





## **Kyle Kepner**

2 Years South Dakota State University Crop Performance Testing

9 Years Assistant Corn Breeder, AgReliant Genetics

6 Years Product Manager Wensman Seed Company



## **Our Mission**

“Provide the research community technology to improve efficiency and accelerate innovation”

**ARM Software is Trusted by Over 10,000  
Researchers and Scientists Worldwide**





Use ARM for all stages of an experiment.

To **plan and create** protocols, to **randomize and manage** trials, to **analyze data and report** the results.



ARM software provides a defined structure to enter information consistently, with master list dictionaries to standardize vocabulary, and has tools for every step of an experiment.





# The Last Year in Review





# ARM the Industry Standard

The top 12 Agro-Chemical companies now depend on ARM Software worldwide.

# Field License Bundle

This bundle brings ARM to the field to help improve efficiency and accuracy.



# Leaf Wall Area

Software solution for an industry specific challenge. ARM facilitates the research techniques for future regulation of product applications.





# Weather Data Import

Collaboration with ClearAg (Iteris) to build a new feature that allows you to import weather data.

ClearAg offers specific information by utilizing meteorology, agronomy, land surface modeling and crop production at specific GPS coordinates.



## **Marketing & Support**

We hired a full-time sales and marketing associate to focus on our client communications.

# The Year Ahead



CUSTOMER  
FRIENDLY  
SUPPORT  
INNOVATIVE  
POSITIVE  
PRECISE  
TIMELY



## Training Initiatives

Continue to expand our tools and resources to make it easier for our clients.

- Tutorials
- Coaching Events
- Webinars

# Product Release

Work as a team to ensure every client is aware of the new features and how to use them to make their work more efficient.



# Precision Ag

Work closely with South Dakota State University to provide support with development and implementation.

- Correlation of known variability
- UAV data analysis





# Client Driven Development

Working closely with our clients to implement additional features and intuitive reporting.

Providing new features throughout the year.



ARM improves efficiency, increases accuracy, and promotes better quality of results.



# ARM 2019 Enhancements

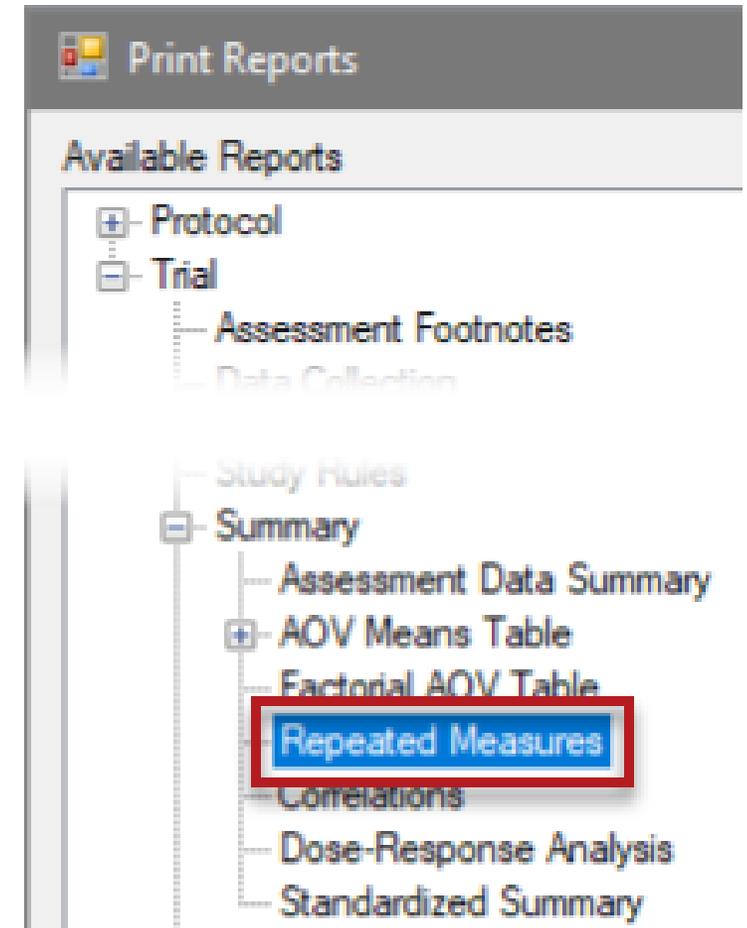
# Repeated Measures

# Repeated Measures

## Analyze repeated assessments across time

### Enhancement

- Powerful statistical analysis which enable the control of factors which cause variability between treatments over time.
- Provides analysis of treatment means over time to determine if there is an overall time effect on the treatments performance.

