ARM 2024 Changes

Protocol Signature
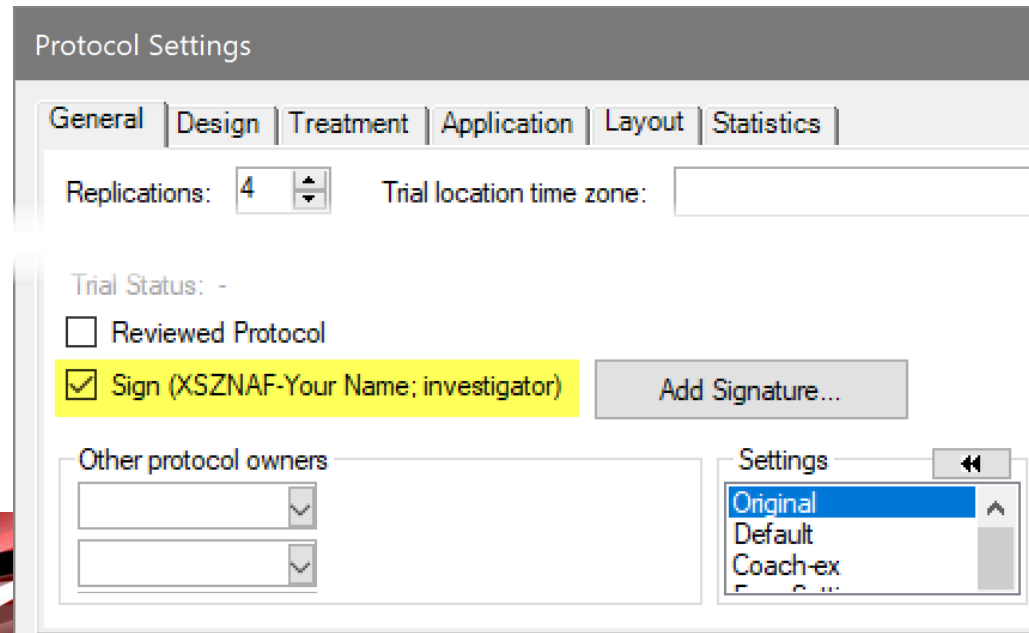
Protocol Signature

Add your signature to a protocol *(just like the Trial Signature)*

1. Protocol Settings > **Sign** checkbox

2. Create your signature in user profile

3. Confirm your role in the protocol (fills from Contacts)

ARM

Protocol Signature

Add your signature to a protocol

- Include signatures on reports (Global Report options)

29 May 2024 (2024-1.prt0) **New Company** ARM 2024.1 Signature Page 2 of 2

ARM ST Tutorial Example Product Screening Number 1

Protocol ID: ST-Exam-241 Location:
Trial ID: Trial Year: 2024
Study Director: R.E. Cearch Sponsor Contact:
Investigator: Your Name

29 May 2024, XSZNAF - Your Name; investigator

- Add a study rule to require a signature

Rule	Type	Editor	Field	Condition
1	Sign	Protocol	Required at Revision Status one-year/final	Everyone in my company

Protocol Validation Messages
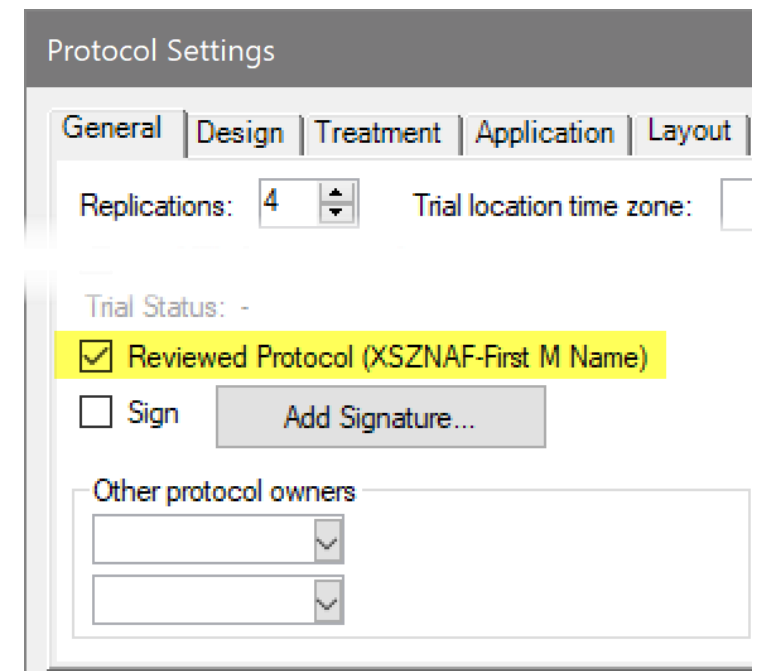
❌ Validation Messages
 ❌ Errors
  ❌ A signature by 'anyone in my company' is required for this study. (Study Rule 1)
   Add a signature on Protocol Settings.

Reviewed Protocol

Reviewed Protocol

Mark a protocol as Reviewed, from Settings > General tab

- Automatically clears when significant changes are made to the protocol
  (not cleared for Status, Trial Location changes)

- Record kept in Notes every time protocol is Reviewed by someone:

Reviewed Protocol

Study Rule: Define **who** can mark a protocol as Reviewed
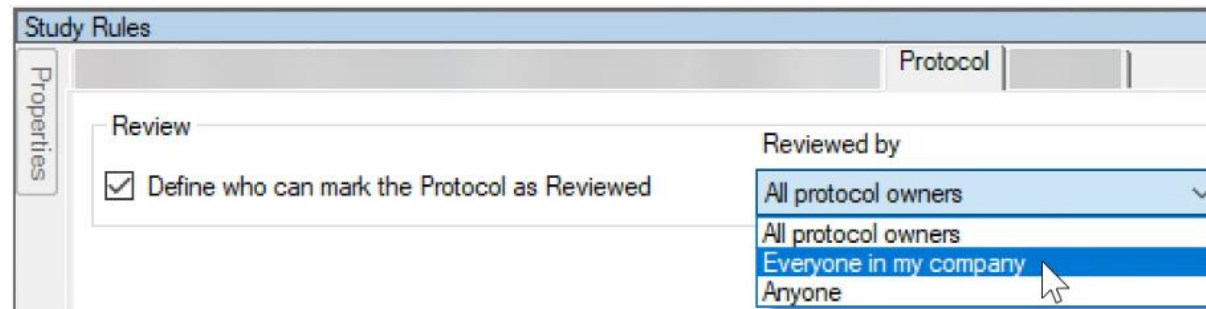
- Essentially creates a "review group"

