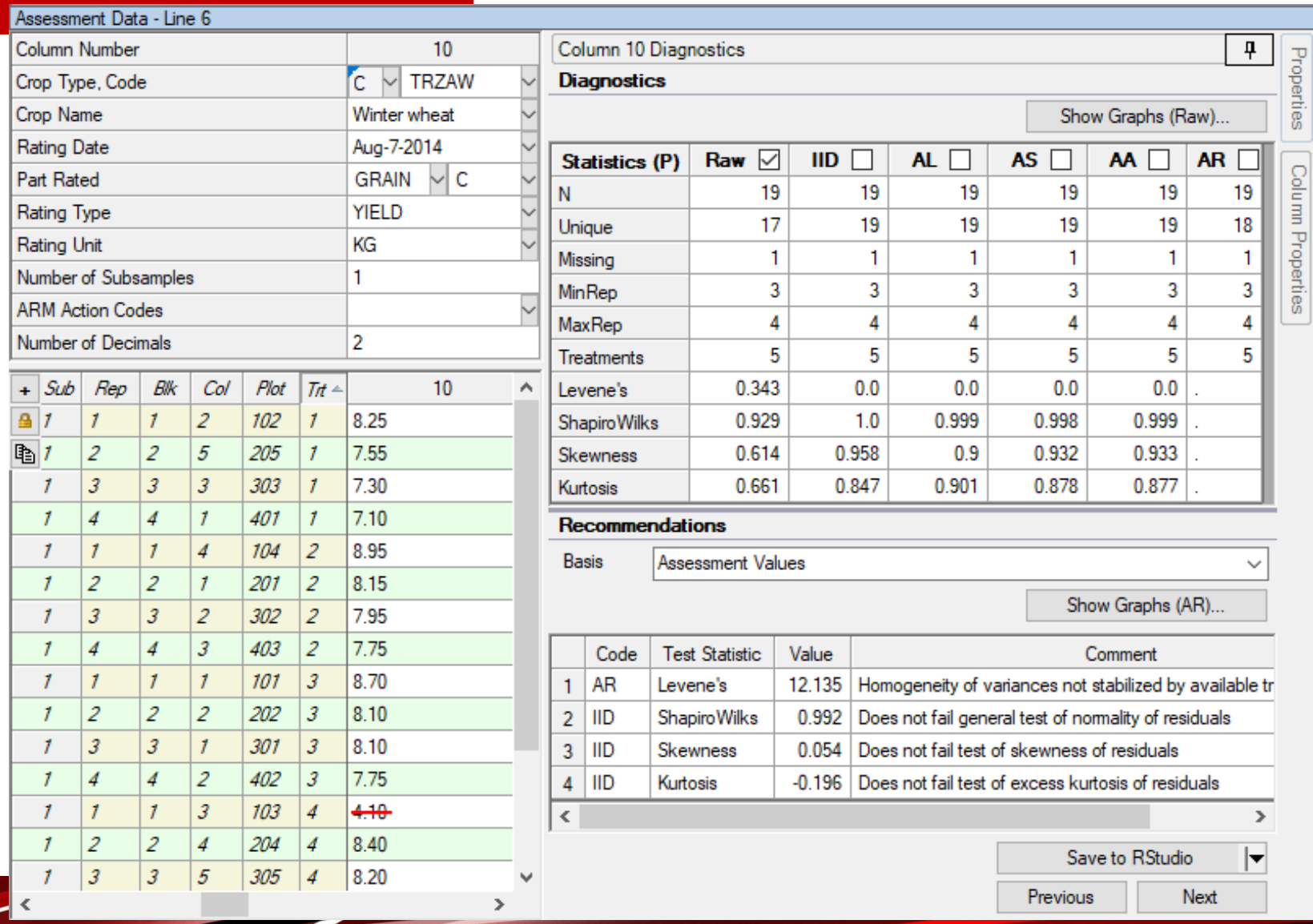
ARM 2019.x Changes

Key Features

Column Diagnostics

Column Diagnostics

- New tool for reviewing data
- Statistical tests for assumptions of AOV, run on residuals
- ARM recommends actions from results
- View diagnostic plots of data and residuals
- Find outliers



Column Diagnostics

Diagnostics

Show Graphs (Raw)...

Statistics (P)	Raw ☑	IID ☐	AL ☐	AS ☐	AA ☐	AR ☐
N	19	19	19	19	19	19
Unique	17	19	19	19	19	18
Missing	1	1	1	1	1	1
Treatments	5	5	5	5	5	5
Levene's	0.343	0.0	0.0	0.0	0.0	.
ShapiroWilks	0.929	1.0	0.999	0.998	0.999	.
Skewness	0.614	0.958	0.9	0.932	0.933	.
Kurtosis	0.661	0.847	0.901	0.878	0.877	.

Statistical tests for assumptions of AOV analysis

- Levene's: homogeneity of variance
- Shapiro-Wilk's: general test for normality
- Skewness/Kurtosis: tests for normality

Tests performed on **residuals**, not raw data

Significant P value -> test fails, so assumption is not met

Column Diagnostics

Recommends actions for failed tests of AOV assumptions

- Transformations
- Non-parametric analysis

Recommendations

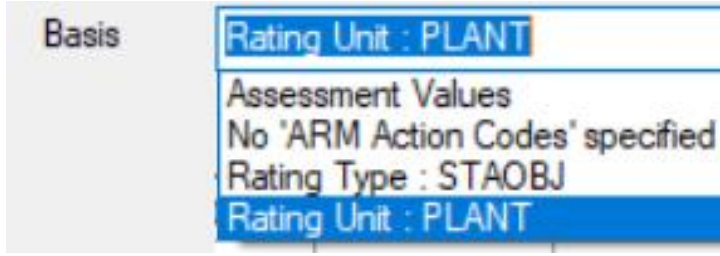
Basis: Rating Unit : PLANT

Show Graphs (AS)...