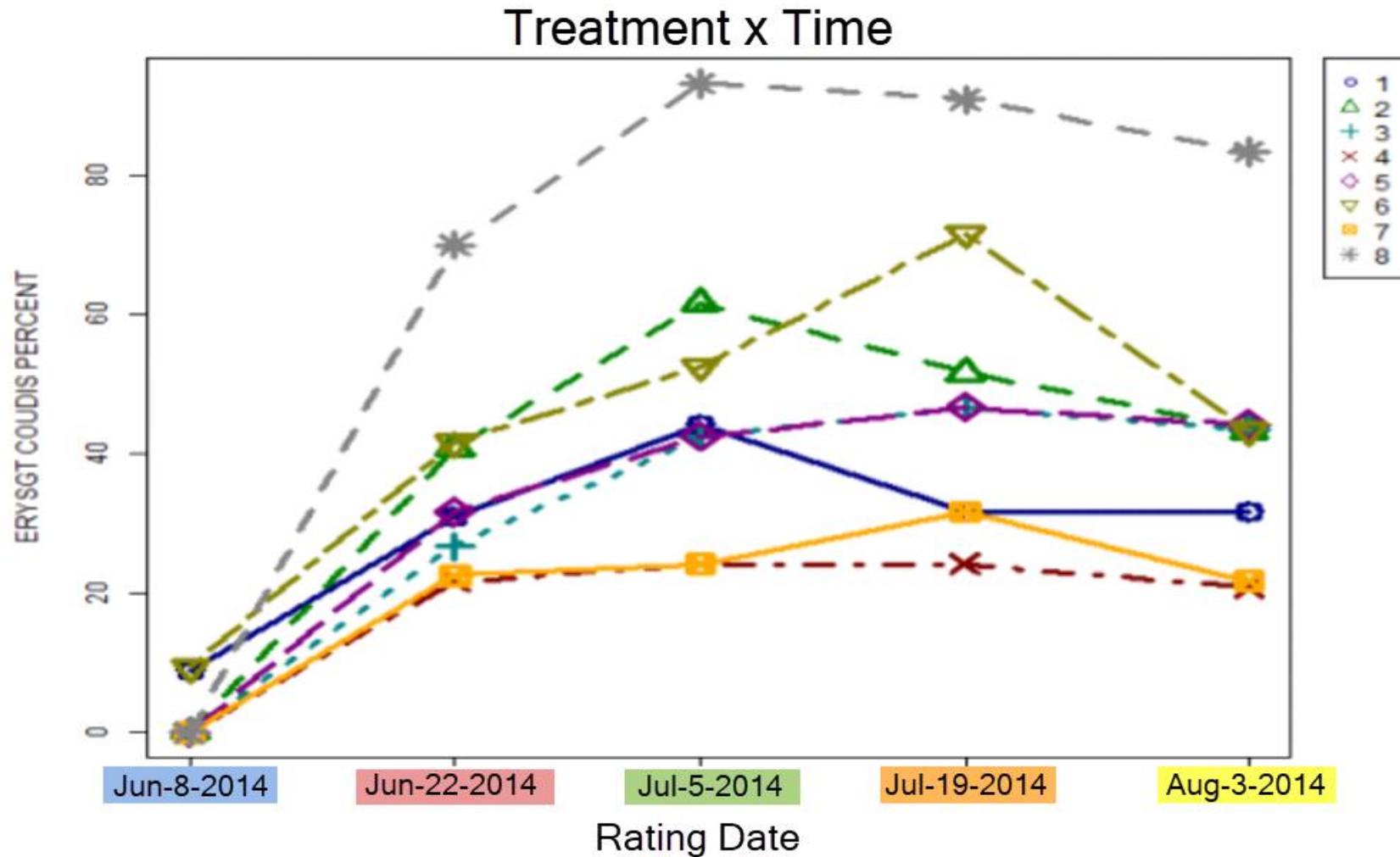


# Repeated Measures

- Assessments repeated at regular intervals during the trial season

Assessment Data - Line 17										
Column Number	1		2		3		4		5	
Pest Name	Powdery mildew		Powdery mildew		Powdery mildew		Powdery mildew		Powdery mildew	
Crop Name	Winter wheat		Winter wheat		Winter wheat		Winter wheat		Winter wheat	
Rating Date	Jun-8-2014		Jun-22-2014		Jul-5-2014		Jul-19-2014		Aug-3-2014	
Part Rated	PLANT	P	PLANT	P	PLANT	P	PLANT	P	PLANT	P
Rating Type	COUDIS		COUDIS		COUDIS		COUDIS		COUDIS	
Rating Unit	PERCENT		PERCENT		PERCENT		PERCENT		PERCENT	
Trt-Eval Interval	38 DA-A		52 DA-A		65 DA-A		79 DA-A		94 DA-A	
↓										
+ Sub	Rep	Blk	Col	Plot	Trt	1	2	3	4	5
1	1	1	1	101	1	10	30	45	30	30
1	1	1	2	102	2	0	40	60	50	45
1	1	1	3	103	3	0	25	40	45	45
1	1	1	4	104	4	0	20	25	25	20
1	1	1	5	105	5	0	30	40	45	45
1	1	1	6	106	6	10	40	50	70	45
1	1	1	7	107	7	0	25	25	30	20
1	1	1	8	108	8	0	70	90	90	85

# Repeated Measures



# Repeated Measures

## Define assessments for analysis:

1. Select a column to find potential repeated assessments.
2. ARM proposes fields to match other columns.
3. Diagnose issues with column selection.
4. Or load from history of column matches.