  - E.g. Sponsor wants internal review, and CRO should not participate

- Note: does not *require* that Reviewed is checked

Equivalence Testing

Equivalence Testing

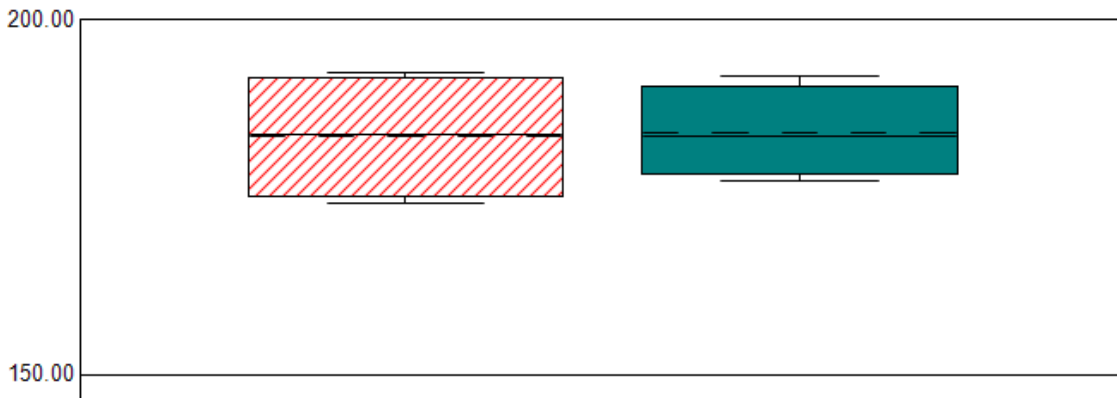AOV: same letter implies treatments are "not significantly different"

But does NOT mean the two are "significantly <u>the same</u>"

Use Equivalence Tests to determine if treatments are effectively the same

Example:
new formulation of a standard product

We want to claim that our new product is <u>just as good</u> as the standard
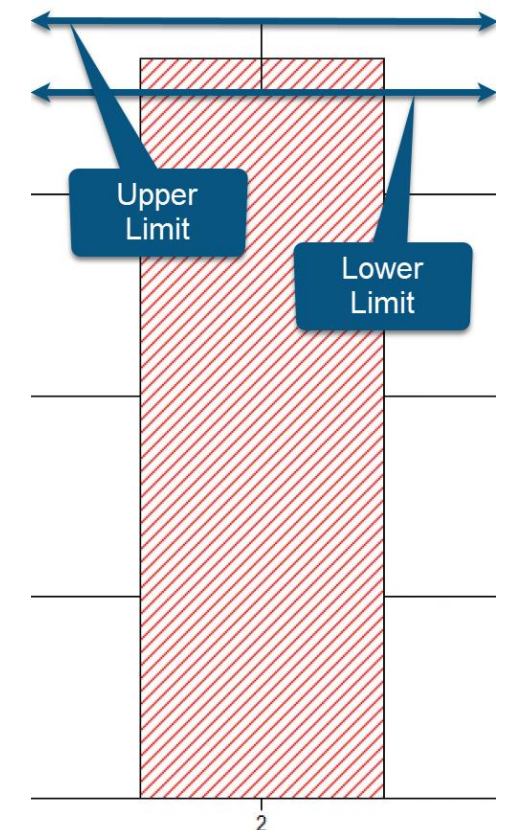
Equivalence Testing

Step 1: Researcher defines how large of a difference is <u>insignificant</u>?

- Percent of standard (e.g. within 3% of standard trt)

- Absolute value (e.g. within 5 bushel of standard)

- Effect size (*Cohen's d = [Trt − Std] / StDev*)

Called the **Limit** in ARM, this difference creates an Equivalence Interval

This is like a "plus or minus" range about the standard trt for equivalent performance

Upper Limit

Lower Limit

Equivalence Testing

Step 2: Hypothesis Test for equivalence

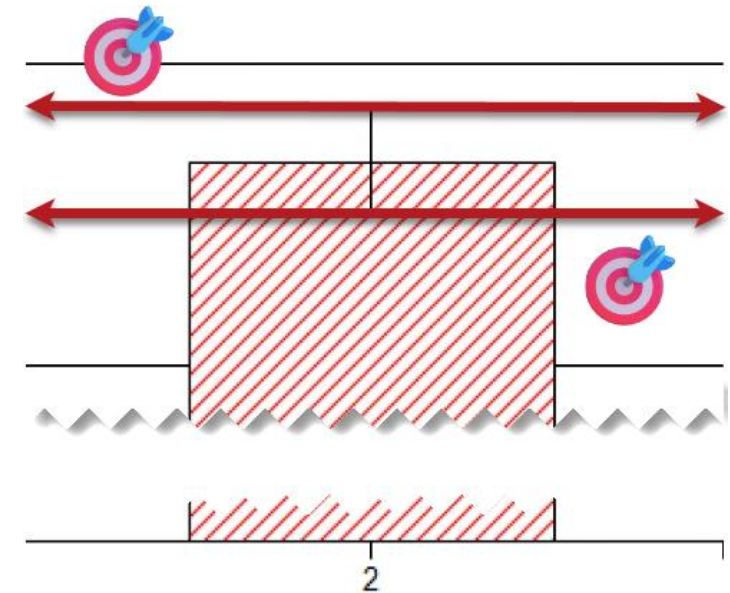Ho: The difference between the treatments is **outside** the equivalence interval

If we can reject Ho, we can conclude the difference is *inside* the interval, and thus we have equivalence

To test "outside the interval" we test:

Compared treatment is *less than* lower limit

Compared treatment is larger than the upper limit

ARM Method = Two one-sided tests (TOST)

Equivalence Testing

An example: 7.5 % of standard

Trial Settings

| General | Design | Treatment | Application | Layout | Statistics |

Planned Comparisons Equivalence Tests

	Method	Limit Basis	Limit	Standard	Alternative	Description
1	Two one-sided tests (TOST)	Percent of standard	7.5	2	3	Product equiv 7.5%
2*						

Turn on AOV report option "Include equivalent tests"

AOV Means Table Report Options

| Report Options | Descriptive Statistics | General Summary | Report Preview |

Mean comparison test

Test: Student-Newman-Keuls

Treatment comparisons
- [ ] Include planned comparisons   Options...
- [ ] Exclude untreated treatment(s) from analysis
- [x] Include equivalence tests   Options...