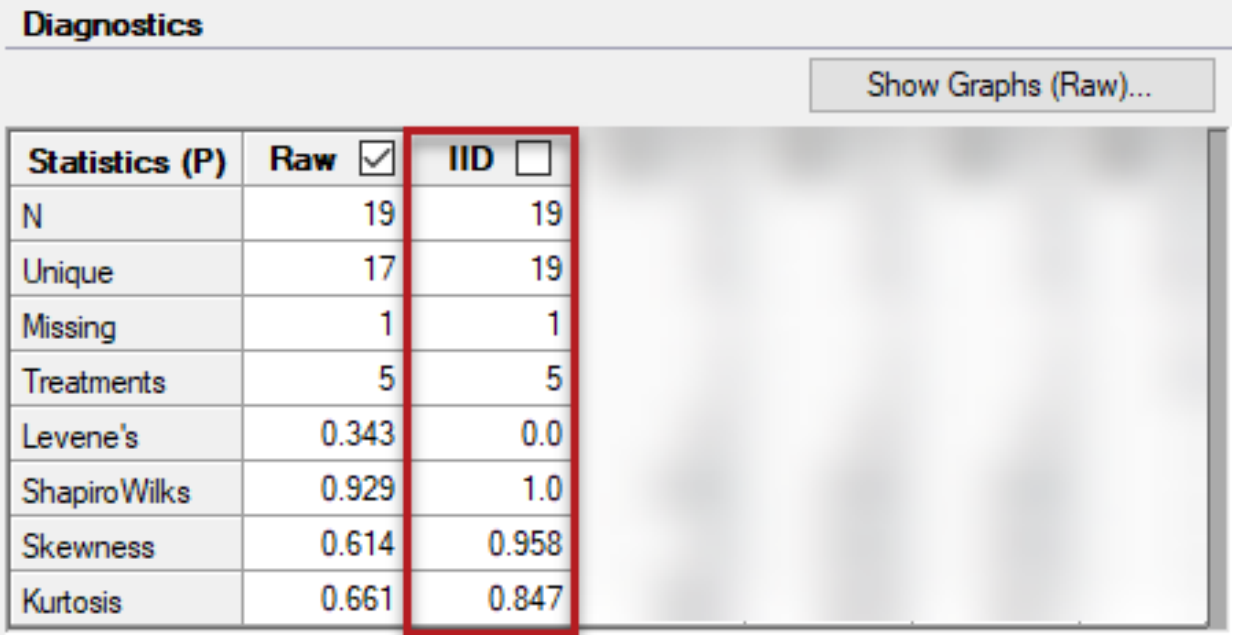
	Code	Test Statistic	Value	Comment
1	AS	Levene's	3.026	Transform to stabilize variance
2	AR	ShapiroWilks	0.873	Available transformations do not improve normality
3	IID	Skewness	0.143	Does not fail test of skewness of residuals
4	AR	Kurtosis	7.126	Available transformations do not correct kurtosis of residuals

Suggestions based on assumed distribution of data

- Determined from: Rating Type, Rating Unit, range of data values



Column Diagnostics



Statistics (P)	Raw ☑	IID ☐
N	19	19
Unique	17	19
Missing	1	1
Treatments	5	5
Levene's	0.343	0.0
ShapiroWilks	0.929	1.0
Skewness	0.614	0.958
Kurtosis	0.661	0.847

IID - new ARM Action Code

- ***I**dentically and **I**ndependently **D**istributed*
- Signifies that column meets all assumptions of AOV

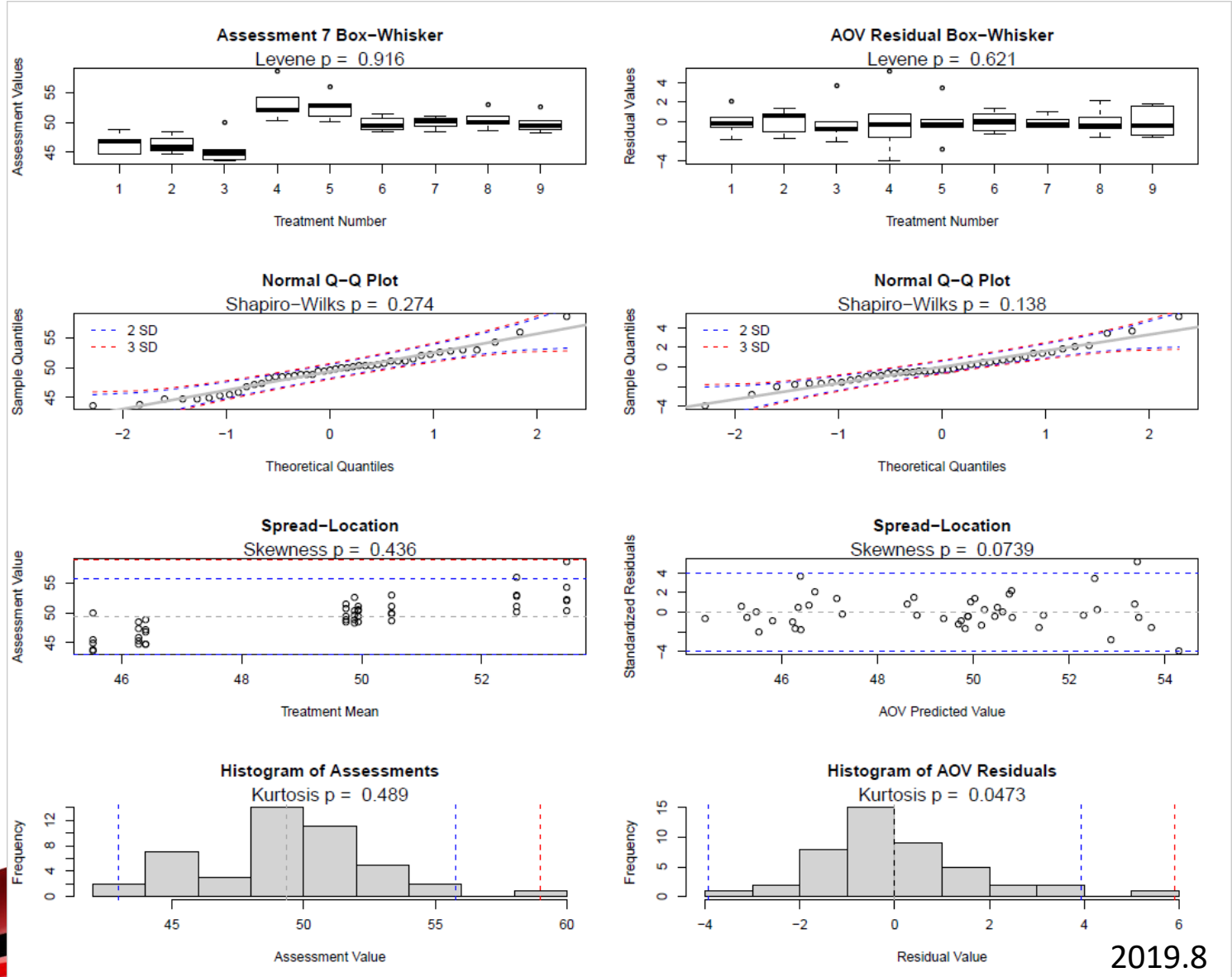
A way to mark column as reviewed, but without any corrections required

AOV analysis is then run on the **residuals** (previously were run on raw data)

Column Diagnostics

View diagnostic plots:

- Data vs. residuals
- AOV residuals vs. transformed residuals



Column Diagnostics

Search for outliers

- Search for outliers based on residuals
- Calculates a studentized residual (accounts for number of observations)

- *(coming soon)* Exclude all calculated outliers in the column

Recommendations

	ActionCode	Criteria	Value	Comment
1	EX	Outliers	NA	Exclude outliers to reduce skewness

Outliers

	plot	treatment	replicate	column	assessment31	StdRes
1	102	9	1	2	1	-4.5

Non-Parametric Statistics

Non-parametric statistics

- Relies on ranks to analyze data, instead of means and st. dev.
- New ARM Action Code: **AR**
  (automatic rank transformation)
  - Rank the data points
    (Kruskal-Wallis or Friedman's test)
  - Perform mean comparison test
    on rank means (LSD)
- Analysis included with other AOV columns