Assessment Data - Line 1

Column Number	1	2	3	4	5
Pest Type	Disease	Disease	Disease	Disease	Disease
Pest Code	ERYSGT	ERYSGT	ERYSGT	ERYSGT	ERYSGT
Pest Name	Powdery mildew of whe				
Crop Code	TRZAW	TRZAW	TRZAW	TRZAW	TRZAW
Crop Name	Winter wheat				
Rating Date	Jun-8-2014	Jun-22-2014	Jul-5-2014	Jul-19-2014	Aug-3-2014
Part Rated	PLANT P				
Rating Type	COUDIS	COUDIS	COUDIS	COUDIS	COUDIS
Rating Unit	PERCENT	PERCENT	PERCENT	PERCENT	PERCENT
Number of Subsamples	1	1	1	1	1
ARM Action Codes					

Define Data Column Matches for Repeated Measures

Heading	Matched Fields	Warnings:	Previous column matches
Pest Code	ERYSGT	<p>Selected assessments have inconsistent intervals of 14, 13, 14, 15 days.</p>	Selected column fields
Crop Code		<p>Instructions</p> <ul style="list-style-type: none"><li>Modify the matched columns by clicking a new column to match, selecting a previous match or editing the 'Matched Fields'.</li><li>Click 'View Selected' to view only the selected columns.</li><li>Click 'Next' to continue.</li></ul>	1 Pest Code=SEPTTR; Rating Type=PESSEV; Rating Unit=%
Rating Date			2 Pest Code=ERYSGT; Rating Type=COUDIS
Part Rated			3 Pest Code=ERYSGT; Rating Type=COUDIS
Rating Type	COUDIS		4 Pest Code=PHYTHB; Crop Code=ZEAMD; Rating Type=DILOGR; Rating Unit=%
Rating Unit	PERCENT		5 Pest Code=ERYSGT; Rating Type=COUDIS; Rating Unit=PERCENT
ARM Action Codes			

Columns matched: 1-5

View Selected Next Cancel Graph Options... Help

# Repeated Measures

Means and comparison letters for:

- Treatments Rating Dates
- Treatment x Rating Date interaction

Apply correction to adjust for correlation (H-F-L or G-G)

Repeated Measures AOV table

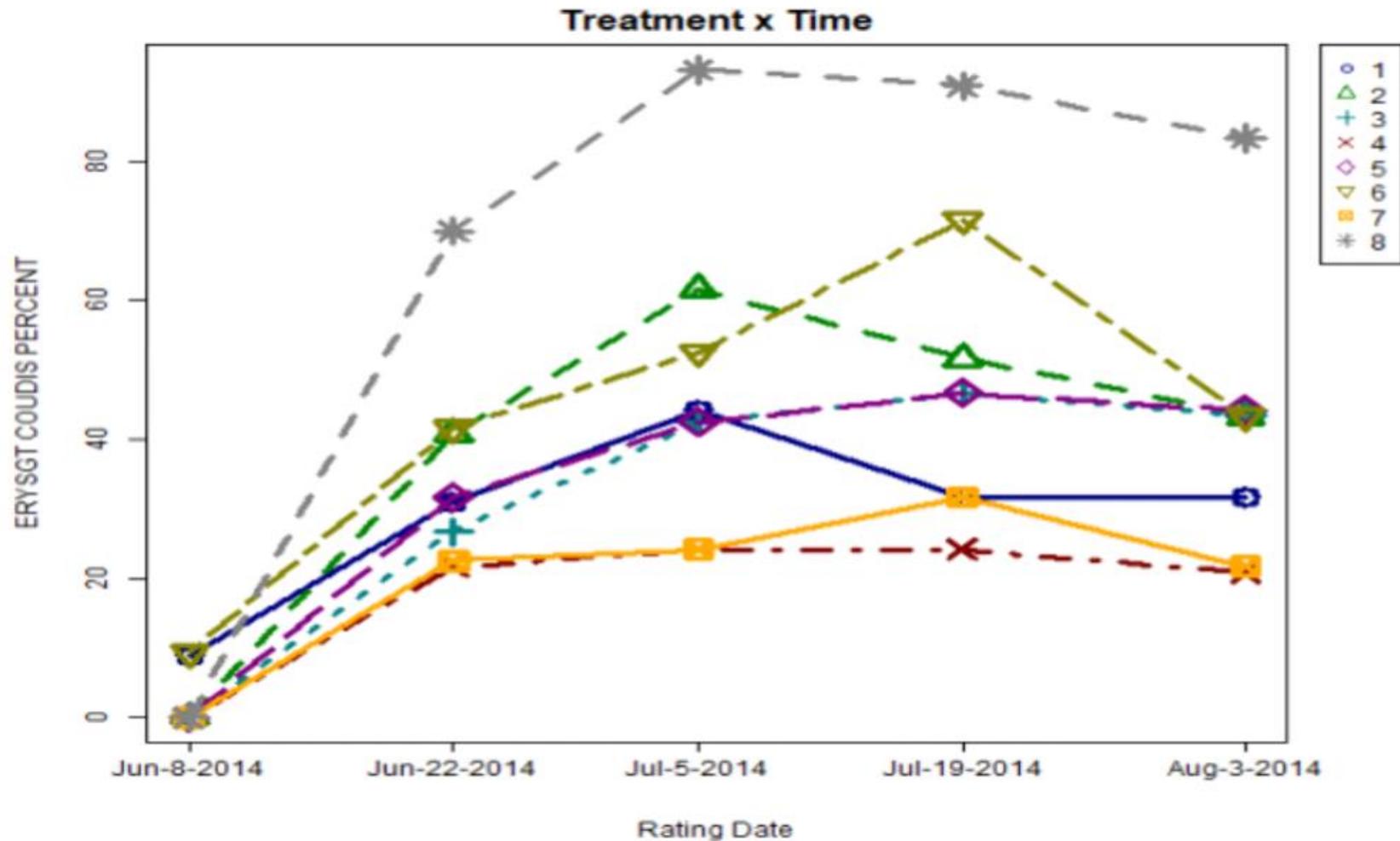
REPEATED MEASURES AOV For D ERYSGT Blumeria graminis tritici Powdery mildew of wheat TRZAW							
PLANT P COUDIS PERCENT 1							
Source	DF	Sum of Squares	Mean Square	F	Prob(F)	HSD (.05)	Variance
Total	220.0	141626.962500					
Replicate	5.0	65.637500	13.127500	3.127	0.0195		0.223238
Treatment	7.0	51065.995833	7295.142262	1737.776	0.0001	1.70	
Treatment Error	35.0	146.929167	4.197976				-0.246155
Rating Date	3.6	71570.358333	17892.589583	3295.895	0.0001	1.31	
Treatment x Rating Date	25.1	17909.441667	639.622917	117.821	0.0001	5.35	
Error/Residual	143.6	868.600000	5.428750				5.428751