P-value for "smaller than lower" (1) and "larger than higher" (2) are listed

Need BOTH to be significant to have equivalence

Equivalence Tests Product equiv 7.5%?	
Mean Difference	1.76
NHST t	2.08
NHST P(t)	0.05
TOST(Lower) t	7.17
TOST(Lower) P(t)	<0.01 1
TOST(Upper) t	-3.01
TOST(Upper) P(t)	<0.01 2
Equivalence established	
NHST Power	0.50

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2024.2

Equivalence Testing

Alternative Step 2: Confidence Interval for equivalence

Define a (1-α), two-tailed confidence interval based on Limit from Step 1

If calculated "Alternative CI" is within this Standard Equivalent interval, then we have equivalence
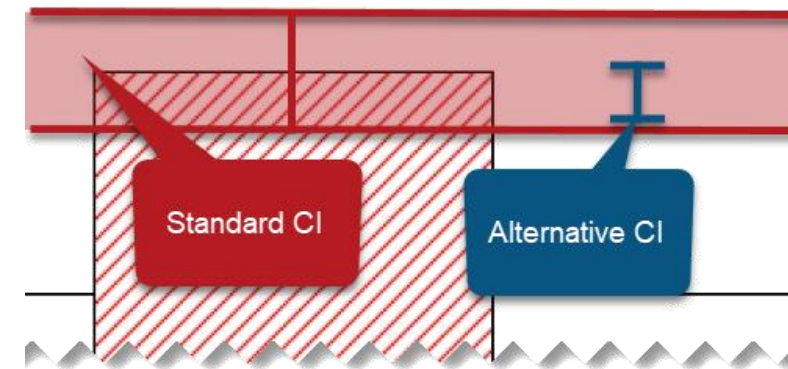
	Method	Limit Basis	Limit	Standard	Alternative	Description
1	Confidence Interval	Percent of standard	7.5	2	3	Product equiv 7.5%?

Equivalence Tests Product equiv 7.5%?	
Mean Difference	1.76
Standard Equiv. Int.	(-4.30,4.30)
Alternative CI	(0.28,3.23)
	Equivalence established
NHST Power	0.50

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2024.2

Summary

Use **Equivalence Tests** to determine if treatments are <u>effectively the same</u>

Choose a **Limit** based on what is an <u>inconsequential</u> difference

Link to full presentation:
https://gdmdata.com/media/documents/EquivalenceTesting.pdf

- Statistical calculations and theory

- More examples (from literature and real-life)

Assessment Editor

Copy Assessment Headers

New shortcut buttons to copy/paste entire header description

- Copy appears only in columns with header information to copy

- Paste appears only in completely empty headers

Required Assessment

Added Required field to header to describe necessity of assessment/SE:

- REQUIR – required rating which **must** be performed

- ALTERN – alternative, a rating is required but allows a **choice** of at least 1 of assessments/SEs marked as ALTERN

- OPTION – optional rating, but **recommended** if applicable

Copied from SE Definitions tab, when applicable

Required Assessment

- When Status=Final, validation error occurs if any REQUIR columns have no data
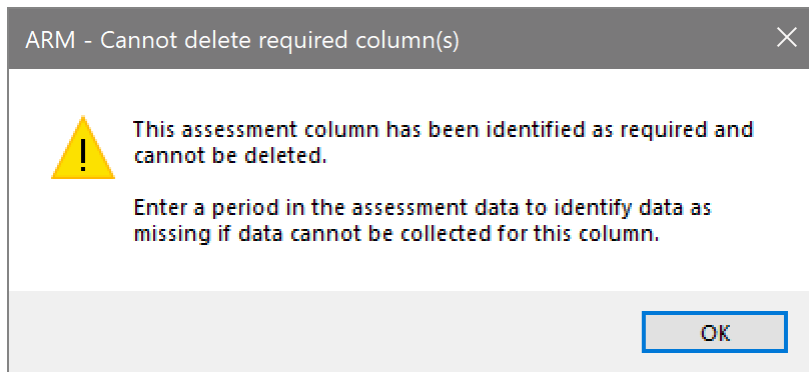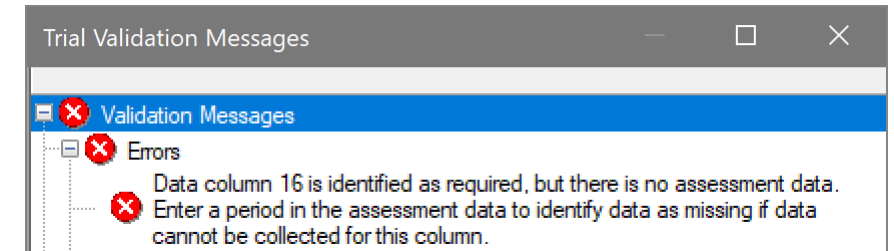
- Prevent a column from being deleted by choosing REQUIR

- *Tip: Lock this field with a rule to prevent editing the value*

Rating Interval

Define numerical interval between valid assessment values
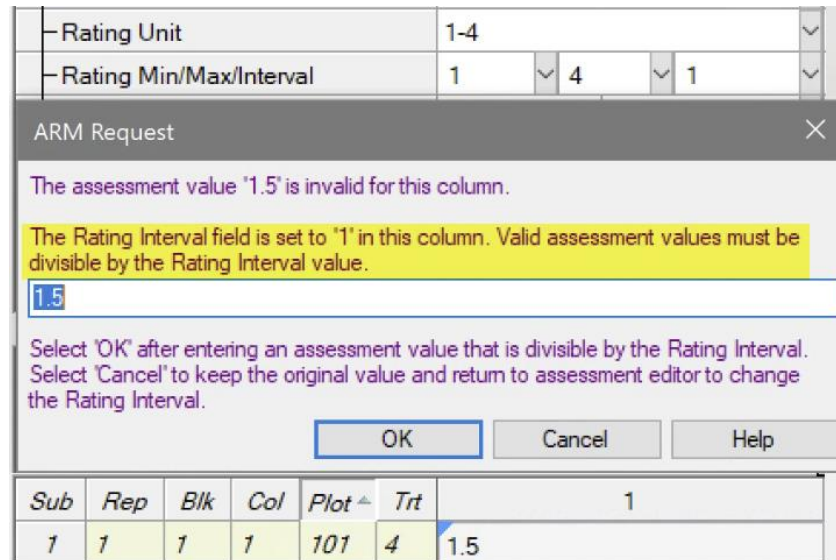
- E.g. Interval=1 for whole numbers, 0.25 for values like 0.75, 1.25