Pest Type			W Weed	W Weed
Pest Name			Oxeye	Oxeye
Rating Date			Sep-4-2016	Sep-4-2016
Rating Type			STAOBJ	STAOBJ
Rating Unit			PLANT	PLANT
Number of Subsamples			1	1
ARM Action Codes				AR
Trt No.	Treatment Name	Appl Code	34	35
1	Burn	A	0.0 c	3.8 b
2	Burn	A	0.1 c	4.7 b
3	Burn	A	0.0 c	4.5 b
4	Mow	A	0.0 c	3.8 b
5	Mow	A	0.0 c	3.8 b
6	Mow	A	0.0 c	3.8 b
7	Spray	A	0.0 c	3.8 b
8	Spray	A	1.7 a	8.9 a
9	Spray	A	0.8 b	7.9 a
LSD P=.05			1.66	1.13
Levene's F			2.794	2.40
Levene's Prob(F)			0.016*	0.035*
Friedman's X2			.	34.526
P(Friedman's X2)			.	0.00
Skewness			2.1418*	0.4492
Kurtosis			3.6057*	4.7736

Reported values for columns 35 are rank means and not assessment means

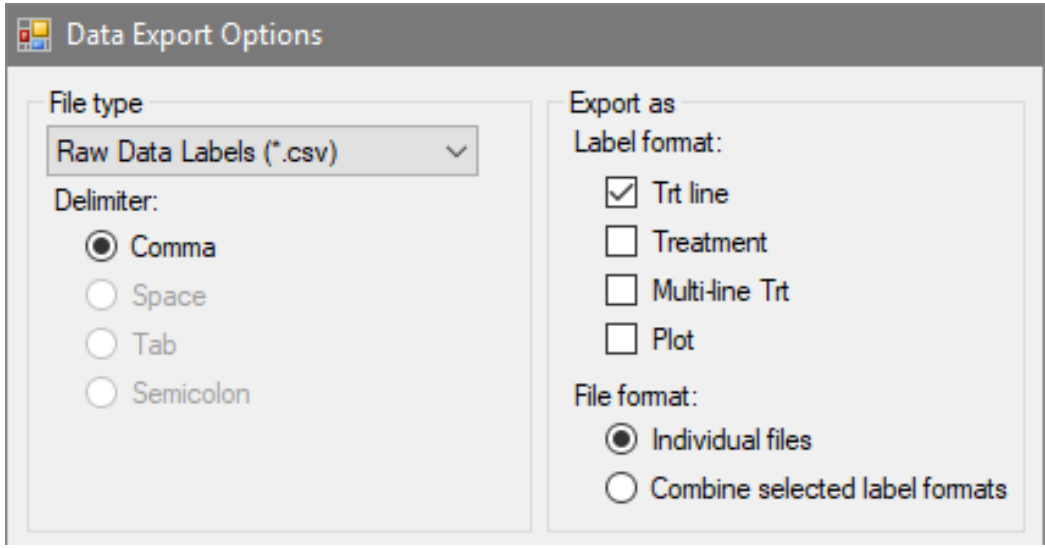
Why non-parametric???

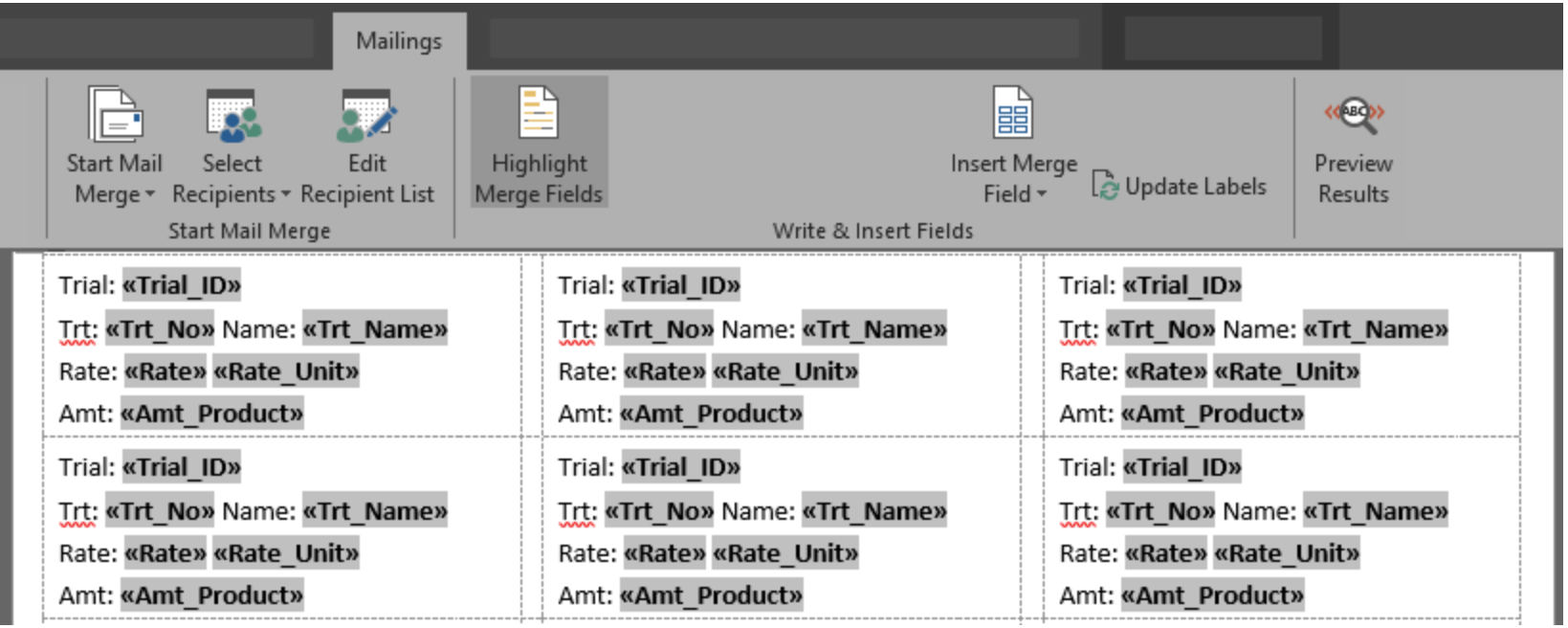
- ANOVA has assumptions that must be met
  - Otherwise results may not be valid
- Non-parametric analysis does not have these restrictions
- Use non-parametric when:
  - Data cannot be corrected to fit assumptions of AOV
  - Data is not real-valued, like counts or index scales