Pest Code	ERYSGT		
Pest Name	mildew of wheat		
Crop Code	TRZAW		
Crop Name	Winter wheat		
Part Rated	PLANT P		
Rating Type	COUDIS		
Rating Unit	PERCENT		
Number of Subsamples	1		
Trt No.	Treatment Name	Rate	Appl Code
		Rate Unit	
<b>TABLE OF Treatment MEANS</b>			
1	Sure Kill	3 lb ai/a A	29.4 f
2	Sure Kill	3 lb ai/a A	39.5 c
3	Sure Kill	3 lb ai/a A	31.8 e
4	Sure Kill	3.5 lb ai/a A	18.2 h
5	Sure Kill	3 lb ai/a A	33.0 d
6	Sure Kill	4 lb ai/a A	43.7 b
7	Super Stomp	2.5 lb ai/a A	20.0 g
8	Untreated		67.5 a
Error DF Correction (H-F-L)			
Tukey's HSD P=.05			1.70
Standard Deviation			2.05
CV			5.79
<b>TABLE OF Rating Date MEANS</b>			
1	Jun-8-2014 (Data Col 1)		2.3 e
2	Jun-22-2014 (Data Col 2)		35.7 d
3	Jul-5-2014 (Data Col 3)		48.1 b
4	Jul-19-2014 (Data Col 4)		49.4 a
5	Aug-3-2014 (Data Col 5)		41.5 c
Error DF Correction (H-F-L)			
Tukey's HSD P=.05			0.90
Standard Deviation			1.31
CV			2.33
<b>TABLE OF Treatment Rating Date MEANS</b>			
1	Sure Kill	3 lb ai/a A	8.8 o
1	Jun-8-2014 (Data Col 1)		
2	Sure Kill	3 lb ai/a A	0.0 p
2	Super Stomp	1.5 lb ai/a A	

# Repeated Measures

## Treatment x Time Graph

- Plot treatment means over time.
- Visually identify treatment interaction across assessment dates.

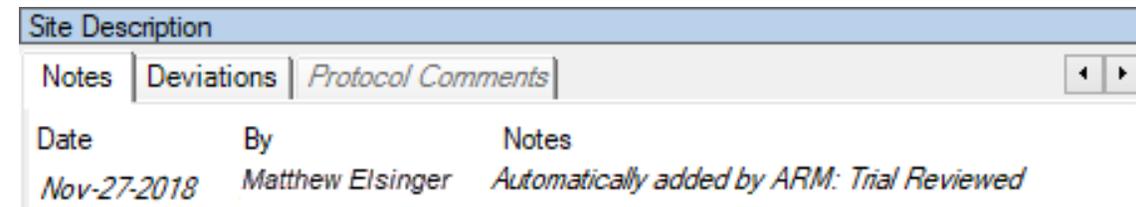
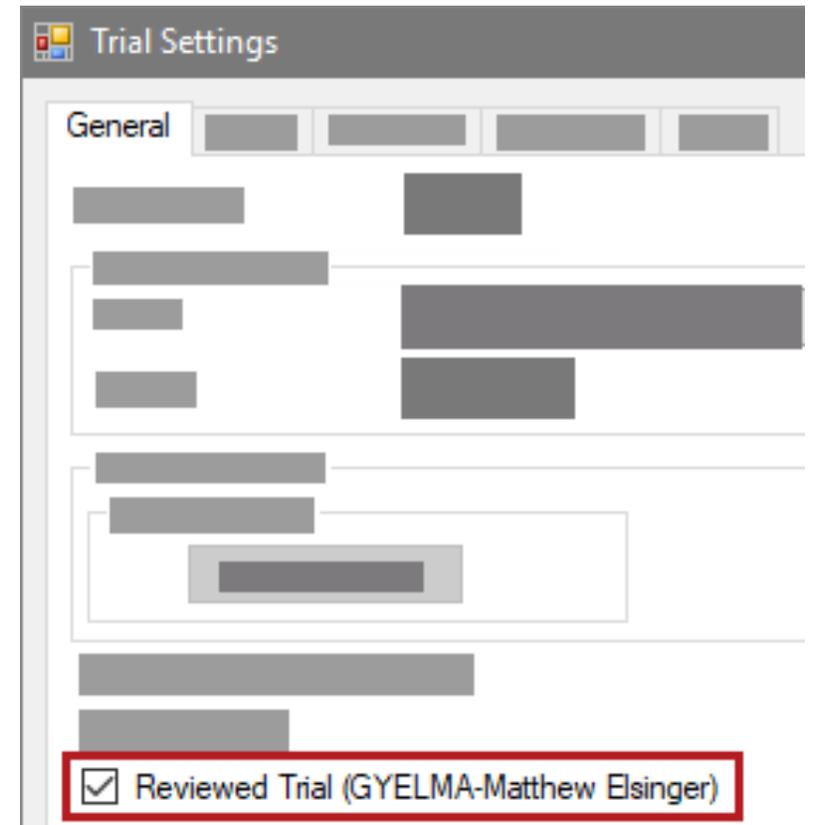