Rating Date	Mar-5-2024	
⊟ Standard Evaluation (SE)		
─ SE Name	ZUSI014	
─ Part Rated	ROOT	
─ Rating Type	DAMINS	
─ Rating Unit	0-3NCR	
─ Rating Min/Max/Interval	0 3 0.25	
─ Number of Subsamples	1	

Sub	Rep	Blk	Col	Plot ▲	Trt	1
1	1	1	1	101	4	0.75
1	1	1	2	102	1	1
1	2	1	3	103	1	0.5
1	2	1	4	104	4	2.25

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2024.0

Rating Interval
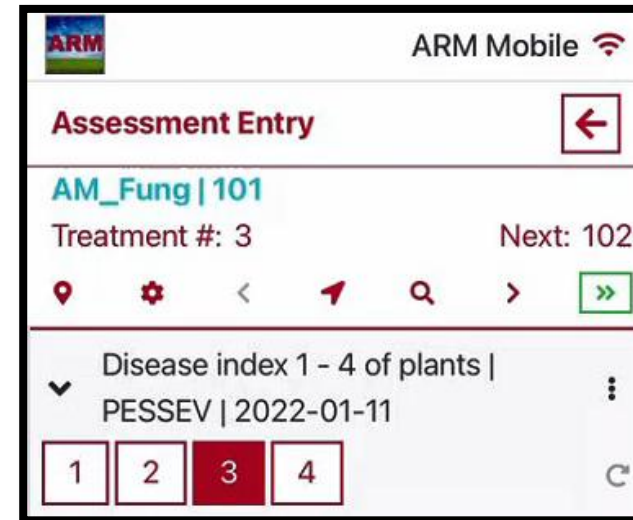
- ARM prompts if invalid data value is entered:

- Intervals define rating shortcut buttons in ARM Mobile:

Copy Coordinates

Right-click to copy GPS coordinates to
Latitude/Longitude of LL Corner fields in Site Description
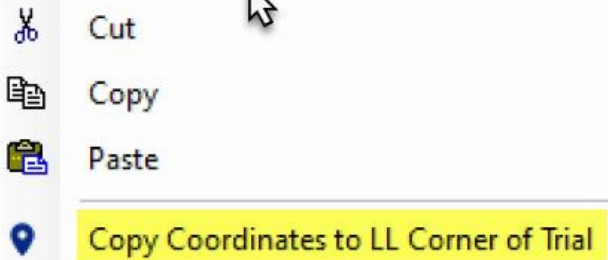
Properties Panels

Size and state of assessment panels are now remembered:

- when leaving and coming back to Assessment editor

- closing ARM and opening a different file

No more re-sizing Column Diagnostics for every trial that is reviewed!

Timing fields

Updated name of Timing header fields:

Removed references to *evaluation* because this is the assessment editor

Tablet Data Entry mode

Reduced width of header prompts to fix more on the screen

Before

After

Site Description

Controlled Environment

Greenhouse tab renamed and generalized for other chambers/environments

Steps to define and save Equipment:

1. Document details of equipment, at least Type and Method/Sub-type

2. Enter Equipment Name (free text)

3. Select drop-down button (or F9) to add to list for use in other trials

Controlled Environment

Greenhouse tab renamed and generalized for other chambers/environments

Greenhouse ID is now **Equipment No**.

1. Define greenhouse/chamber on Equipment tab

2. Link to Controlled Environment daily entries

Lists equipment defined only in current trial

Controlled Environment

Greenhouse tab renamed and generalized for other chambers/environments

Document **light** information:

1. Define light equipment on Equipment tab (and re-use in any trial)

2. Link to Controlled Environment daily entries

ARM Powered by GDM Solutions

2024.4

Controlled Environment

Greenhouse tab renamed and generalized for other chambers/environments

Document **irrigation** details:

1. Define irrigator details on Equipment tab (and re-use in any trial)

2. Link to Controlled Environment daily entries

Experimental Unit

Experimental Unit field used in place of "Plot" in ARM prompts

More intuitive for non-field experiments like orchard or greenhouse studies

Editor View

Hide multiple fields at once within a Site Description table

Drag to highlight multiple columns/rows, then right-click > "Hide Current Field"

Quick View toolbar

Automatically filter visible **Pest Description** fields by type

Simplifies interface to view/enter only pertinent information

Multi-select to view fields from multiple types at once

Trial Location GPS

Added the ability to use Google Maps for the Trial Location GPS:
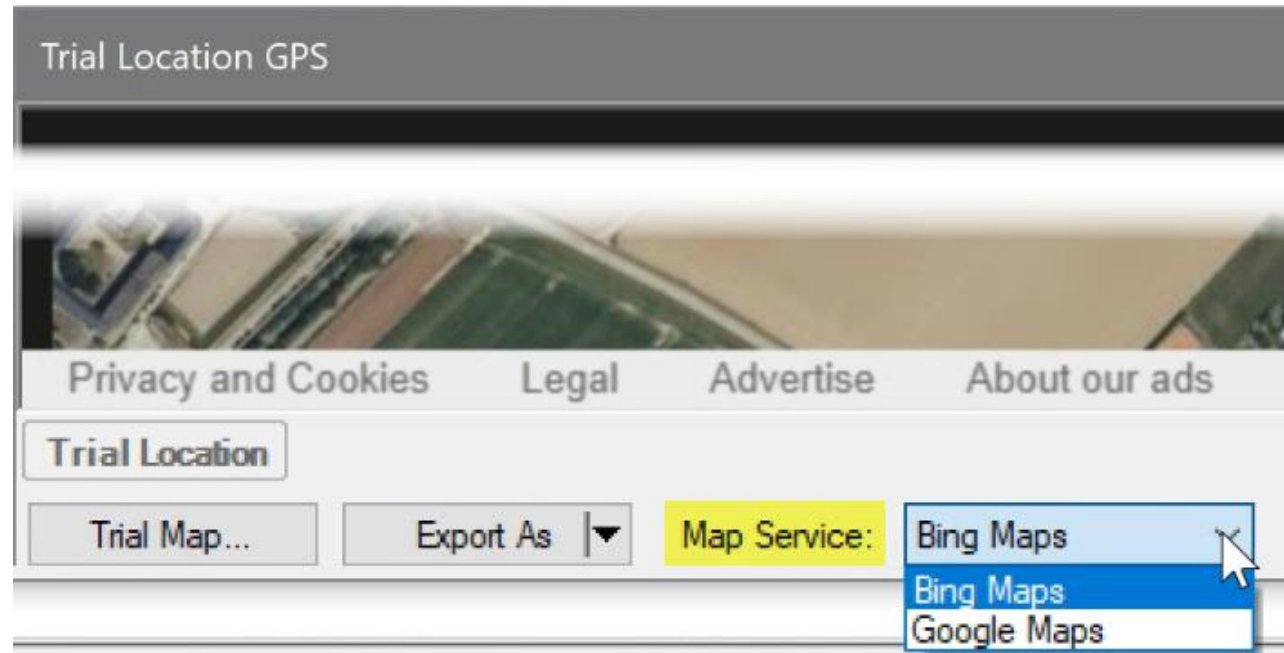
Google Maps supports only 1 coordinate, so just Lower Left is displayed

