-mixed products that contain different concentration units, such as g AI/L + BCFU/mL.
- Calculate Other Rate for Units ending in 'Row-m' or 'Row-FT'
- Calculate Other Rate even when 'Calculated Mix Size' in Settings is 0

Edit - Delete Treatments

Selected treatments are marked to better show which treatments will be deleted





Treatments

- Calculate Other Rate for Units ending in 'Row-m' or 'Row-FT'
- Calculate Other Rate even when 'Calculated Mix Size' in Settings is 0



Site/Protocol Description

- Grid columns auto-size to fit text in repeating section grids after pasting, such as when paste weather data
- Read-only grid fields display in italic font

| | A | B | C | D |
|---------------------------------|----------------------|------------------------|------------------------|------------------------|
| <i>Application Date:</i> | <i>04/02/2014</i> | <i>04/12/2014</i> | <i>04/23/2014</i> | <i>05/03/2014</i> |
| <i>Crop 1 Code, BBCH Scale:</i> | <i>MABSD BPOM</i> | <i>MABSD BPOM</i> | <i>MABSD BPOM</i> | <i>MABSD BPOM</i> |
| <i>Leaf Wall Area, Unit:</i> | <i>12903 m2/ha</i> | <i>16129 m2/ha</i> | <i>16129 m2/ha</i> | <i>16129 m2/ha</i> |
| <i>LWA Formula:</i> | <i>10000/3.1*2*2</i> | <i>10000/3.1*2.5*2</i> | <i>10000/3.1*2.5*2</i> | <i>10000/3.1*2.5*2</i> |



Site/Protocol Description

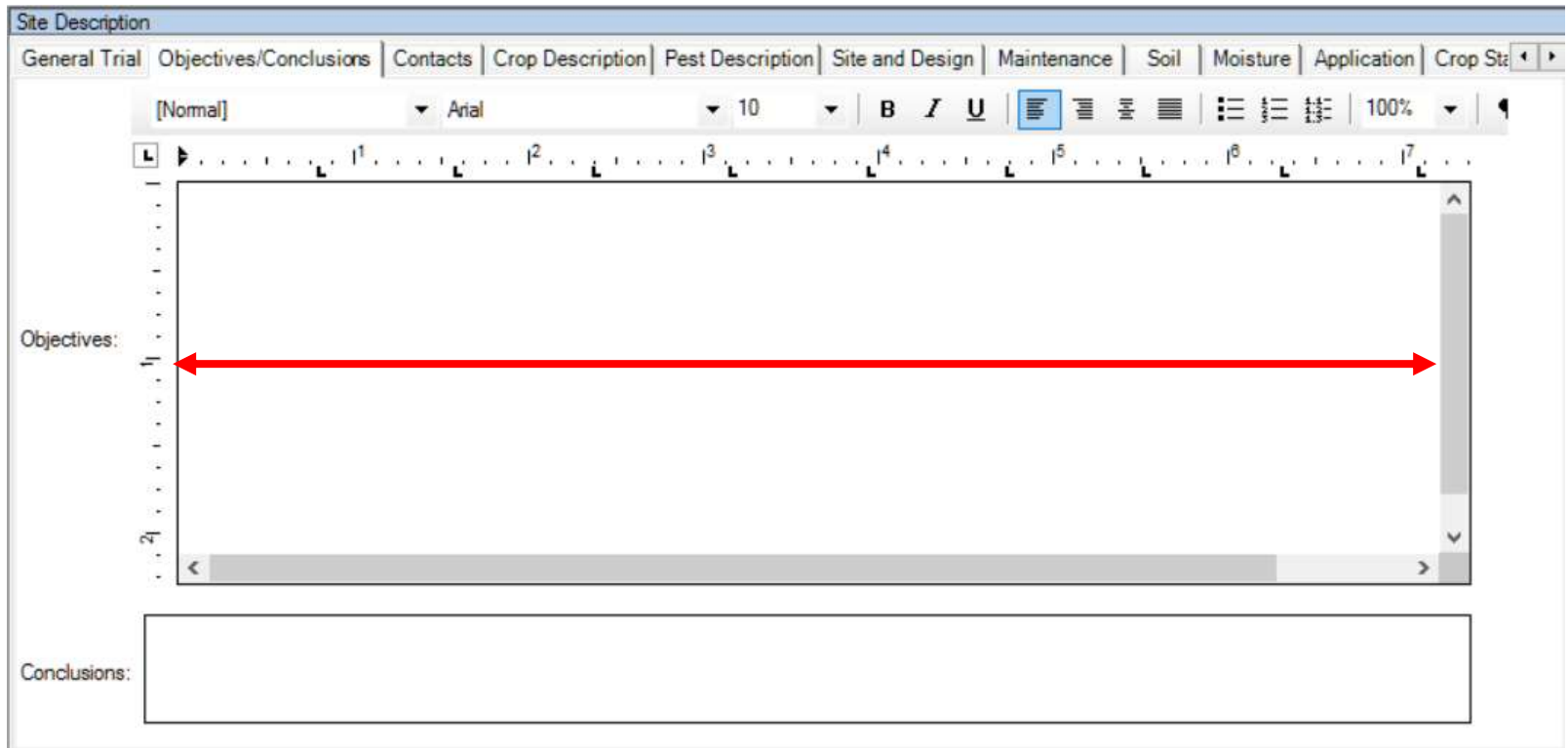
Application Equipment tab

- Message to enter Mix Size per '/10000 m2 LWA' when Application Volume is 'L/10000 m2 LWA'
- Mix Size auto-copied from Settings only when Application Volume in Site Description is same as Settings
- 'Application Volume Unit' and 'Mix Size Unit' fields auto-filled only when associated value field contains an entry

Site/Protocol Description

Rich Text Comments

Automatically sized to match print margins



Tablet Data Collector

Pinch-to-zoom, for easier screen resizing on Windows touch tablets

Assessment Data - Line 1

| Column Number | 20 | 21 |
|---------------|--------|--------|
| Rating Type | PHYGEN | CONTRO |
| Rating Unit | % | % |

| Sub | Plot | 20 | 21 |
|-----|------|----|----|
| 1 | 101 | | |
| 1 | 102 | | |
| 1 | 103 | | |
| 1 | 104 | | |
| 1 | 105 | | |
| 1 | 205 | | |
| 1 | 204 | | |
| 1 | 203 | | |
| 1 | 202 | | |
| 1 | 201 | | |
| 1 | 301 | | |
| 1 | 302 | | |
| 1 | 303 | | |
| 1 | 304 | | |

Properties

Exit TOC Tools
Tablet AOV Means Table
Data Data
Entry Entry
Assessment Map

Assessment (Plot 101, Col 20)

Comment

GPS:

Damaged
Image

Attach

100 7 8 9 -
←

0 4 5 6 +
←

Copy Down 1 2 3
←

Missing 0 .
←

Tab < > [X]

150%

8:13 PM
3/22/2013

Tablet Data Collector


- 'Set GPS' button records location of:
- Current data value
 - Current plot



Tablet Data Collector - GPS

Displays Trial Map to show actual trial shape when recording GPS for trial corners

| | Latitude | Longitude |
|-------------|----------|-----------|
| Lower Left | 50.5667° | 4.6833° |
| Upper Left | | |
| Upper Right | | |
| Lower Right | | |

Record GPS 

OK
Cancel
Help

Tablet Data Collector 2016.1

Starting 'Tablet Data Entry' mode displays a wizard to also define 'Image Auto-Capture', reducing number of steps to take pictures

Tablet Data Entry Options

Sort order

'Plot' experimental unit Assessment (Serpentine within blocks)

Treatment Harvest (Serpentine across blocks)

Cursor order

By column across 'Plot' Across columns within subsample

Across columns within 'Plot'

Show shortcut keys on tablet data entry keypad

Record current GPS location when entering assessment data

Trial backup interval ('Plot' experimental units): 1

Help Cancel Next >

Tablet Data Entry - Image Options

Copy to trial folder Rename image

File name components

Trial ID: 1 Plot: 4

Trt: 2 Sub: 5

Asm. Date: 3

Add T, P, S (Trt, Plot, Sub) prefix to file name components

G-All7_Fung_T0003_25-Jan-2016_P101

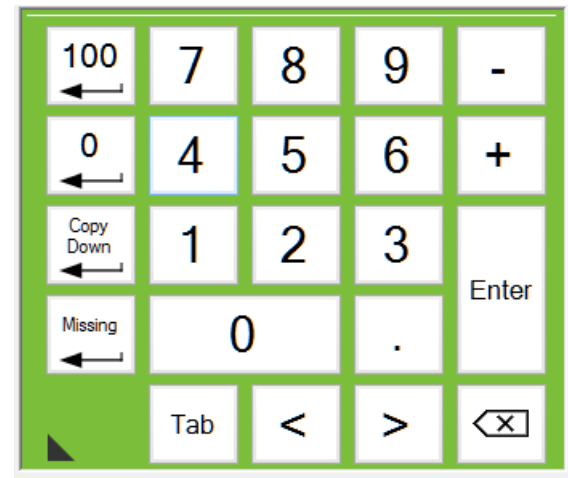
Number of images per 'Plot' experimental unit within an assessment column: 1