# Study Review

# Review Study

## Mark a trial as Reviewed

- Track whether a trial has been reviewed
- Identifies who marked as reviewed
- Trial Settings > General tab
- 'Trial Reviewed' action is automatically logged in Notes tab of Site Description
- Checkbox is cleared when any change is made to data in the trial



Site Description		
Notes	Deviations	Protocol Comments
Date	By	Notes
Nov-27-2018	Matthew Elsinger	Automatically added by ARM: Trial Reviewed

# Review Study

## Create a review group

- 'Review' study rule defines who is allowed to mark a trial as reviewed
- **Condition** field defines who to include in the group:
  - just protocol or trial owner(s)
  - everyone in my company
  - Anyone (i.e. no group)
- Example: Sponsor wants to ensure the study is reviewed internally. Contractor can still create their own separate review group to review before sending back to the sponsor by adding another 'Review' rule for their company.

Study Rules - Rule 1 of 1				
Rule	Rule ID	Editor	Field	Condition
1	Review	Trial	Trial	Everyone in my company

# Study Rules

# Study Rules

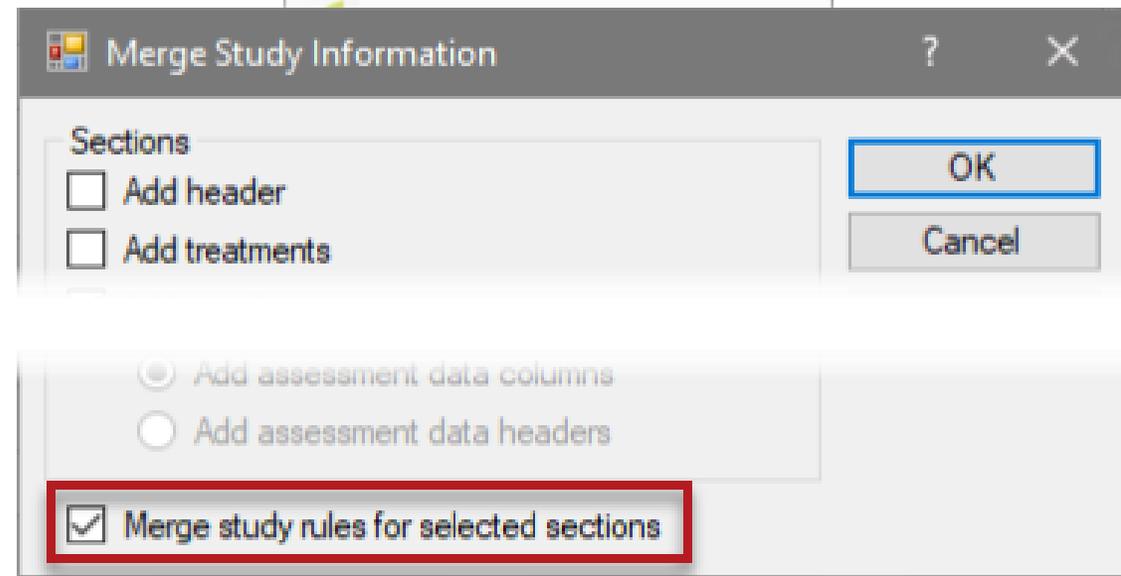
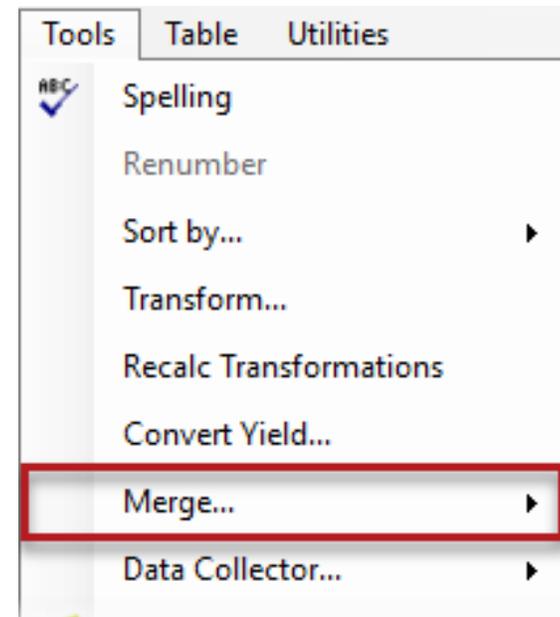
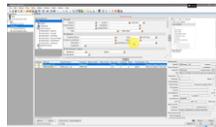
## Merge Study Information

- Easily copy information from study to study.
- Replaces “Save As” function.

## Enhancement

- Choose to *not* merge study rules if the study is originated by your company.
- Offers new flexibility for internal researchers.