GPS Coordinates

Paste latitude and longitude at the same time when the copied values are separated by a space, comma and space, or tab

Works with Trial Location GPS tool:
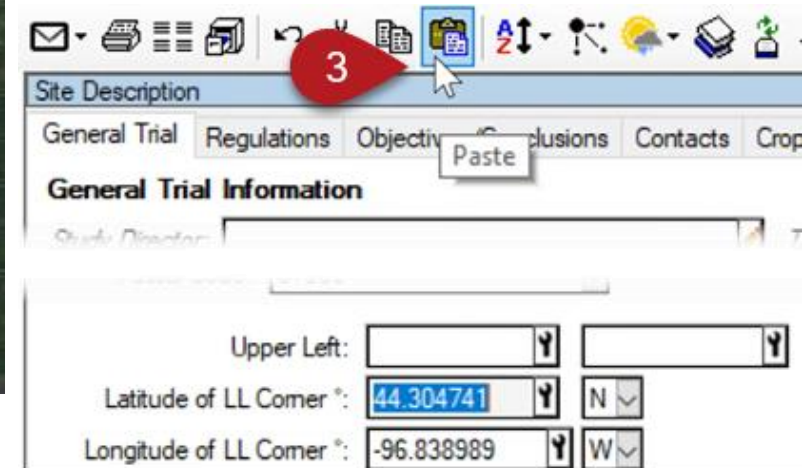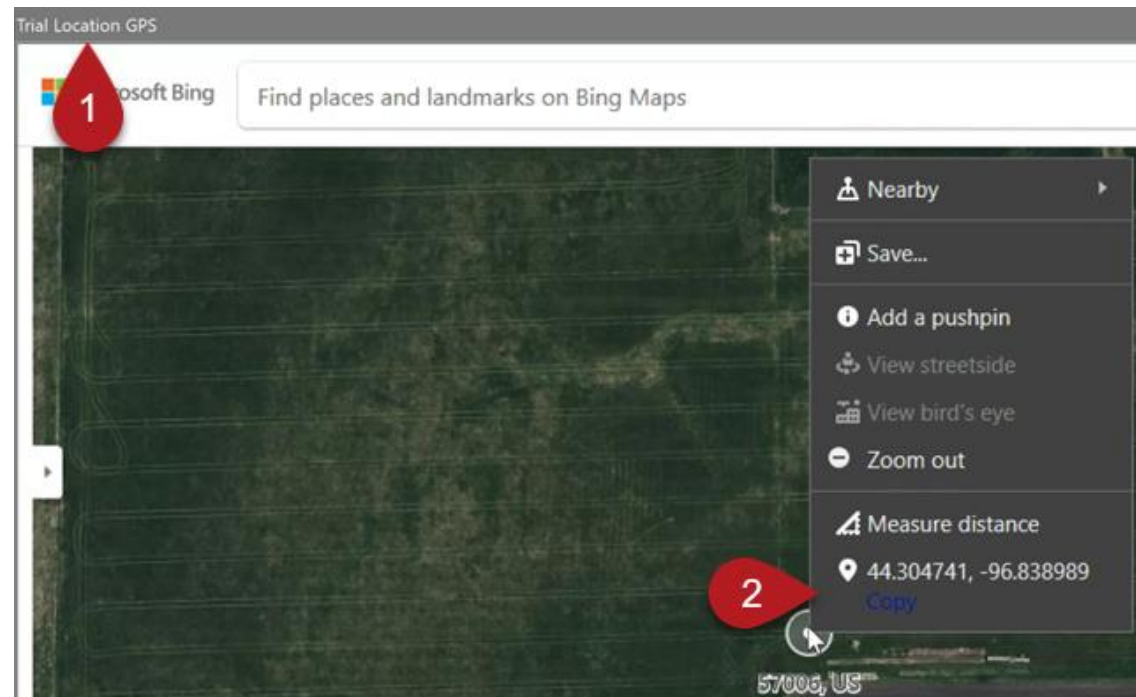
New fields in 2024.2

New fields to document Solar Radiation at time of application:

Average amount of high-energy solar radiation that reaches Earth's surface at the trial location