Custom Labels

Custom Labels

- Create custom labels by exporting treatment/plot information to .csv





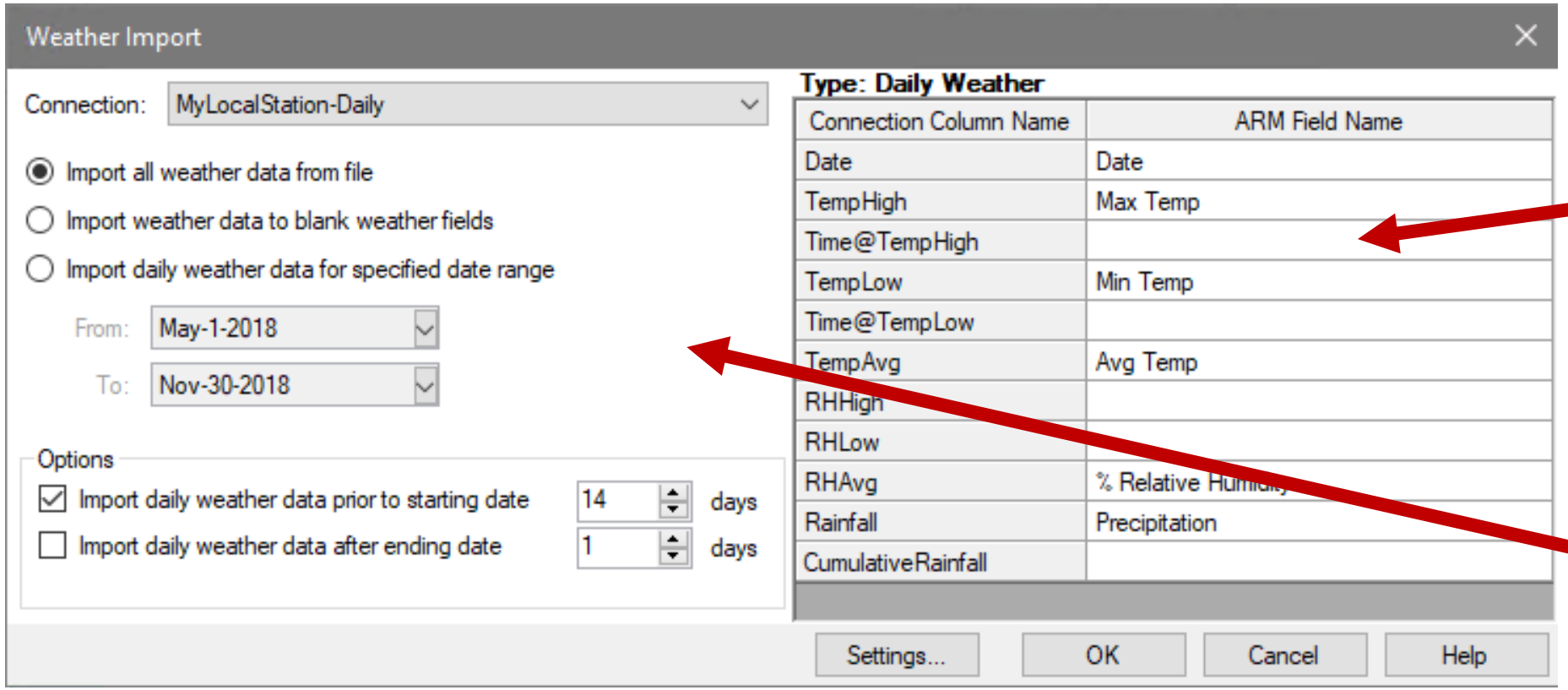
- Use Mail Merge in a word processor to create your own labels

View Tutorial Video

Import Weather Data

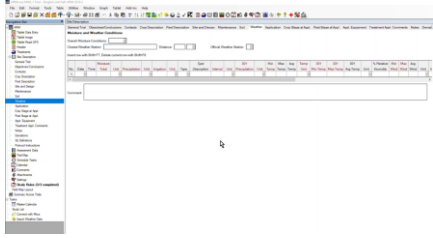
Import weather data

- Import weather data from **any** weather source CSV file

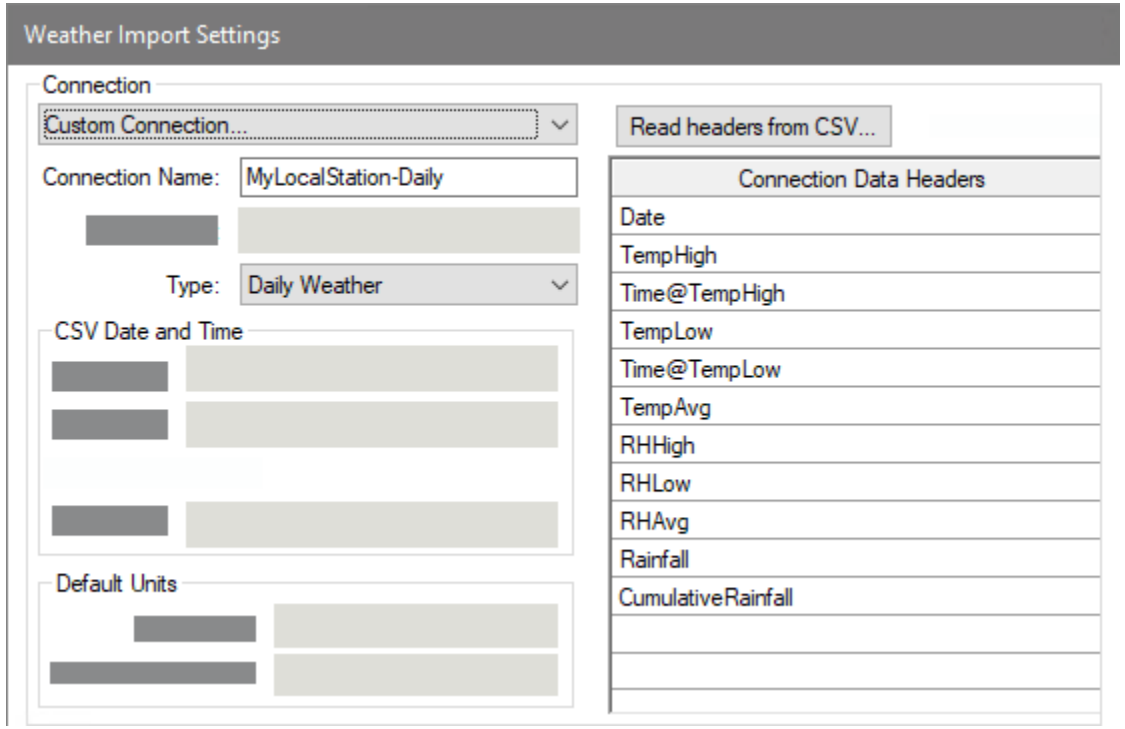


- Define connection between CSV and ARM fields
- Specify what dates to import data from file