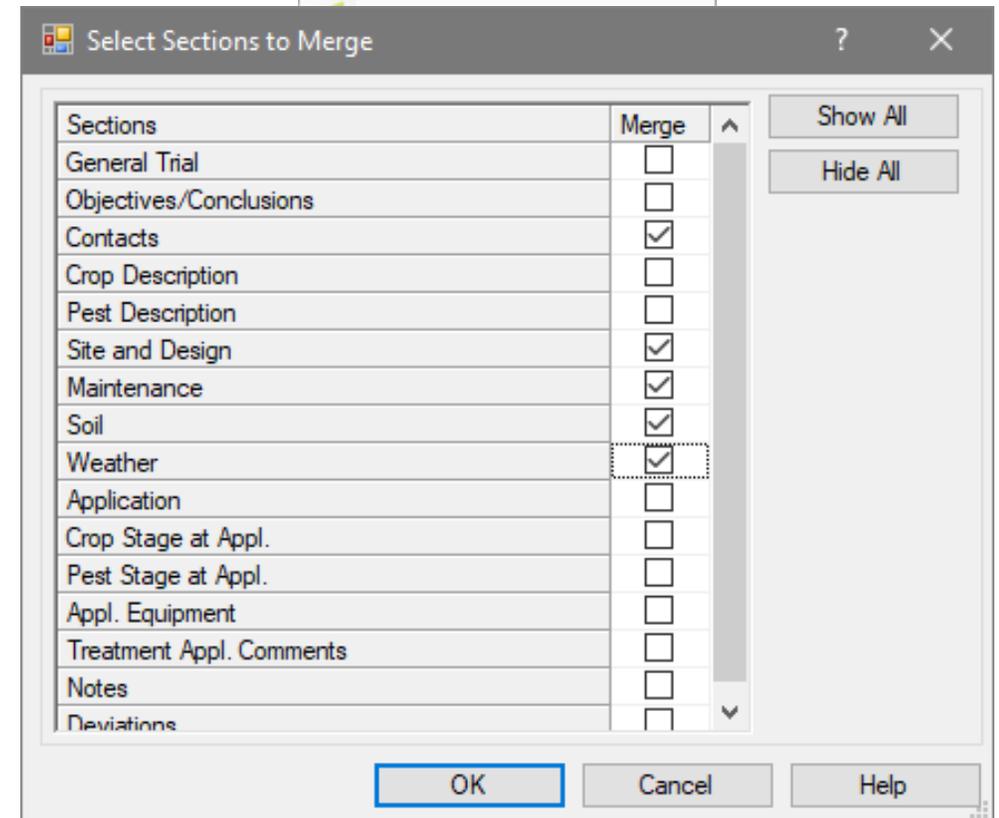
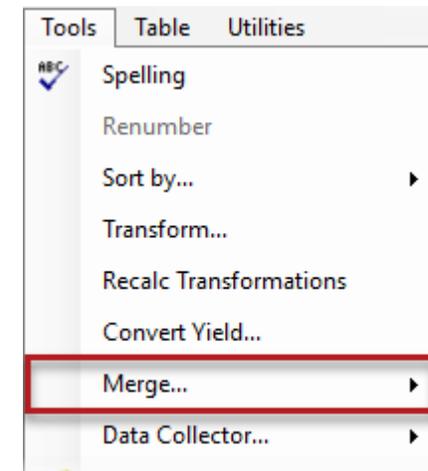
## Feature in action



# Merge Study Rules

## Enhancement

- Limit study rules merged to only selected protocol/site description sections.