Contacts

Added validation list for Organization Type field

Notes

Added Notes section to Protocol Description

This table is read-only, only for automatic notes like signatures

GPS Coordinates

Increased precision of alternative GPS display formats

- Show 4 decimal places at the last value *(minutes or seconds)*
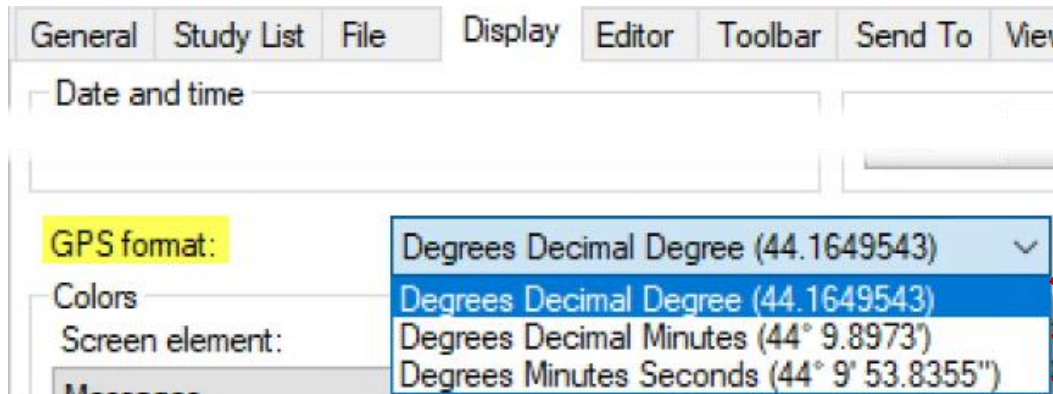
Product Amount Calculations

Product Calculations

Use '1000 Seed Weight' from Crop Description for calculations

1. Link treatment line to crop with Crop ID Number field

2. Fill in 1000 Seed Weight for that crop/variety

3. Calculations can now factor in weight, e.g. Mix Size in kg

Trt Line	Trt No.	Type	Treatment Name	Form Type	Rate	Rate Unit	Appl Code	Appl Timing	Crop ID Number
3	2	SDTR	STD Seed Treatment	CF	0.75	mg AI/Seed	A		1
4	2	VAR	Seed Product 1		35000	Seeds/A	B		1
5	2	INOC	Phytophthora infestans	AL	3.5	Bio En/Row-FT	B		1
6	3	SDTR	SDTR Chem 1	CF	1	mg AI/Seed	A		1
7	3	SDTR	SDTR Chem 2	CF	0.5	mg AI/Seed	A		1
8	3	SDTR	SDTR Chem 3	CF	0.007	mg AI/Seed	A		1
9	3	VAR	Seed Product 1		35000	Seeds/A	B		

Crop Description

Crop 1: C ZEAMD Zea mays indentata Dent corn

Entry Date:	Crop Group:
Variety: Reid Yellow Dent	Stage Scale: BBCH
Seed Lot No:	Maturity Group:
% Germination:	% Seed Moisture:	Seed Source:
Seed Shape: FLAT	1000 Seed Weight: 145 g
	Seed Size:

Reps: 4   Appl Code: A   Plots: 4 by 20 feet
Slurry Rate: 200 mL/100 kg   Mix Size: 2 kg seed (4 mL vol)

Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Appl. Amount	Amt Product to Measure
2	SDTR	STD Seed Treatment	30	%	CF	0.75	mg ai/seed	-	34.44 mL/mx
3	SDTR	SDTR Chem 1	500	G/L	CF	1	mg ai/seed	-	27.63 mL/mx
	SDTR	SDTR Chem 2	25	%	CF	0.5	mg ai/seed	-	27.55 mL/mx
	SDTR	SDTR Chem 3	3.5	LB/GAL	CF	0.007	mg ai/seed	-	0.2302 mL/mx
4	SDTR	SDTR Chem 1	500	G/L	CF	2	mg ai/seed	-	55.25 mL/mx

2024.1

'1000 Seed Weight' now groups Product Amount Totals for variety treatment lines (type=VAR)

- Useful when totaling across trials with different varieties

Product Amount Totals

Add up to 2 additional Treatment fields to product totals table

- Used for matching and combining product amounts

Reports

Site Description report

Tables that do not fit on a single page wrap directly below the previous table section

Weather Conditions

Overall Moisture Conditions: SLIWET slightly wet

No.	Date	Moisture Total	Unit	Min Temp	Max Temp	Avg Temp	Temp Unit	Min % Relative Humidity	Max % Relative Humidity	Avg % Relative Humidity	Min Wind	Max Wind	Avg Wind	Unit
1.	Jul-1-2024	1.8	mm	15.99	20.27	17.73	C	65	89	76.3	19.1	41.8	28.3	KPH
2.	Jul-2-2024	0.4	mm	16.54	22.96	19.802	C	68	97	83.3	0.4	20.9	11.2	KPH
3.	Jul-3-2024	0	mm	14.93	27.43	21.558	C	44	93	68.2	0	23.4	10.3	KPH
4.	Jul-4-2024	4.4	mm	15.45	21.56	18.55	C	65	92	83	0	31.3	13	KPH
5.	Jul-5-2024	0	mm	14.63	24.21	19.306	C	56	95	77.7	0	28.1	13.4	KPH
6.	Jul-6-2024	8	mm	15.07	26.8	19.583	C	46	95	77.4	0	16.2	7.6	KPH
7.	Jul-7-2024	0	mm	12.92	25.2	19.173	C	48	99	75.3	0	24.5	7.5	KPH
8.	Jul-8-2024	0	mm	13.8	26.76	20.675	C	50	98	72.7	0	11.5	5	KPH
9.	Jul-9-2024	0.5	mm	14.77	27.55	21.981	C	48	96	72.3	0	11.5	4.5	KPH
10.	Jul-10-2024	3.9	mm	16.98	26.77	22.026	C	51	97	75.1	0	23.4	9.1	KPH
11.	Jul-11-2024	0	mm	15.83	27.41	22.185	C	47	97	72	0	22	10.4	KPH
12.	Jul-12-2024	0	mm	17.1	28.9	23.569	C	60	95	76.8	11.5	29.5	19.9	KPH
13.	Jul-13-2024	0	mm	21.57	32.28	26.277	C	60	97	83.5	0.4	24.5	13	KPH
14.	Jul-14-2024	0	mm	20.5	30.62	25.462	C	48	98	73.5	1.1	29.5	8.4	KPH
15.	Jul-15-2024	1.4	mm	18.24	28.81	23.673	C	62	95	79	5.4	24.1	14.5	KPH