Import weather data

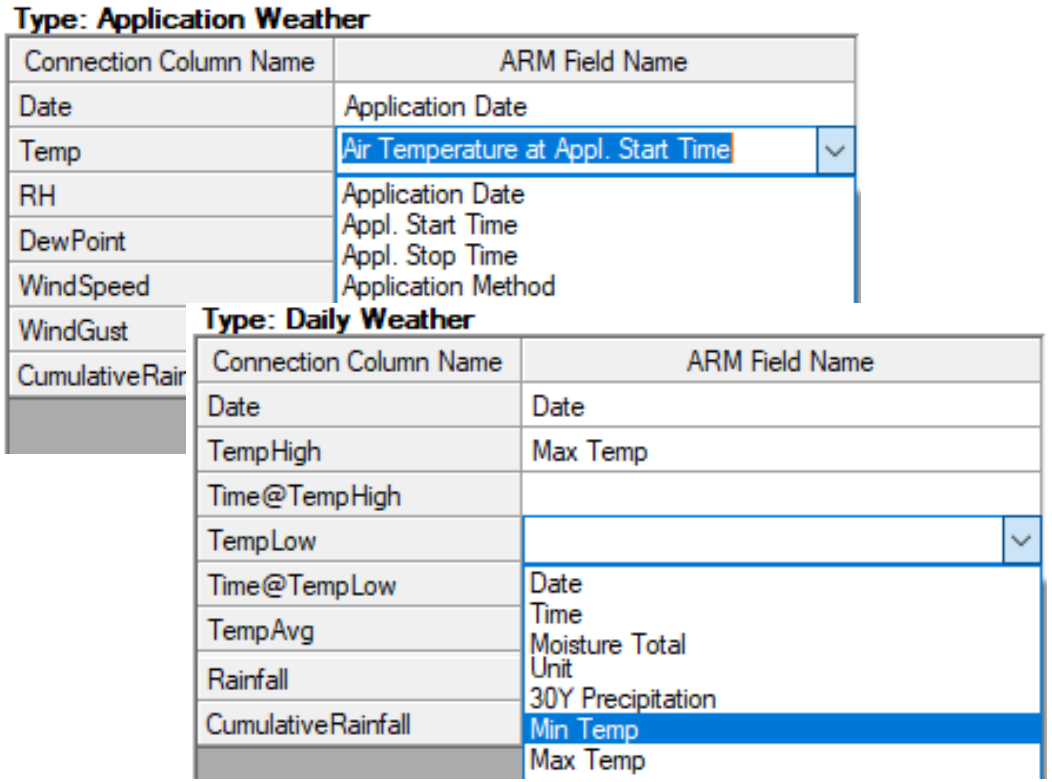
Feature in Action: 

1. Define connection type and read column headings from CSV



2. Map CSV headings to ARM weather fields

   Hourly = Application; Daily = Weather table



SE Definitions

SE Definitions

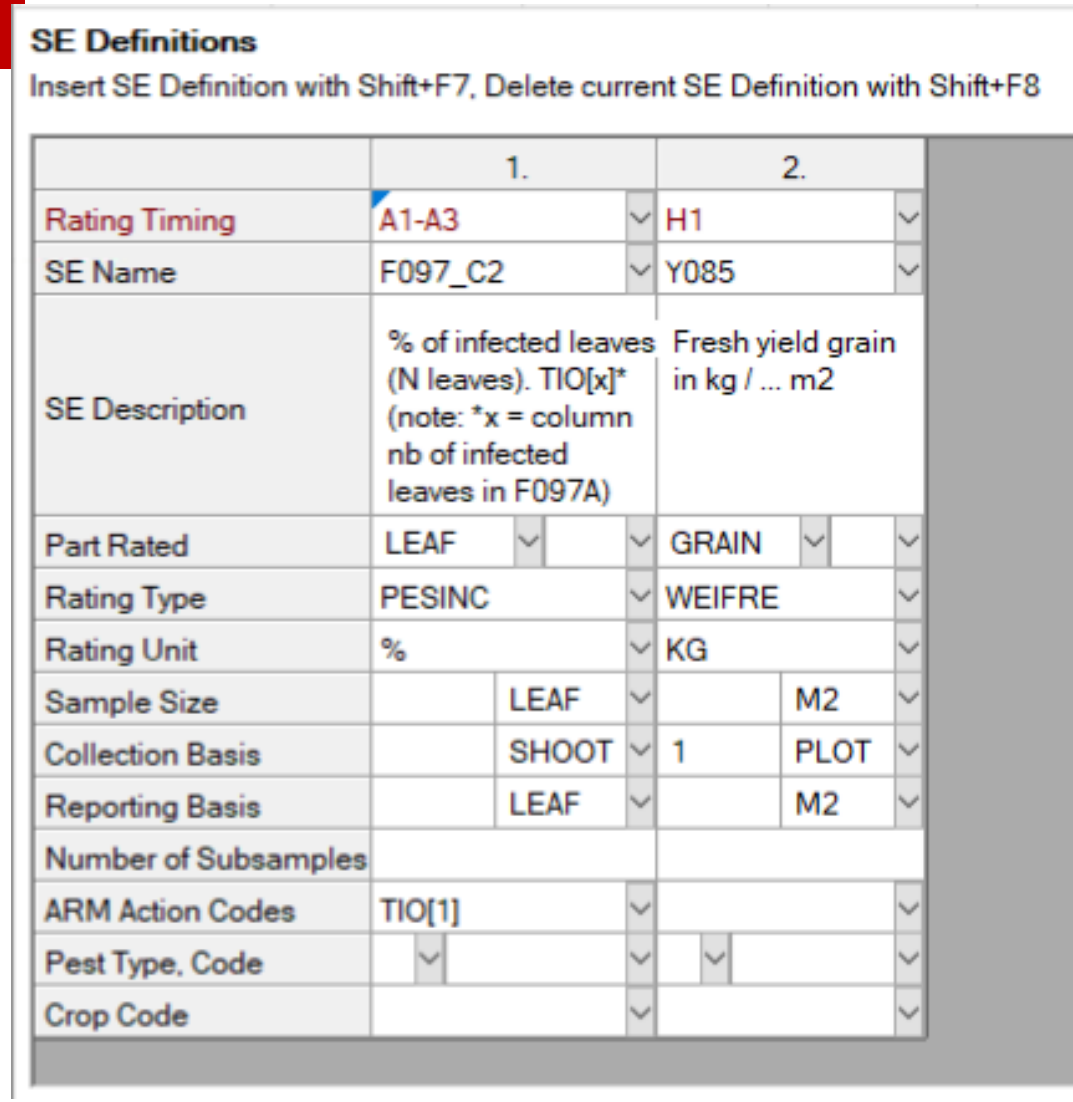
Plan and define standard evaluations (SEs) and tasks to use in the study