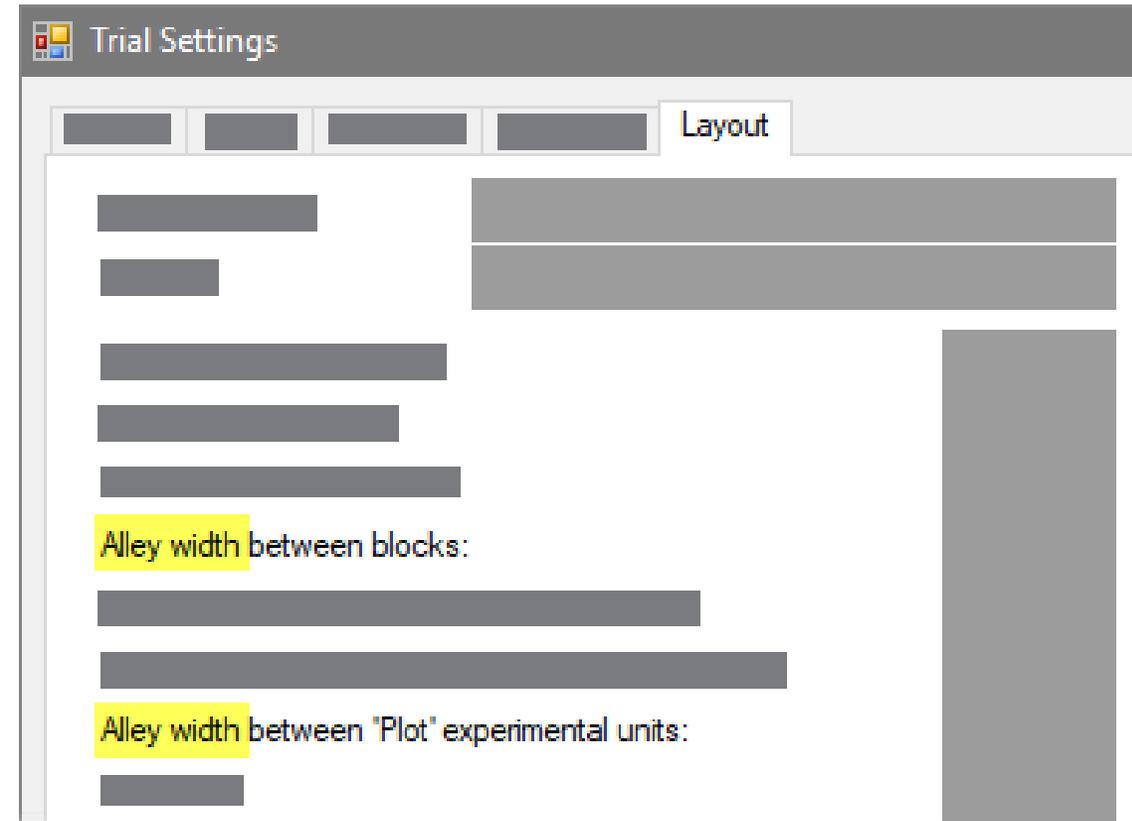


# Study Settings

# Layout Options

## Clarified 'buffer' option text

- Changed to 'Alley width' - a more commonly used term
- Previously called 'Buffer' between blocks or plots
- Protocol/Trial Settings > Layout tab



# Site Description

# Track Trial Progress\*

## Why document trial progress?

- Requested by sponsors.
- Provides visibility and credibility to timely data entry.
- Added new fields to track status and progress throughout the season.

### General Trial Information

Discipline:	H	herbicide	Data Location:	
Trial Status:	E	established	Trial Reliability:	
Trial Usage/Type:	SCR	Screening/Exploratory	ARM Trial Created On:	Sep-19-2018
Initiation Date:	Sep-19-2018		Planned Completion Date:	Aug-19-2014

### Pest Description

Insert Pest with Shift+F7, Delete current Pest with Shift+F8

Pest 1 Type:	W	Code:	GGGAN	Annual grasses	Entry Date:	Jul-20-2018
Common Name:			Annual grasses			
Attributes:						

# Track Trial Progress\*

Additional new fields to track status and progress throughout the season.

- Application tab > **Appl. Entry Date**
- Assessment Header > **Data Entry Date**

Assessment Data - Line 4	
Column Number	1
Part Rated	LEAF <input type="checkbox"/> C <input type="checkbox"/>
Rating Type	PHYGEN
Rating Unit	%
Number of Subsamples	1
<b>Data Entry Date</b>	<b>Sep-19-2018</b>
Trt-Eval Interval	7 DA-C

## Application Description

	D
Application Date:	Sep-19-2018
Appl. Start Time:	11:15 AM
Application Method:	SPRAY
Application Timing:	POSPOS
Application Placement:	BROFOL
Applied By:	
<b>Appl. Entry Date:</b>	<b>Sep-19-2018</b>
Air Temperature Start, Stop:	19.5      C

# Tablet Data Collector (TDCx)

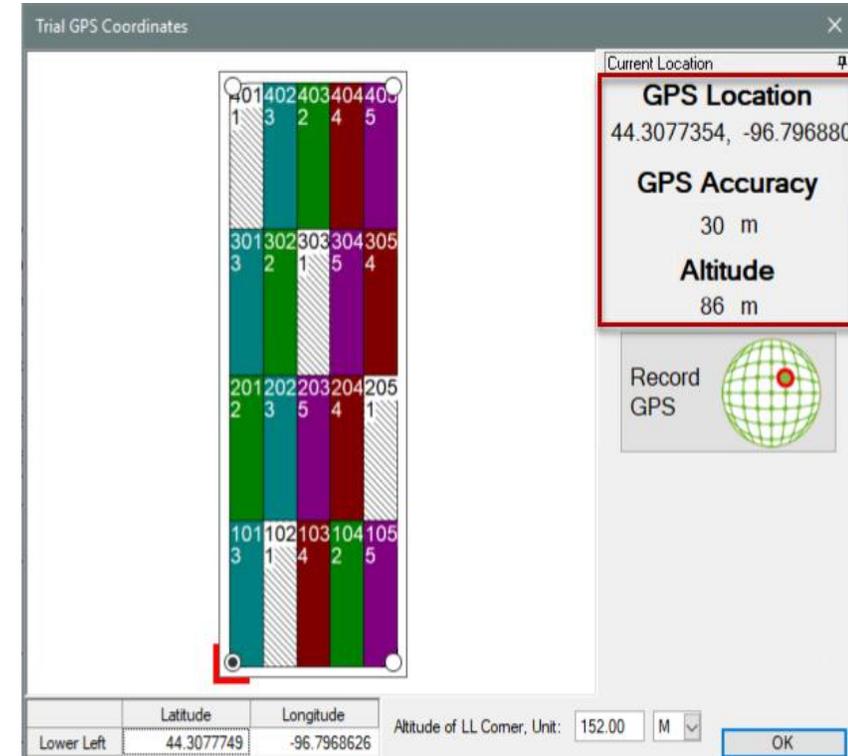
# Record GPS

## Display the current position in real-time

- Researchers now can determine the accuracy of the GPS device while documenting coordinates.
- TDCx will display: GPS coordinates, accuracy and altitude.