No.	Date	% Cloud Cover	Avg Shortwave Radiation	Unit	Avg Soil Temp	Unit	0-10 cm Scaled Soil Moisture	0-200 cm Scaled Soil Moisture	Source
1.	Jul-1-2024	85	134.279	W/m2	18.782	C	0.69	0.87	DTNLLC
2.	Jul-2-2024	59	169.988	W/m2	20.201	C	0.68	0.84	DTNLLC
3.	Jul-3-2024	32	305.16	W/m2	21.388	C	0.64	0.81	DTNLLC
4.	Jul-4-2024	79	177.426	W/m2	20.347	C	0.81	0.81	DTNLLC
5.	Jul-5-2024	42	277.851	W/m2	20.608	C	0.84	0.82	DTNLLC
6.	Jul-6-2024	38	274.686	W/m2	21.563	C	0.82	0.82	DTNLLC
7.	Jul-7-2024	43	255.674	W/m2	20.958	C	0.86	0.84	DTNLLC
8.	Jul-8-2024	7	331.977	W/m2	22.374	C	0.76	0.84	DTNLLC
9.	Jul-9-2024	23	273.558	W/m2	23.22	C	0.7	0.83	DTNLLC
10.	Jul-10-2024	33	293.853	W/m2	23.76	C	0.74	0.84	DTNLLC
11.	Jul-11-2024	1	328.095	W/m2	23.51	C	0.67	0.83	DTNLLC
12.	Jul-12-2024	2	322.876	W/m2	23.9	C	0.61	0.82	DTNLLC
13.	Jul-13-2024	33	238.348	W/m2	25.818	C	0.58	0.82	DTNLLC
14.	Jul-14-2024	28	297.722	W/m2	26.502	C	0.55	0.81	DTNLLC
15.	Jul-15-2024	47	195.618	W/m2	24.671	C	0.59	0.81	DTNLLC

Borders

New Global report option for borders of Site Description sections

No border: *Single separator line:*   *Full border:*

Summary Reports

Improved reporting of assessments where error variance is 0

- F statistics (AOV) report as 'Not a Number'

- Mean comparisons are 'not applicable'

*Occurs when there is no variation in treatment response
(e.g. no pest pressure or crop damage)*

Rating Date	15 Jul 2023	15 Jul 2023	13 May 2023
Part Rated	LEAF, C	PLANT, C	LEAF3, P
Rating Type	PHYGEN	VIGOR	PESSEV
Rating Unit	%	%	%
Rating Min/Max/Interval	0, 100, -	0, 100, -	0, 100, -
Number of Subsamples	1	1	10
Crop Type, Code	C, TRZAW	C, TRZAW	C, TRZAW
Crop Name	Winter wheat	Winter wheat	Winter wheat
Pest Code			SEPTTR
Pest Name			
Trt-Eval Interval	7 DA-C		
Number of Decimals			

na = not applicable

Trt No.	Treatment Name	Rate	Rate Unit	Appl Code	1*		
1	Untreated Check			ABC	0.0 na	100.0 na	4.55 a
2	Tub	0.5	l/ha	ABC	0.0 na	100.0 na	1.93 b
3	Tub	1	l/ha	ABC	0.0 na	100.0 na	1.53 b
4	Tilt 250	0.5	l/ha	ABC	0.0 na	100.0 na	1.83 b
5	Mico 60 Fungol	1.5 1.25	l/ha l/ha	AB C	0.0 na	100.0 na	2.70 b

LSD P=.05		.	
Standard Deviation	0.00	0	
CV	0.0		NaN = not a number
Levene's Prob(F)	.		0.73
Replicate F	NaN	NaN	0.757
Replicate Prob(F)	NaN	NaN	0.5394
Treatment F	NaN	NaN	8.877
Treatment Prob(F)	NaN	NaN	0.0014

Means followed by same letter or symbol do not significantly differ (P=.05, Student-Newman-Keuls).
Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL.
Could not calculate LSD (% mean diff) or mean separation letters for columns 1,2 because error variance is 0.
Mean separation letters are 'na' (not applicable) when error variance is 0

Mean Comparison 'na'

Scenario 2: Differences between treatments, but no differences across replicates (0 variation)

E.g. visual assessment aggregated across replicates

Same statistical result: Error Mean Square = 0

Rating Date	Jun-12-2024
Part Rated	PLANT, C
Rating Type	PHYGEN
Rating Unit	%
Rating Min/Max/Interval	0, 100, -
Sample Size	1 PLOT
Crop Type, Code	C, HORVS

Trt No.	Treatment Name	Rate	Rate Unit	1
1	Untreated check			0.0 na
2	Product1	0.075	l/ha	0.0 na
3	Product1	0.15	l/ha	25.0 na
4	Product2	1.5	l/ha	10.0 na
5	Product2	3	l/ha	15.0 na
LSD P=.05				.
Standard Deviation				0.00
CV				0.0
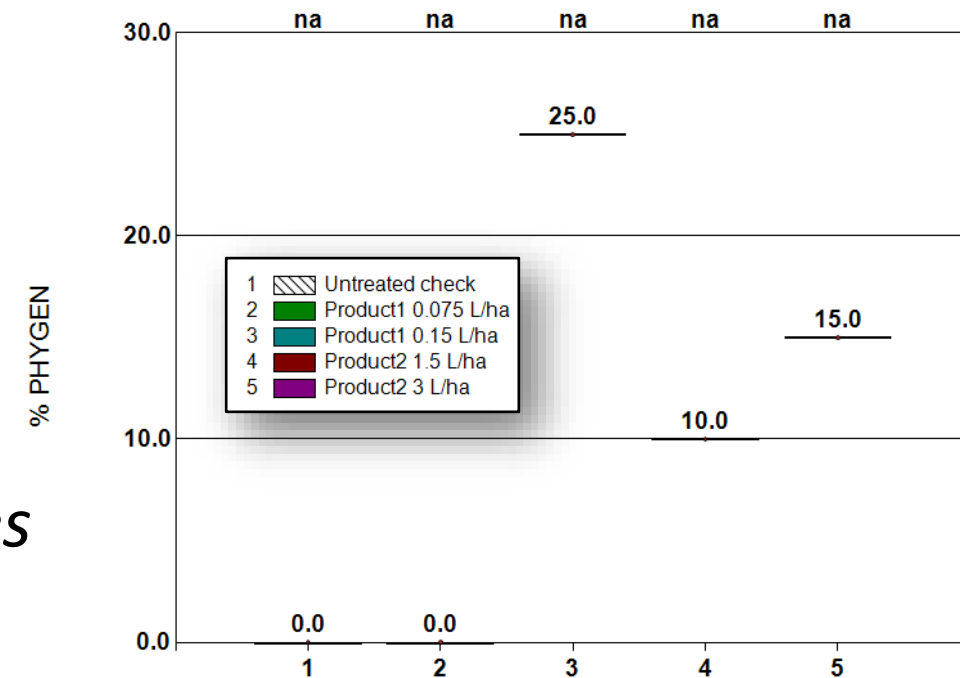
*Note: na does **not** mean "no significance", it means "we cannot calculate statistical significance"*