Cancel < Back Finish

Tablet Data Collector 2016.1

Further touch interface improvements:

- Study List fits on 7" tablet
- Touchpad:
 - Text auto-sizes for button size
 - Tab and arrow keys are larger
- Larger 'display list' buttons are easier with fingers
- Auto-closes Study Rules tab



| | |
|---------------|--------------------------|
| Column Number | 14 |
| Part Rated | <input type="checkbox"/> |
| Rating Date | <input type="checkbox"/> |
| Rating Type | <input type="checkbox"/> |
| Rating Unit | <input type="checkbox"/> |



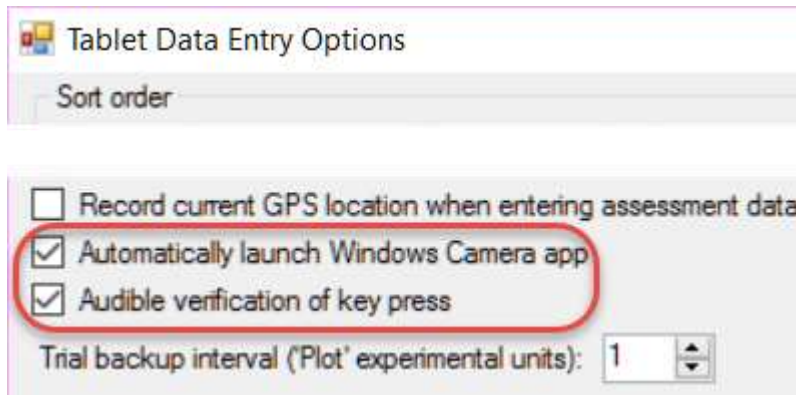


Tablet Data Collector 2016.2

- Starting Tablet Data Entry automatically starts camera app in Windows 10
- Remembers ARM + camera app size and position for both landscape & portrait mode
- Larger text on 'Copy Down', 'Missing', 'Enter', and 'Tab' keypad buttons
- Several more data column and editor sizing and scrolling enhancements

Tablet Data Collector

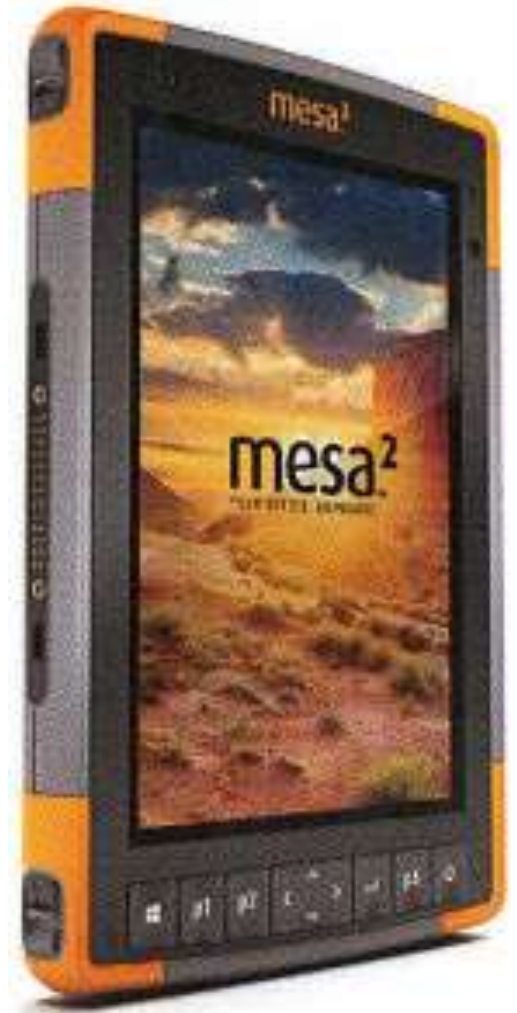
- Auto-open Camera app (Windows 10+)
- 'Audible verification of key press' makes a 'click' sound when each TDC keypad button is pressed



New Tablet Hardware

HarvestMaster Mesa²

- 7 inch Windows 10 tablet
- Waterproof, dustproof
- Released 2Q2016



Trial Map

Change plot number format at any time without re-randomizing the trial:

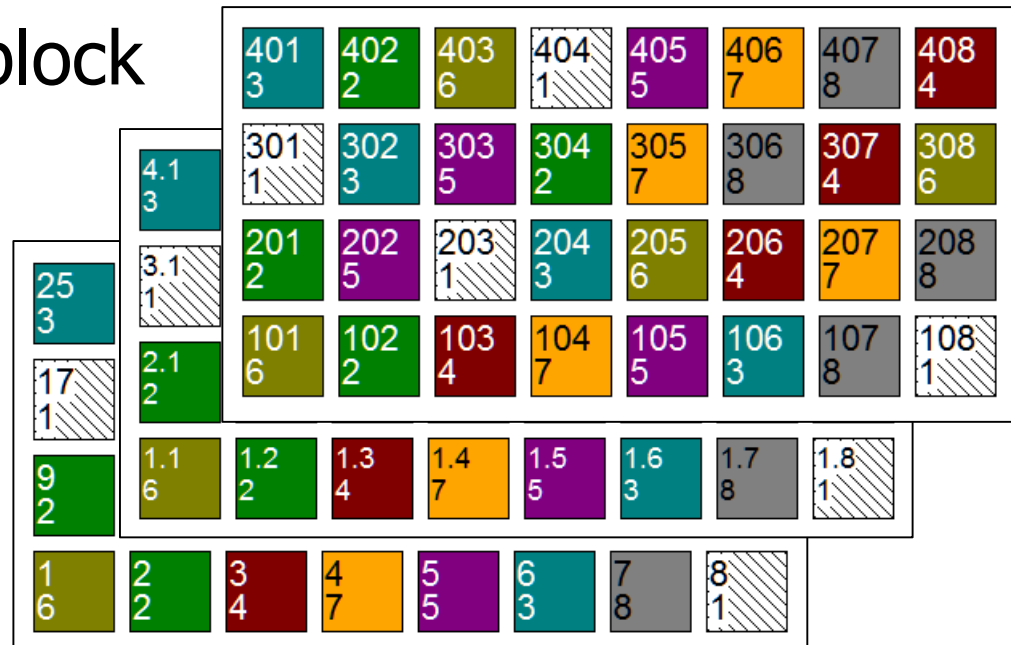
- Standard by rep/block
- Range by Row
- Sequential

Trial Settings

Layout

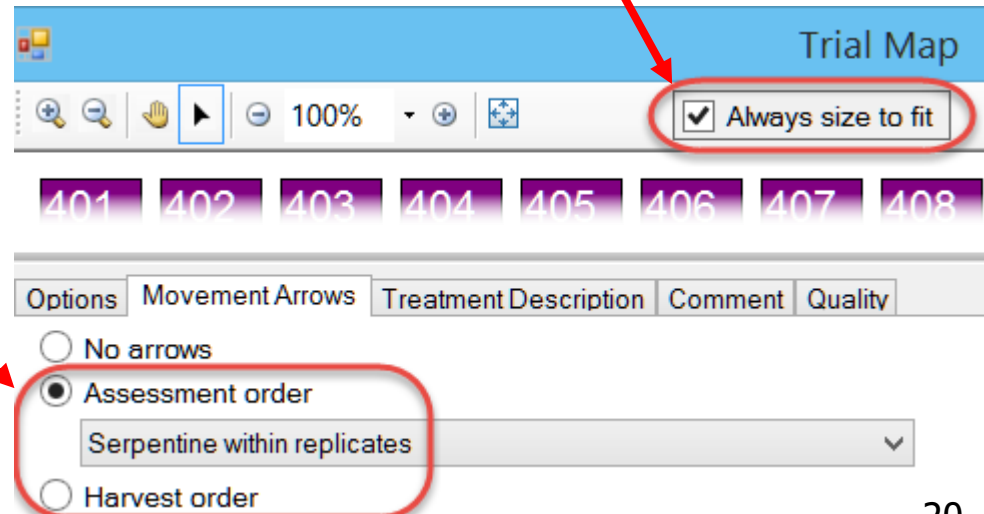
'Plot' numbering: Standard by rep (101,102, etc.) ▼

- Standard by rep (101,102, etc.)
- Standard by block (101,102, etc.)
- Range by Row
- Sequential (1, 2, 3, etc.)