## Where is this feature?

Choose “Tablet Read GPS Editor”



# ARM Migration

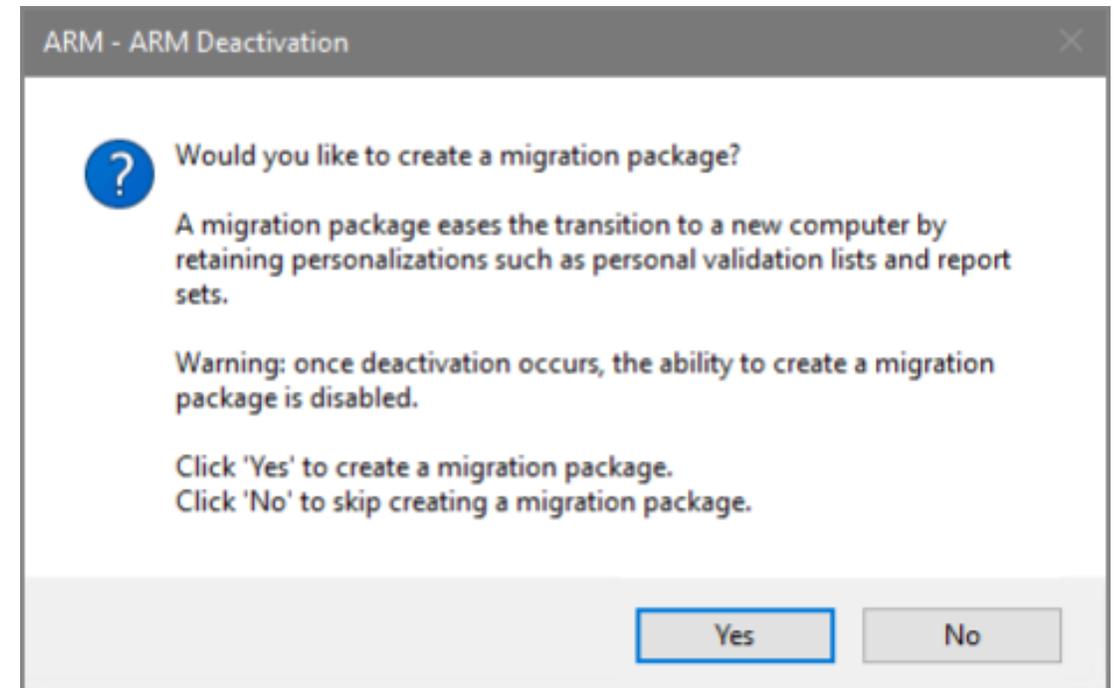
# Migrate Settings\*

## Copy settings when moving to a new PC

- Copy personal lists, report sets, ARM settings to new computer

### What's new?

Prompt to create package *before* deactivating the old PC.



# SE Definitions

# SE Definitions\*

## Plan and define standard evaluations (SEs) and tasks to use in the study

- Simpler than importing SEs from file into assessment data editor

Use Tools > 'Build Header, Tasks' to create the SEs and tasks defined in this tab

## Multiple rating timings create columns for each timing code

- Two-column SE F097\_C2 times 3 rating timings A1-A3 = 6 total data columns

### SE Definitions

Insert SE Definition with Shift+F7, Delete current SE Definition with Shift+F8

	1.	2.
Rating Timing	A1-A3	H1
SE Name	F097_C2	Y085
SE Description	% of infected leaves (N leaves). TIO[x]* (note: *x = column nb of infected leaves in F097A)	Fresh yield grain in kg / ... m2
Part Rated	LEAF	GRAIN
Rating Type	PESINC	WEIFRE
Rating Unit	%	KG
Sample Size	LEAF	M2
Collection Basis	SHOOT	1 PLOT
Reporting Basis	LEAF	M2
Number of Subsamples		
ARM Action Codes	TIO[1]	
Pest Type, Code		
Crop Code		

# SE Definitions\*

1. Display SE Name list
2. Select an SE, can search/filter descriptions
3. Preview assessment columns defined in SE

Can also define tasks on this tab to add to Schedule editor

The screenshot shows the 'SE Definitions' window in a software application. At the top, there is a 'Site Description' field and a section for 'SE Definitions' with instructions: 'Insert SE Definition with Shift+F7, Delete current SE Definition with Shift+F8'. Below this is a table with columns for 'Rating Timing' and 'SE Name'. A red callout '1' points to the 'SE Name' column. Below the table is a 'SE Name Master List (SE\_TABLE)' with columns for 'SE Name' and 'SE Description'. The list contains various SEs like F088, F089, F090, F091, F092, F093\_C2, F094\_C3, F095\_C2, F096\_C2, F097\_C2, F098\_C5, F099\_C5, F100\_C2, F101\_C2, F102\_C2, and F103. A red callout '2' points to the 'SE Name' column of this list. To the right is a 'Preview' window showing a table with columns for 'Column Number', 'SE Name', 'Part Rated', 'Rating Type', 'Rating Unit', 'Sample Size, Unit', 'Collection Basis, Unit', 'Reporting Basis, Unit', and 'ARM Action Codes'. A red callout '3' points to the 'Rating Unit' field in the preview table. At the bottom of the window are buttons for '(All)', '(All)', 'Active Filter', 'Remove Filter', 'Display Personal', 'Add to Personal', 'OK', and 'Cancel'.