Assessment Data Summary

Only print the relevant number of subsamples when fewer columns are included on the report

Example: (column 3 has 10 subsamples, but is not printed)

OLD

NEW

Trt	Treatment		Rate	Appl			
No.	Name	Rate	Unit	Code	Plot	1	2
1	Untreated Check			ABC	102	0.0	100.0
					205	0.0	100.0
					303	0.0	100.0
					401	0.0	100.0
					Mean =	0.0	100.0
2	Tub	0.5	l/ha	ABC	104	0.0	100.0
					201	0.0	100.0
					302	0.0	100.0
					403	0.0	100.0
					Mean =	0.0	100.0

Schedule Tasks

Schedule Tasks

Now supports **Pest Establishment Date** for Tasks and Interval

Schedule Tasks

Application list now includes Method, Timing, and Placement

Adds detail for scheduling applications or
tasks relative to applications

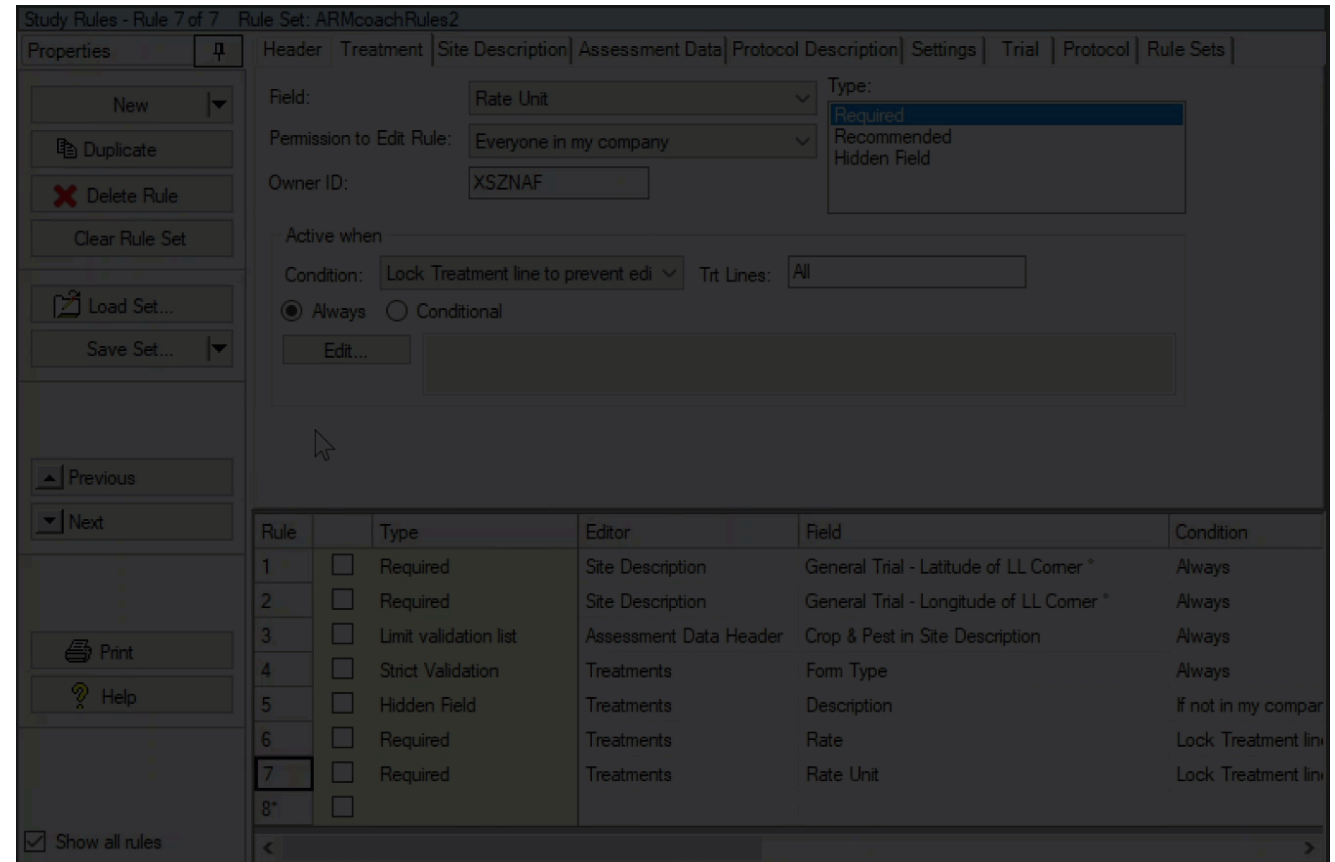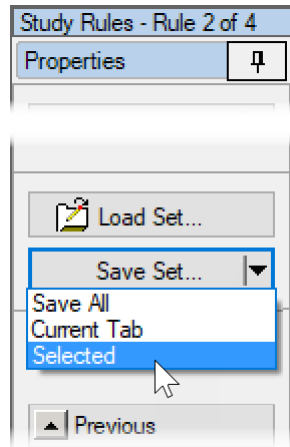*Fixes issue where applications did not display in this list in a protocol*

Study Rules

Selected rules

Added checkboxes to select a group of rules to perform actions:

- Delete

- Copy/Cut *(use right-click)*

- Save Set

Attachments

Attachments Editor

New option to display size of attachment files

Files can be changed outside of ARM, so this is a toggle to turn on or off

Study List

Study List

Added new fields to the Study List:

- Trial Origin, SE Definitions – SE Name, Assessment Data – SE Name

Tip: Use both SE Name filters to find trials that did not use a particular SE:

Bug Fixes

Impactful fixes

Fixed issue where box-whisker graph outliers may be beyond the Y-axis range, when the Y axis scale is set to Zero Origin.

Improved messaging when an image is corrupt or too large to add to the Profile or to sign a trial.

Fixed so trial columns that have a blank ARM Action Code are not forced into separate grand mean columns in ARM ST (Summary across Trials) add-in.

Changed so incompatible filename characters are not allowed in Protocol ID and Trial ID fields. These include:
    \ / : * ? < > | # % & $! ' @ + ` =