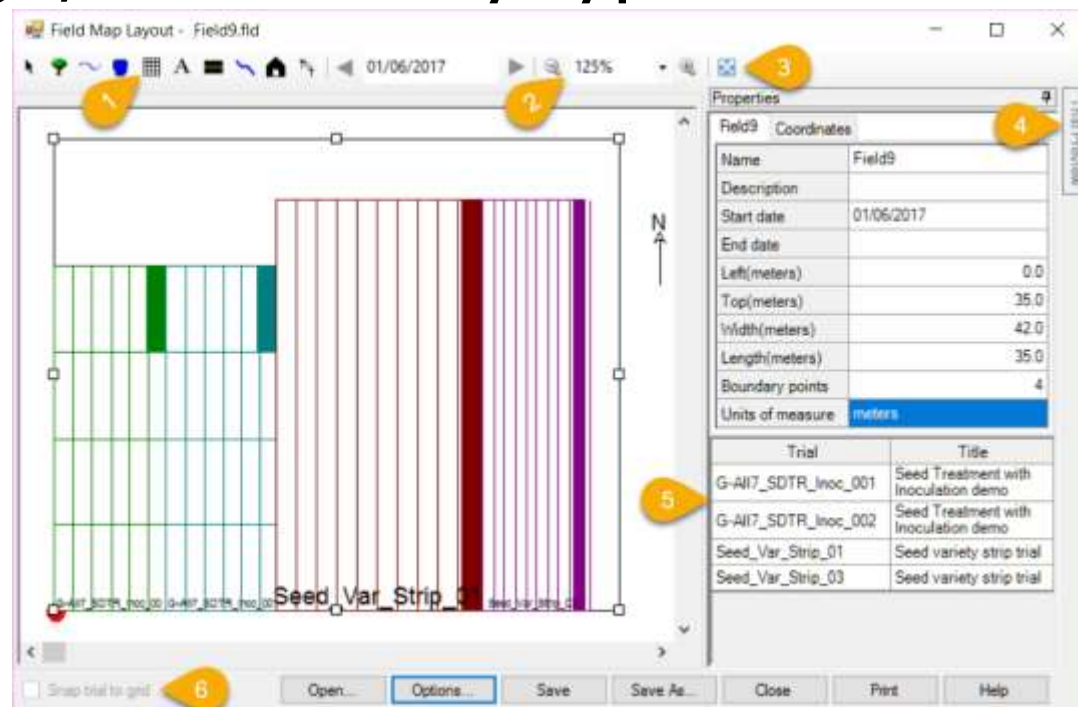
Trial Map

- Dynamically auto-resize map and zoom level so entire trial always fits into trial map dialog
- New movement arrow choices:
 - Serpentine within replicates
 - Reversed serpentine within replicates
 - Within replicates
 - Reversed within replicates



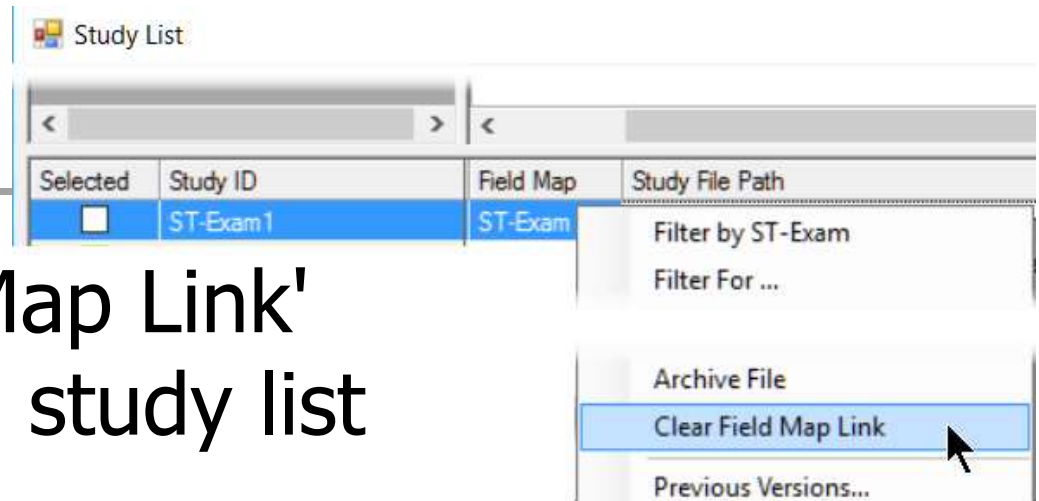
Field Map

1. Add trials from study list
2. Larger zoom range, or manually type a value
3. Size-to-Fit button
4. Trial Preview tab
5. Trial legend grid
6. Snap trial to grid

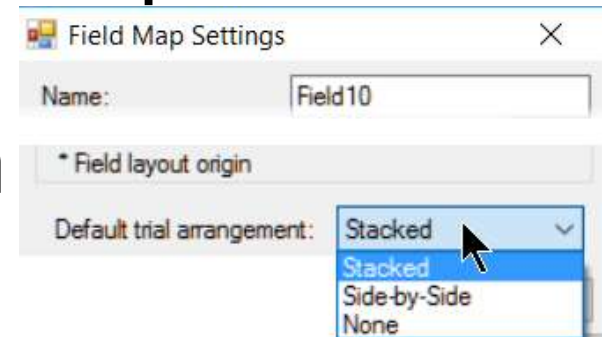


Field Map

- 'Clear Field Map Link' right-click on study list



- 'Default trial arrangement' option on Field Map Settings, to auto-arrange trials when added to field map



GDM and HarvestMaster

ARM Connect to
HarvestMaster
Mirus Software:



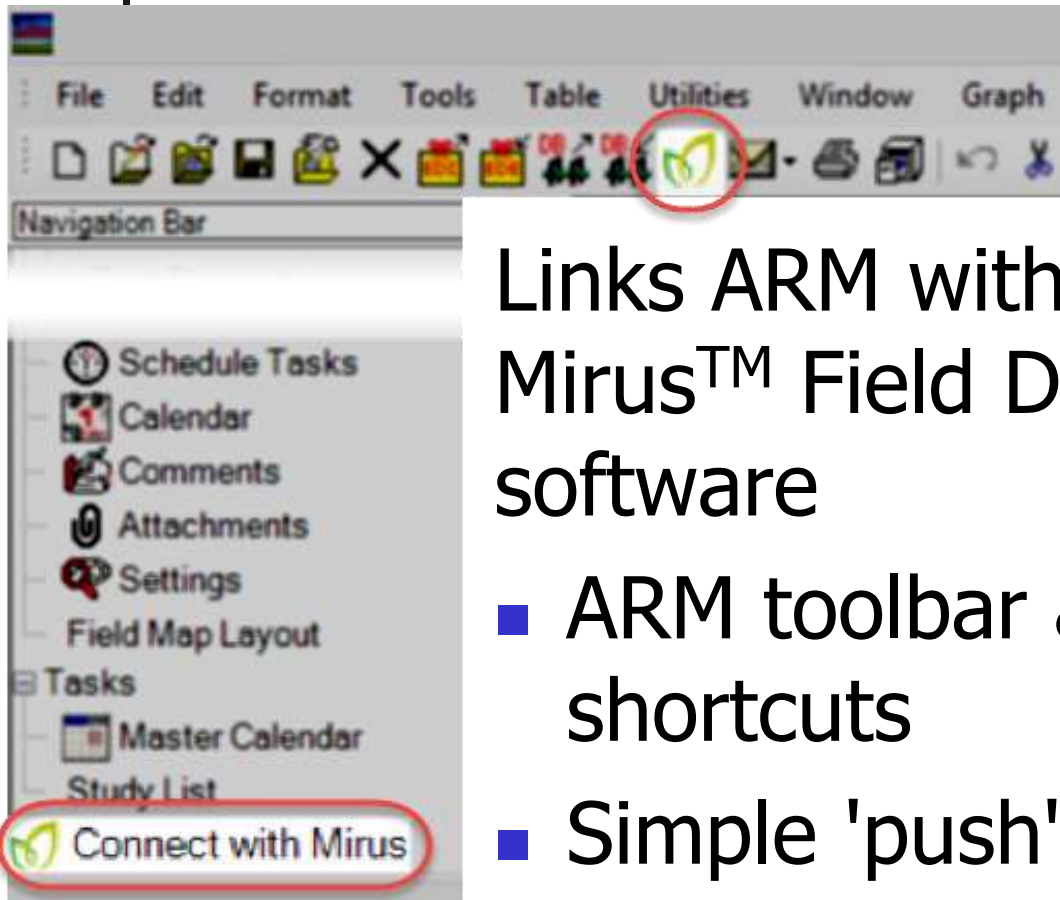
- ARM pushes field or trial map to Mirus
- Mirus uses with:
 - HarvestMaster Harvest Data Systems
 - Research sprayers
 - Other research equipment
- Mirus pushes harvest results to ARM