- Simpler than importing SEs from file into assessment data editor

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

Multiple rating timings create columns and tasks for each timing code

- Two-column SE F097_C2 times 3 rating timings A1-A3 = 6 total data columns



SE Definitions

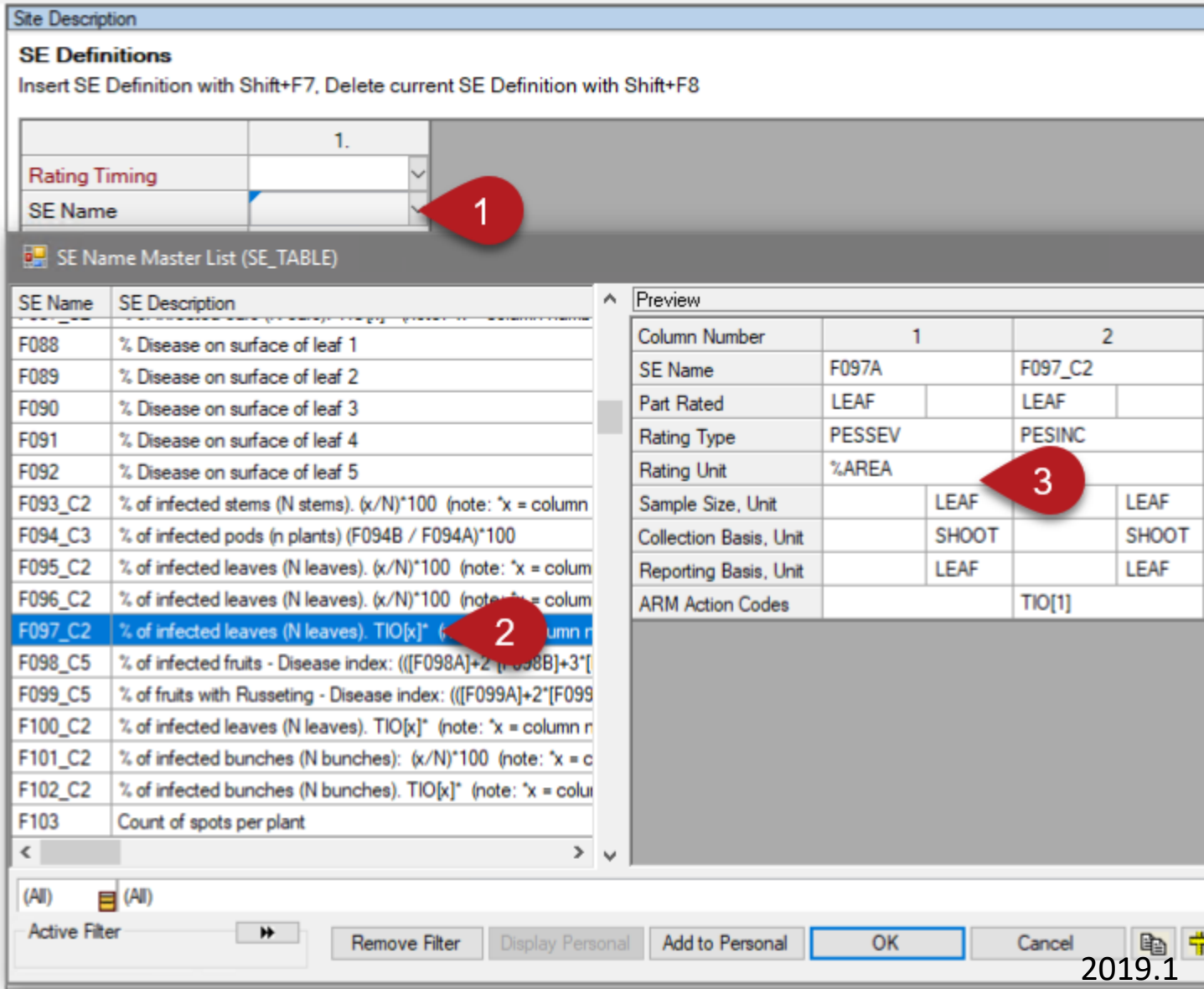
Insert SE Definition with Shift+F7, Delete current SE Definition with Shift+F8

	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

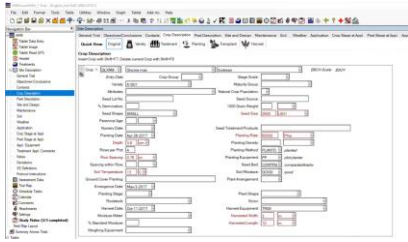


ARM 2019.x Changes

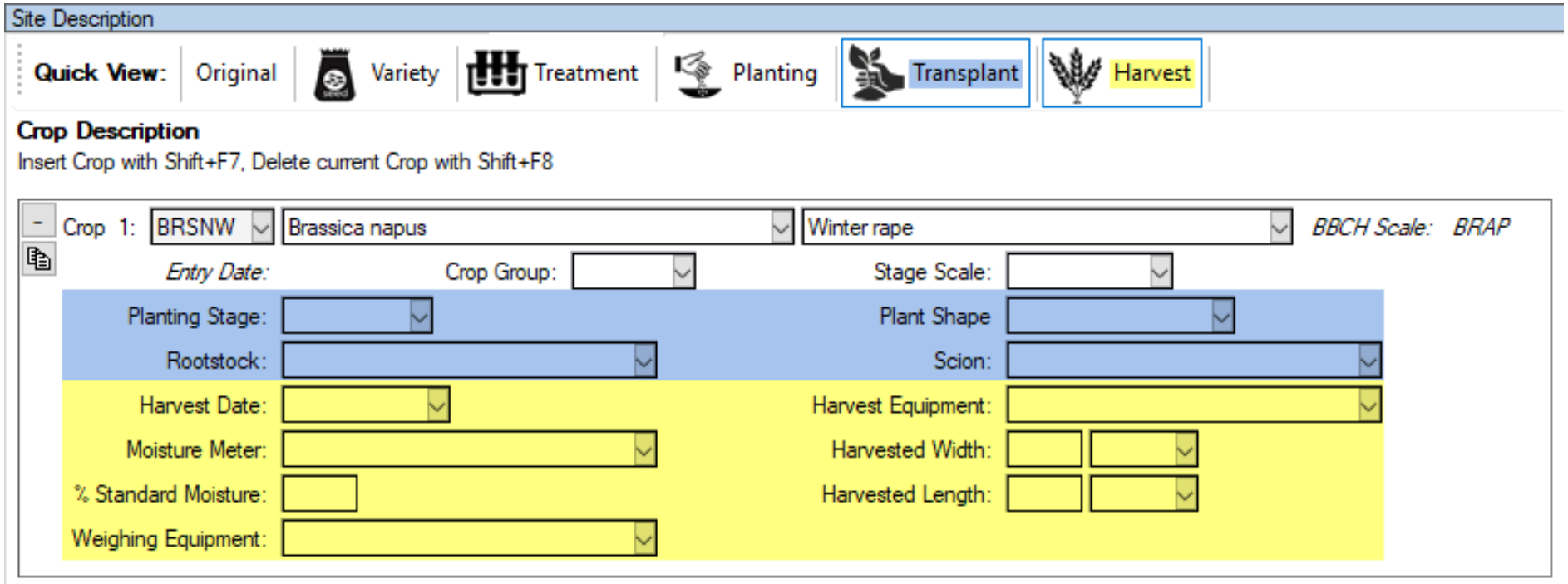
Additional enhancements

Site Description

Quick View toolbar

Feature in Action: 