Details at GDM and HarvestMaster booths in exhibit hall

Jan. 2017



Connect with Mirus

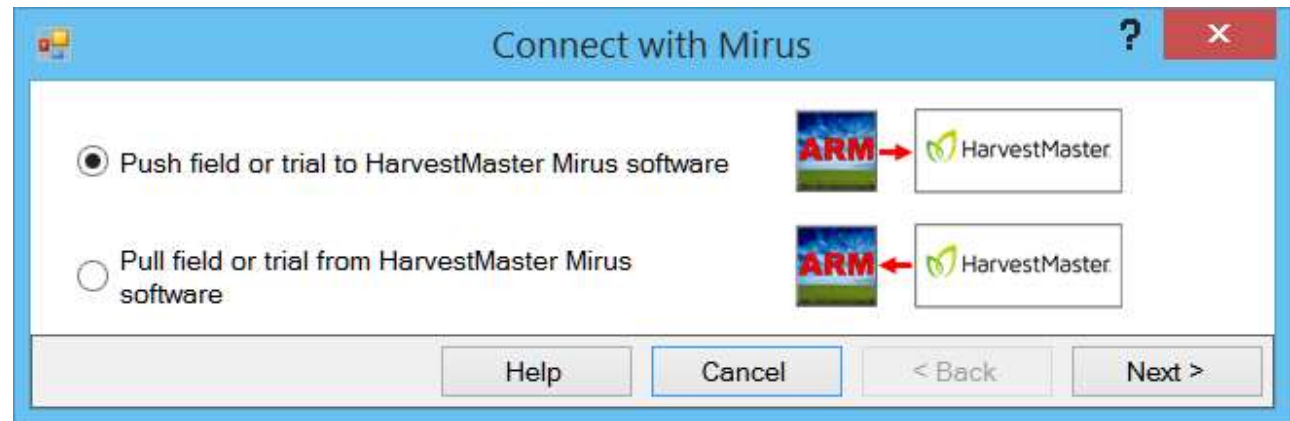


Links ARM with HarvestMaster's Mirus™ Field Data Collection software

- ARM toolbar and Navigation Bar shortcuts
- Simple 'push' and 'pull' connector

Connect with Mirus

- Wizard interface for simplicity



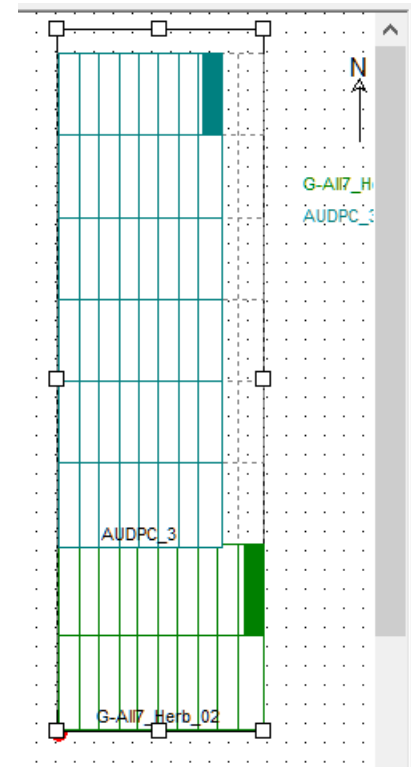
- Choose field or trial(s) from Study List

| Study List | | | |
|--|--------------------|-----------|----------|
| Select trial(s) to push to HarvestMaster Mirus software. | | | |
| Field Map | Location | Crop Code | Study ID |
| | Shipman, IL 62012 | TRZAW | AUDPC_2 |
| | Brighton, IL 62012 | TRZAW | AUDPC_3 |

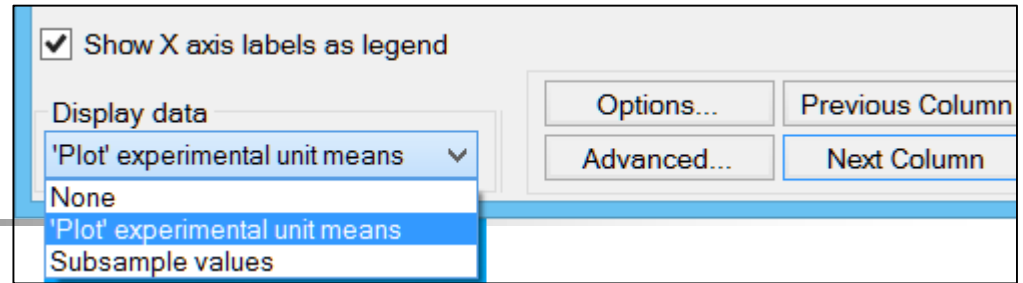
Connect with Mirus

Major improvements to ARM field map to support layout and harvest of multi-trial fields, such as:

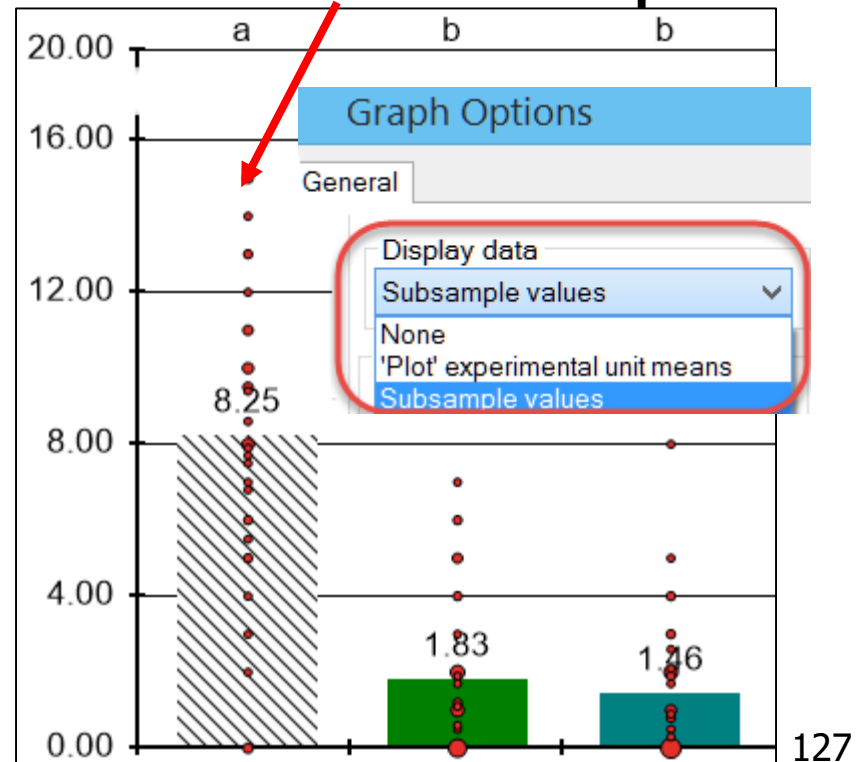
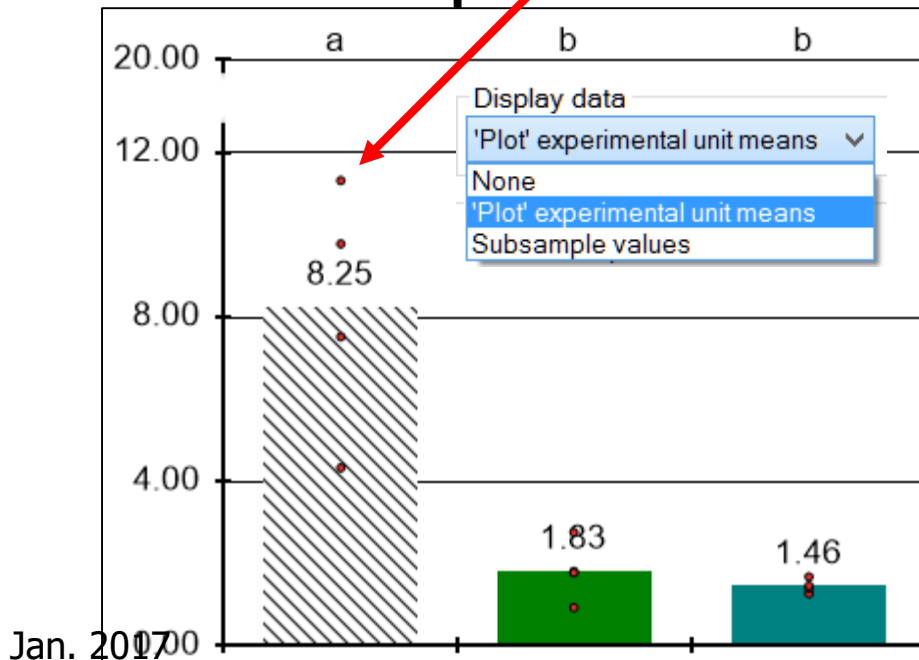
- Plot grid for trial layout
- Drag to arrange trials
- Use GPS trial coordinates



Graphs

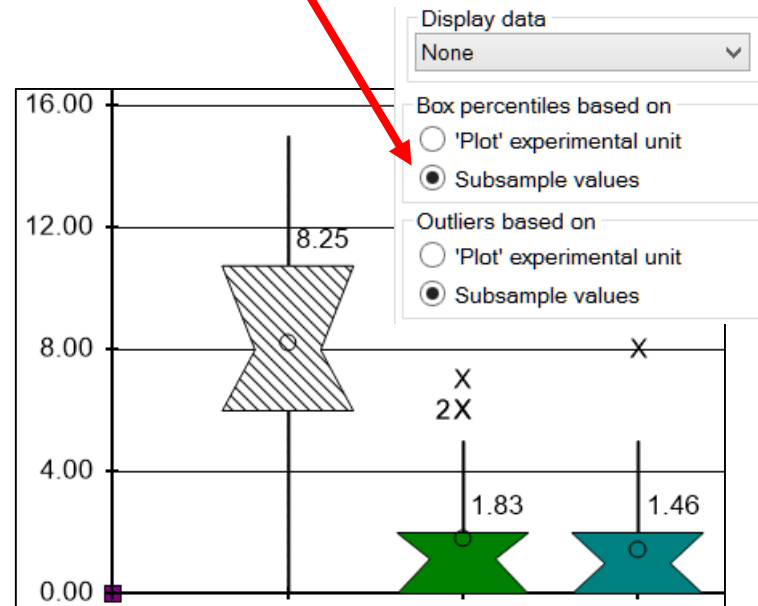
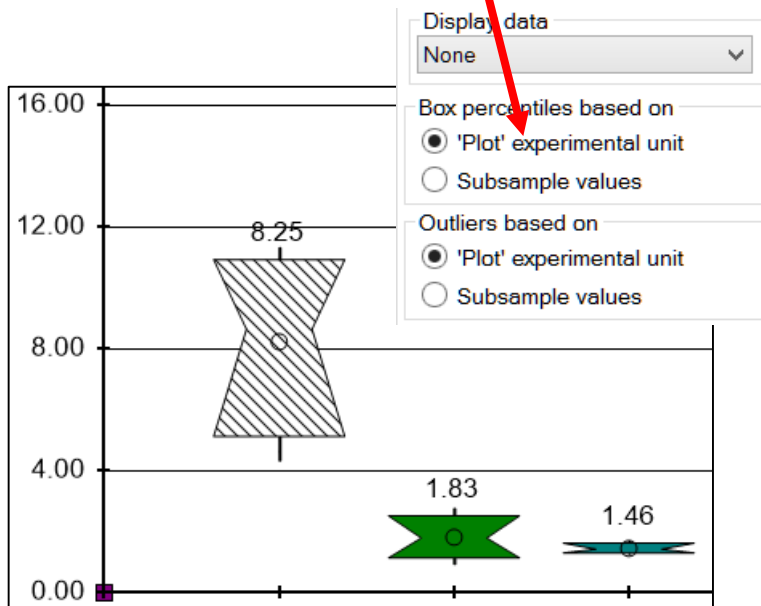


'Display data' option on viewer adds scatter graph showing plot or individual subsample values as points



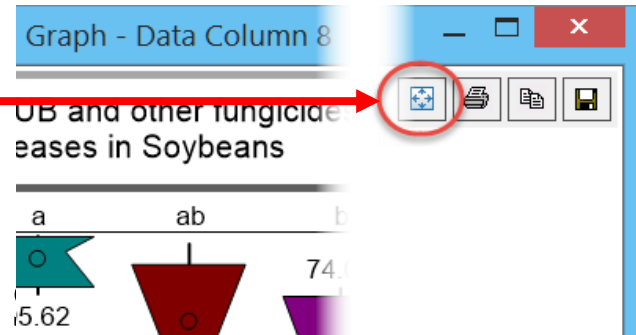
Box-Whisker Graph

'Box percentiles' and 'Outliers based on' options of 'Plot' or 'Subsamples' for box-whisker

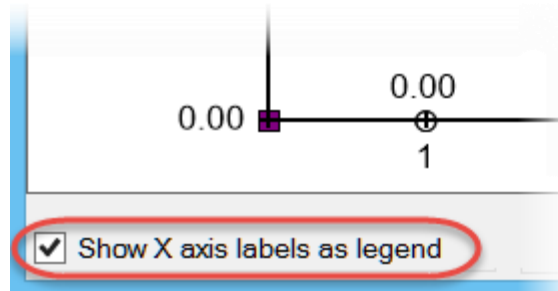


Graphs

- New 'Size to Fit' button re-sizes and re-positions graph to fit current window



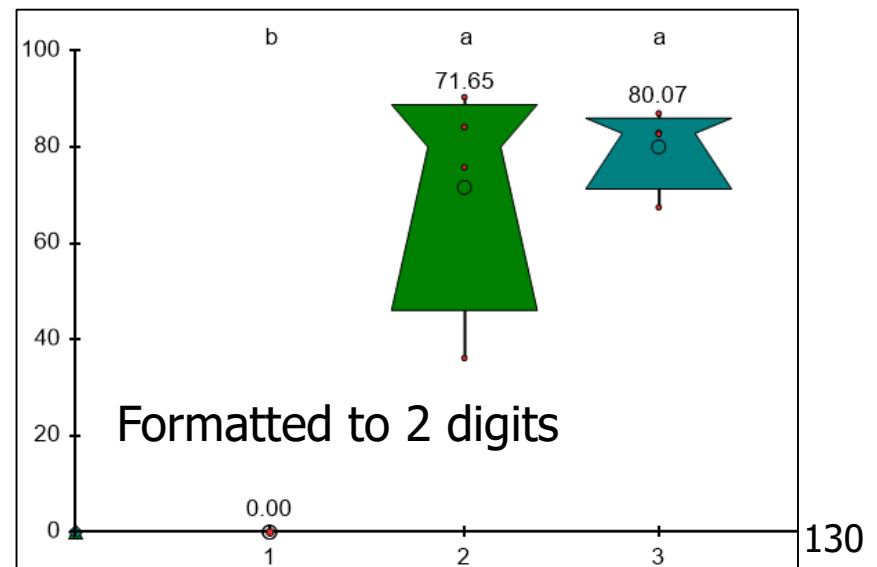
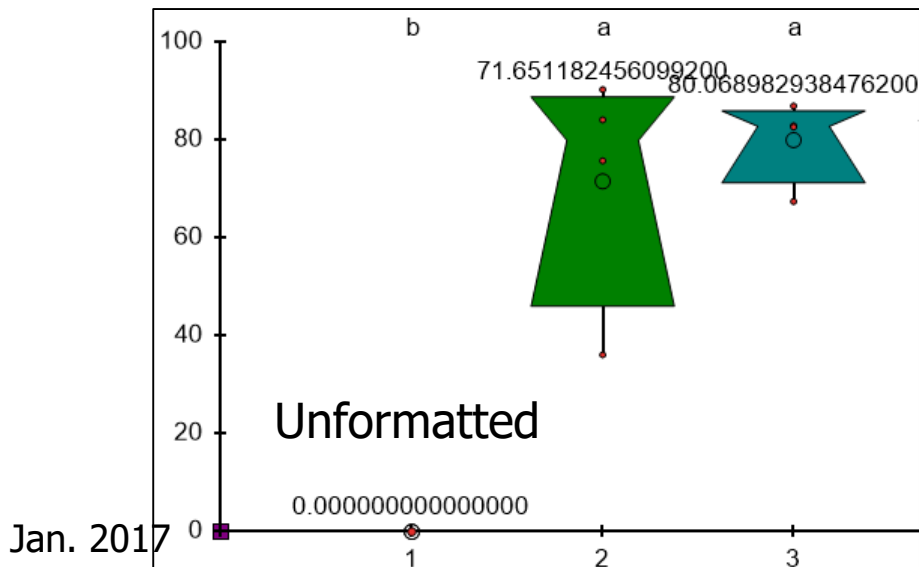
- Use 'Show X axis labels as legend' to better display detailed treatment information or many treatments