- Automatically filter visible Crop Description fields by task
- Simplifies interface to view/enter only pertinent information

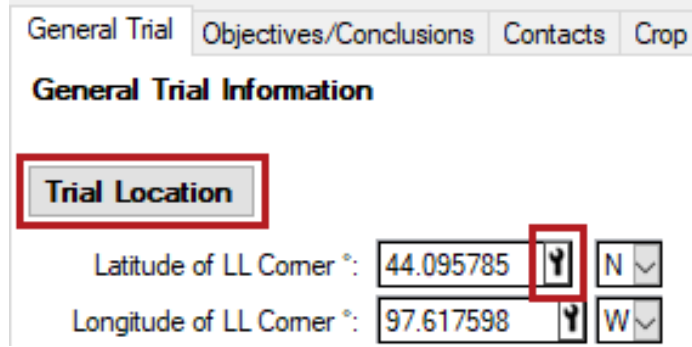


- Multi-select to view fields from >1 task at a time

Trial Location GPS

- Visually verify accuracy of trial GPS coordinates
- Auto-fills Time Zone and Angle y-axis to North (Orientation) based on GPS coordinates

Trial Location GPS

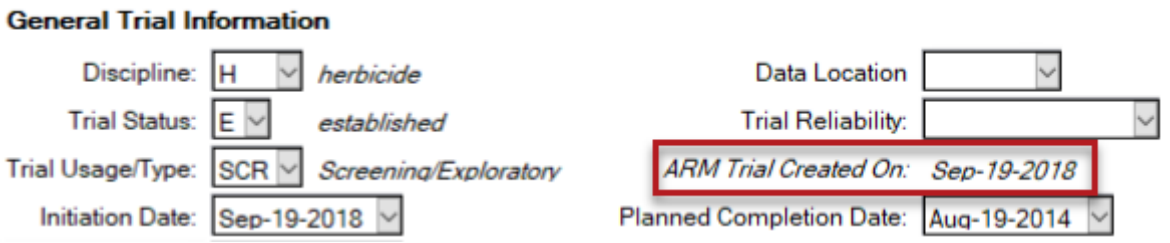


- Open from Tool icon in GPS field, or Trial Location button
- Useful to catch errors in GPS coordinates entered!

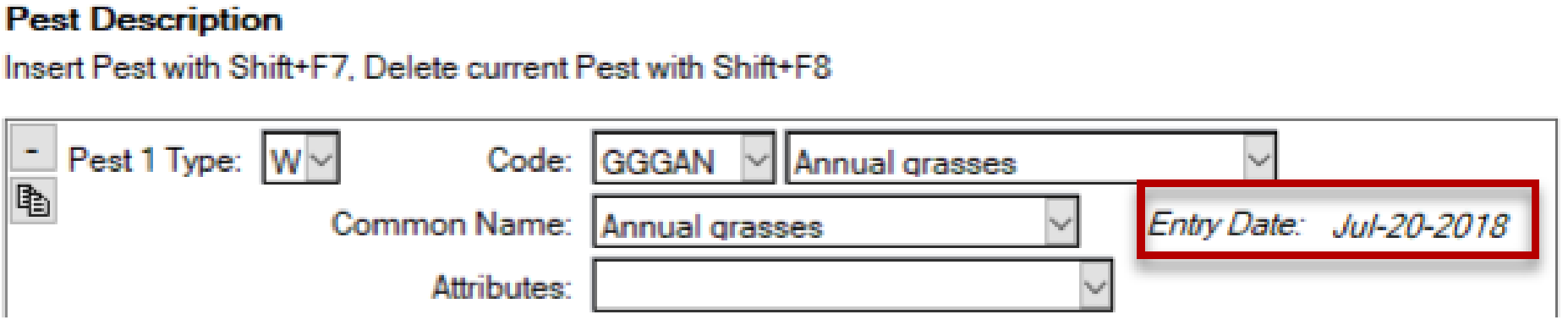
Track Trial Progress

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.



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 C
Rating Type	PHYGEN
Rating Unit	%
Number of Subsamples	1
Data Entry Date	*Sep-19-2018*
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:	
Appl. Entry Date:	*Sep-19-2018*
Air Temperature Start, Stop:	19.5 C

Trial Origin

Why track the trial origin?

- Helps answer budget questions.
- Valuable to the R&D division.
- ID's in-house, contracted or by a public institution trials.

Trial Location

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

Trial ID	Responsible	Site	Trial Origin	Number of Trials	Site Requirements
123 a 1-5	R.E. Cearch		C	5	
123 a 6-7	Debra Dooley's Data		I	2	
123 a 8-10	Fred's Quality Data		C	3	