| SEPTTR | Legend Item |
|--------|------------------------------------|
| 1 | Untreated Check |
| 2 | Tub 0.5 L/ha |
| 3 | Tub 1 L/ha |
| 4 | Tilt 250 0.5 L/ha |
| 5 | Mico 60 1.5 L/ha; Fungol 1.25 L/ha |

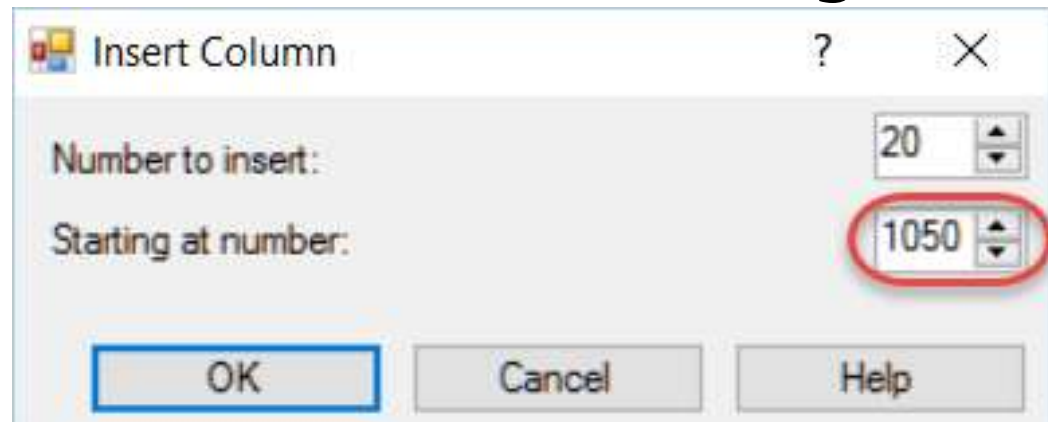
Graphs

Format data labels on Bar and Line graphs based on 'Number of Decimals' specified in the Assessment column - avoids displaying too many decimal digits for calculated data columns



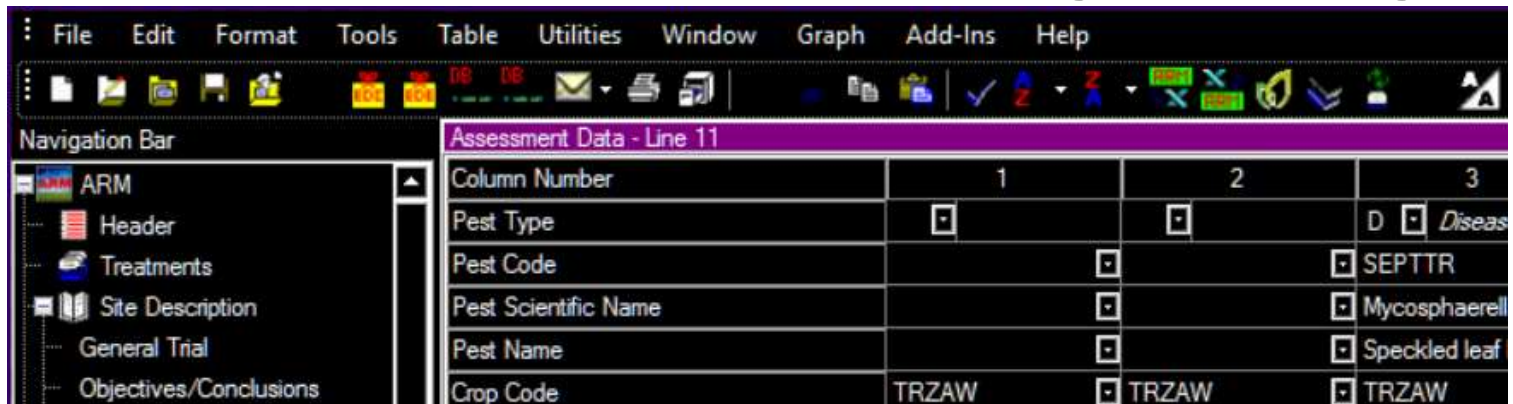
Supports Larger Trials

- Up to 9999 treatments per trial (previously 999, then 2500)
- Up to 32,767 data columns per trial (previously limited to 999 on some dialogs, such as when inserting data columns)



High Contrast Display Button

- High contrast display button on ARM toolbar, changes between:
 - Standard display colors, and
 - Windows High Contrast colors
- Can improve readability in bright sunlight





'Save As' Enhancements

- Protect study rules supported only in ARM 2016/2015 or newer by preventing saving in ARM 9 format*
 - No longer prompts about overwriting existing study file when keeping the same name and changing version
 - Defaults to .prt0/.dat0 in ARM 2017+
- * ARM 9 becomes obsolete and unsupported after December 31, 2016



GDMdef Study Definitions

- Trial Year field in Header
 - Is auto-filled with current year
 - Is validated to help avoid invalid entries
- Changed Appl. Start Time and Moisture Time fields to time format, not free text
- Renamed 'Density' to 'Specific Gravity' in treatments editor



GDMdef Study Definitions

- New GPS Precision field in General Trial tab of Site Description
- 'CFU/g' displays in the Rate Unit list
- More rate units in Other Rate Unit list

GDMdef Study Definitions

'LWA Formula' Crop Stage at Appl field shows values for Leaf Wall Area calculations *

| | A | | B | | C | |
|-------------------------------------|---------------|--------------------|-----------------|--------------------|-----------------|--------------------|
| <i>Application Date:</i> | 02/04/2014 | | 12/04/2014 | | 23/04/2014 | |
| <i>Crop 1 Code, BBCH Scale:</i> | <i>MABSD</i> | <i>BPOM</i> | <i>MABSD</i> | <i>BPOM</i> | <i>MABSD</i> | <i>BPOM</i> |
| <i>Treated Canopy Height, Unit:</i> | 2 | m | 2.1 | m | 2.2 | m |
| <i>Leaf Wall Area, Unit:</i> | 12903 | m ² /ha | 13548 | m ² /ha | 14194 | m ² /ha |
| <i>LWA Formula:</i> | 10000/3.1*2*2 | | 10000/3.1*2.1*2 | | 10000/3.1*2.2*2 | |


= 1 ha / 3.1 m row width * 2.1 m treated height * 2 row sides

* Leaf Wall Area is used in EU for all crop protection product applications to 3-D crops such as orchards and vines - see EPPO Guideline 1/239



GDMdef Study Definitions

Added Köppen-Geiger climate zones to new Climate Zone master list

 Climate Zone Master List (SART)

| Climate Zone | Climate Zone | Type | Online Reference |
|--------------|--|---------------|---|
| Aw | Tropical Savannah | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| BSh | Arid Steppe Hot | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| BSk | Arid Steppe Cold | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| BWh | Arid Desert Hot | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| BWk | Arid Desert Cold | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cfa | Temperate, Perennial Rain, Hot Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cfb | Temperate, Perennial Rain, Warm Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cfc | Temperate, Perennial Rain, Cold Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Csa | Temperate, Dry, Hot Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Csb | Temperate, Dry, Warm Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cwa | Temperate, Dry Winter, Hot Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cwb | Temperate, Dry Winter, Warm Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |
| Cwc | Temperate, Dry Winter, Cold Summer | Köppen-Geiger | http://koeppen-geiger.vu-wien.ac.at |

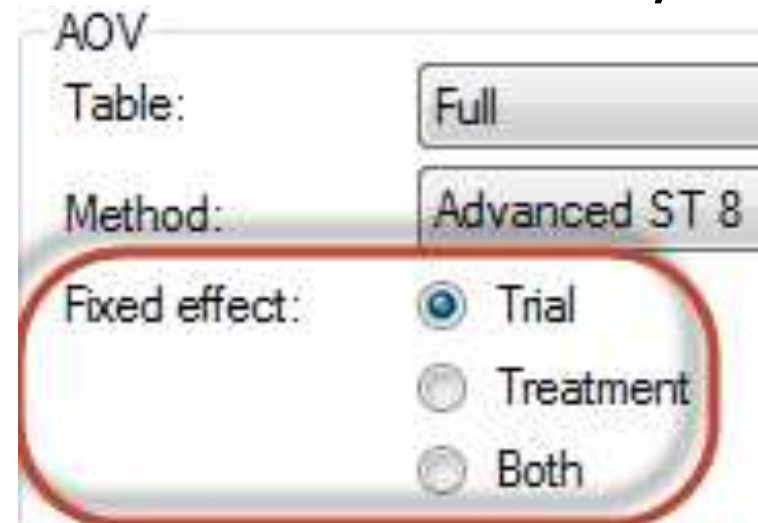


Sponsor Customizations May be Set to Expire

- Sponsors may 'expire' their customized study definitions for contractors:
 - ARM displays warning messages when customization is expiring
 - Are identified as 'obsolete' in About ARM
 - Cannot create protocol or trial
 - Can request customization again from sponsor after expired

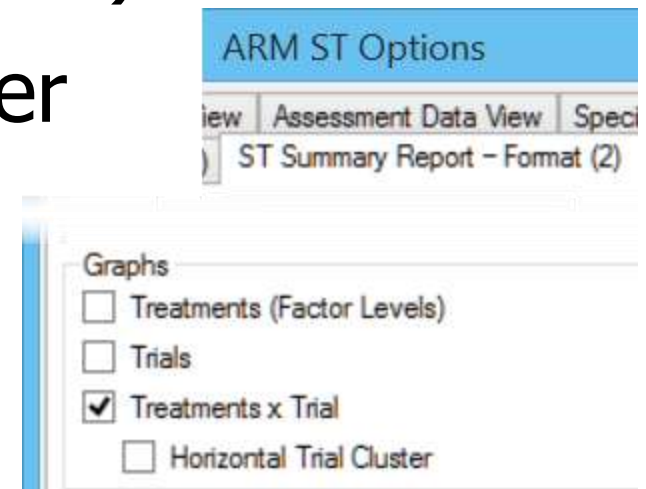
Summary Across Trials

- ST Report option to print Mean Level CV
- Identify on ST Report the error term used for mean comparison tests when either Trial or Treatment is random, as defined on ST Summary Options dialog



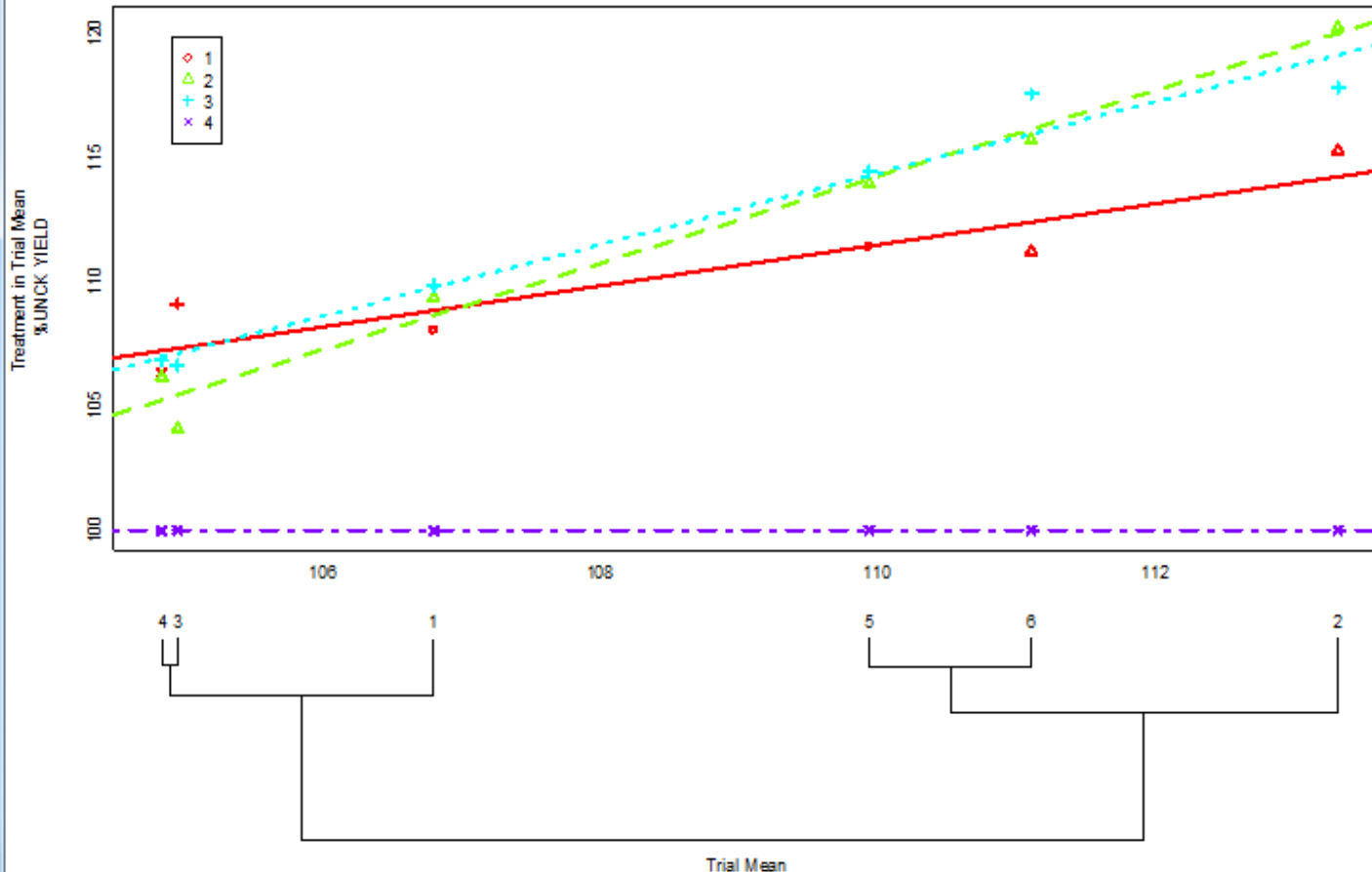
Summary Across Trials

- Graph helps identify "location" (trial) groups when evidence of location effect (treatment x trial interaction) is detected
- Option to rotate the cluster analysis dendrogram, useful when analyzing many trials
- 'Print ST Summary' dialog displays faster



Summary Across Trials

Treatment Stability and Trial Clusters for Grand Mean 11



Legend

| | Trials | Means |
|---|----------|-------|
| 4 | ST-Exam4 | 104.8 |
| 3 | ST-Exam3 | 105 |
| 1 | ST-Exam1 | 106.8 |
| 5 | ST-Exam5 | 109.9 |
| 6 | ST-Exam6 | 111.1 |
| 2 | ST-Exam2 | 113.3 |

| Treatments | |
|------------|--------------------------------|
| 1 | Super Stomp 1.5 L/ha |
| 2 | Stamper 4 L/ha C50220 0.5 L/ha |
| 3 | Sure Kill 2 L/ha C50220 1 L/ha |
| 4 | Untreated |

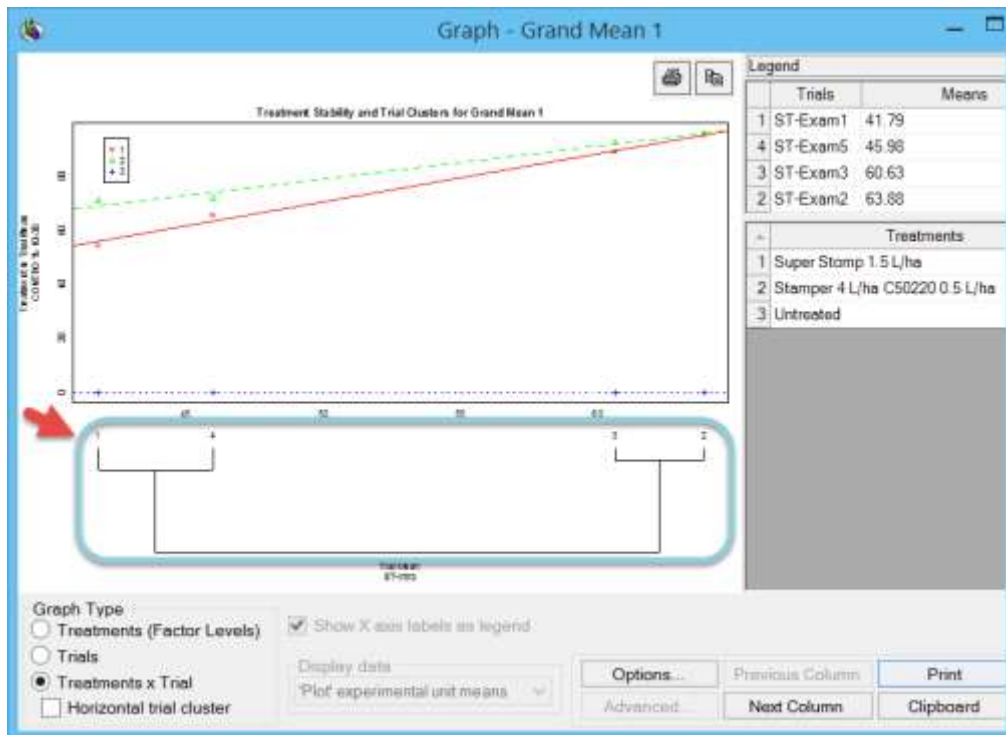
Graph Type

- Treatments (Factor Levels)
- Trials
- Treatments x Trial

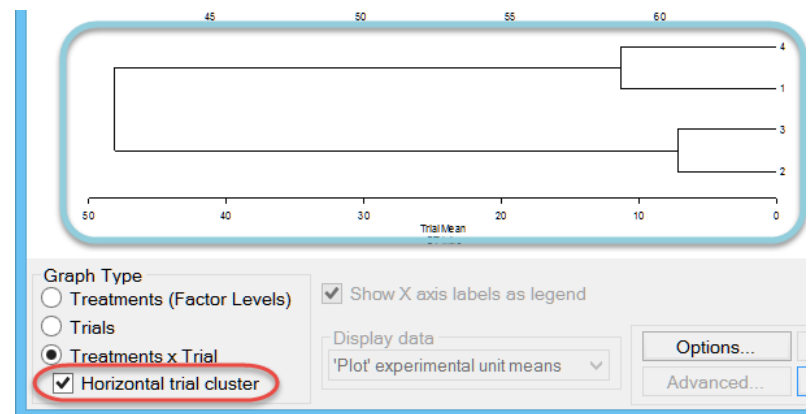
Options... Previous Column Print Save... Open...
 Advanced... Next Column Clipboard Save As... Help

ST Graph

'Horizontal Trial Cluster' option shortcut on graph viewer for a Treatment x Trial graph



- Better displays large number of trials
- Includes its own X-axis





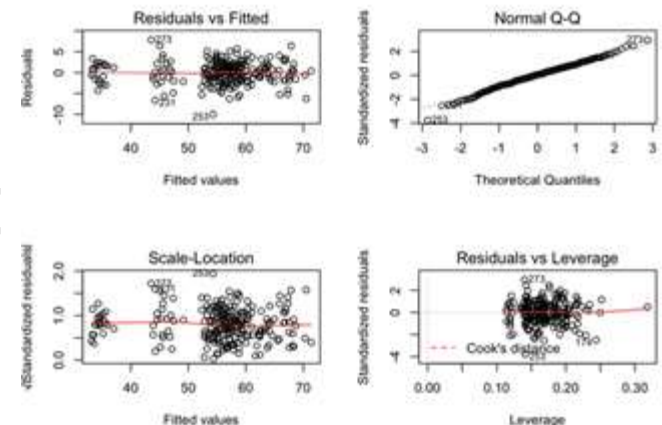
'Save As' Enhancements

- Protect study rules supported only in ARM 2016/2015 or newer by preventing saving in ARM 9 format*
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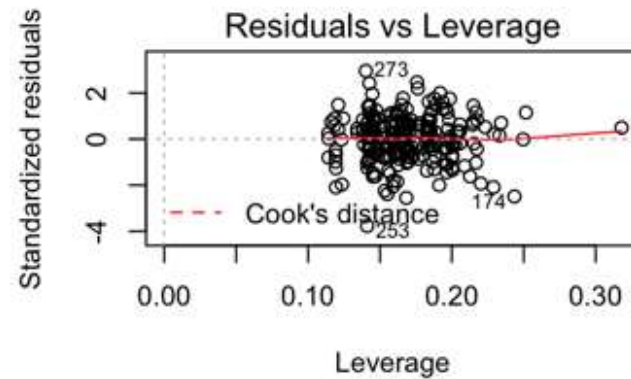
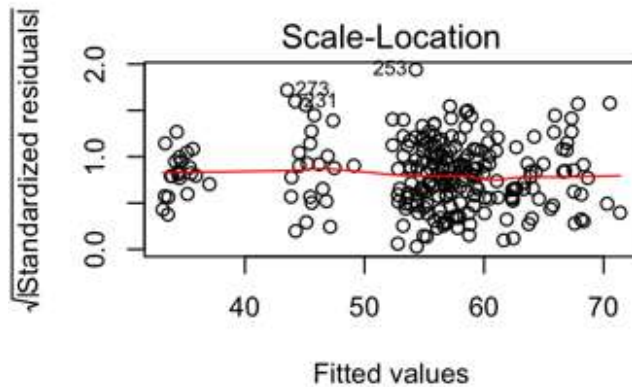
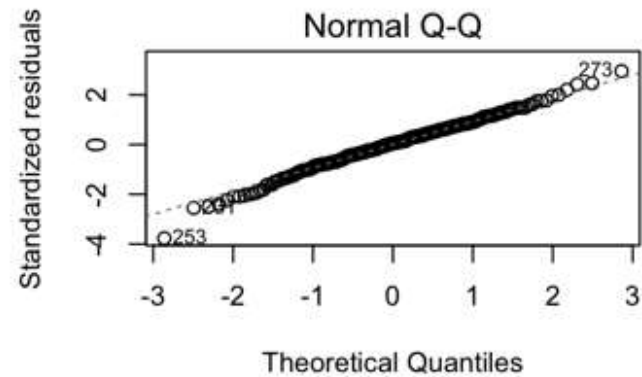
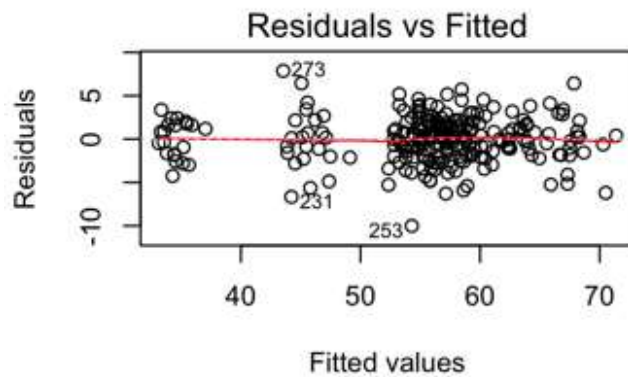
Residuals Graphs (Coming soon)

- On assessment editor
- Shows **unexplained** variability after removing treatment and replicate effects from analysis
- Can indicate when using a data correction transformation may help meet AOV assumptions

| Column 1 Properties | |
|------------------------|----------|
| Previous | Next |
| Column Flags: | Original |
| Min/Max entry: | 0 100 |
| Low/High value: | 0 0 |
| Descriptive Statistics | Refresh |
| LSD P=.05: | 0.00 |
| Standard Deviation: | 0.00 |
| CV: | 0.00 |
| Grand Mean: | 0.0 |
| P(Bartlett's X2): | . |
| P(Friedman's X2): | 1.0 |
| Skewness: | . |
| Kurtosis: | . |
| Replicate Prob(F): | 1.0000 |
| Treatment Prob(F): | 1.0000 |



Residuals Graphs (Coming soon)



Licensing

- Less frequent internet connect to verify license information
- More license information on About ARM





ARM 2017

- Is available now
- Is a key benefit of the new Annual Software Maintenance payment
- Automatically provided to clients using ARM 2016/2015 via electronic download by ARM Check for Updates program