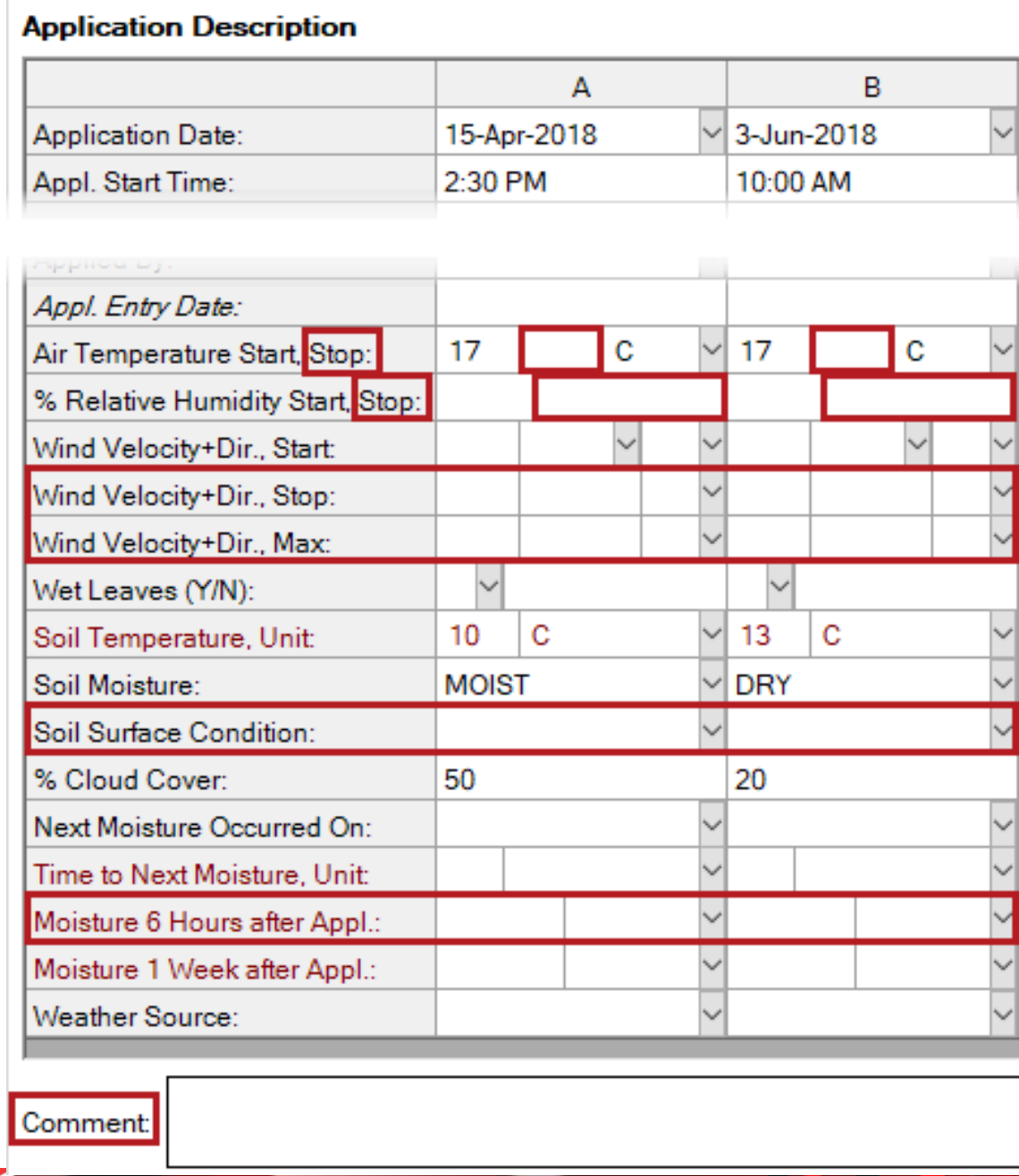
Header editor > Trial Origin or,

Trial Establishment Guidelines > Trial location Table

Application tab

New fields to document additional weather details at time of application:

- 'at stop time' variants of:
  - Air Temperature
  - % Relative Humidity
  - Wind Velocity + Direction
- Soil Surface Condition
- Moisture 6 Hours after Appl
- Comment



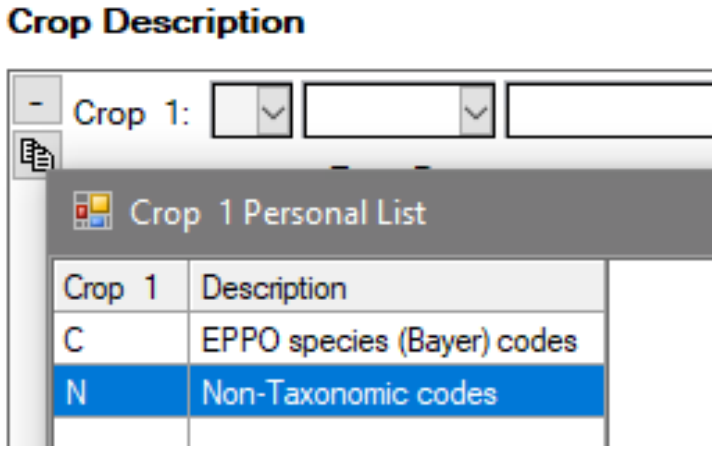
Application Description

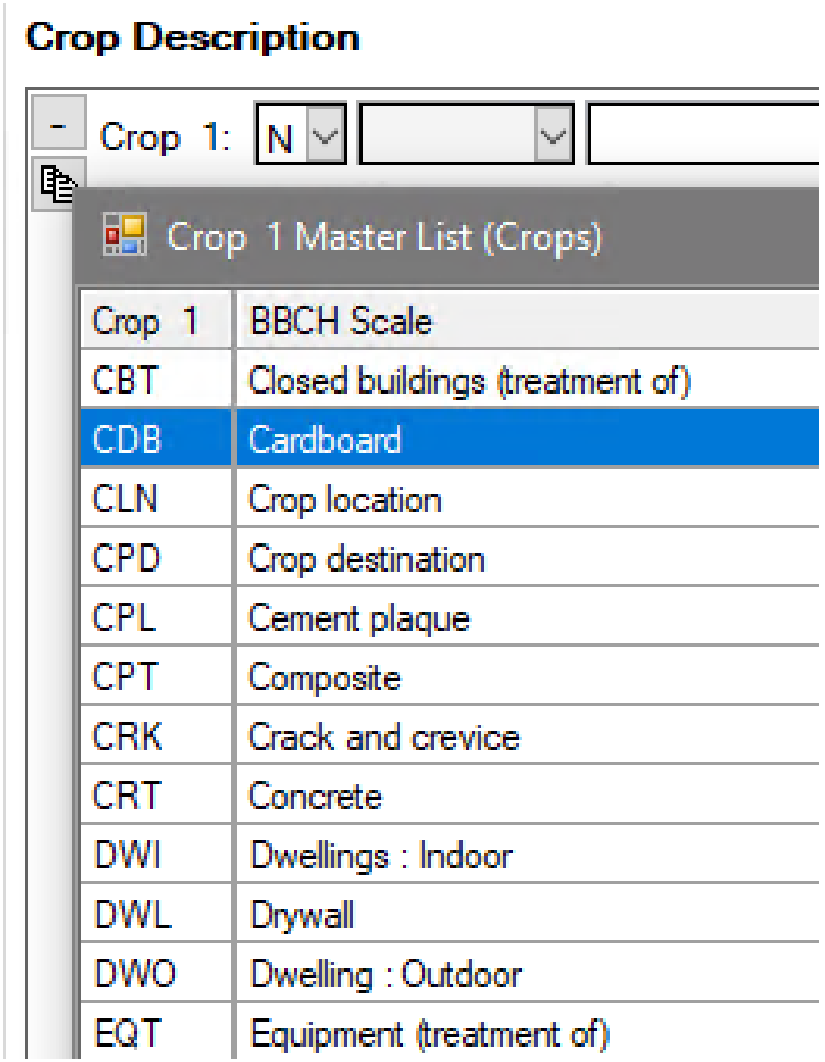
	A	B
Application Date:	15-Apr-2018	3-Jun-2018
Appl. Start Time:	2:30 PM	10:00 AM
Appl. Entry Date:		
Air Temperature Start, Stop:	17 C	17 C
% Relative Humidity Start, Stop:		
Wind Velocity+Dir., Start:		
Wind Velocity+Dir., Stop:		
Wind Velocity+Dir., Max:		
Wet Leaves (Y/N):		
Soil Temperature, Unit:	10 C	13 C
Soil Moisture:	MOIST	DRY
Soil Surface Condition:		
% Cloud Cover:	50	20
Next Moisture Occurred On:		
Time to Next Moisture, Unit:		
Moisture 6 Hours after Appl.:		
Moisture 1 Week after Appl.:		
Weather Source:		

Comment:

Objects as crops

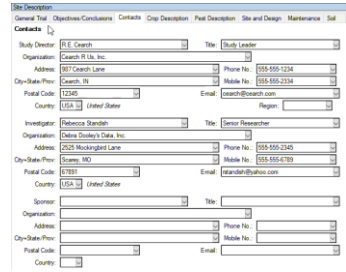
- Added non-taxonomic objects under study (entered as crops)
- New Crop Type field splits crops into EPPO and non-taxonomic objects



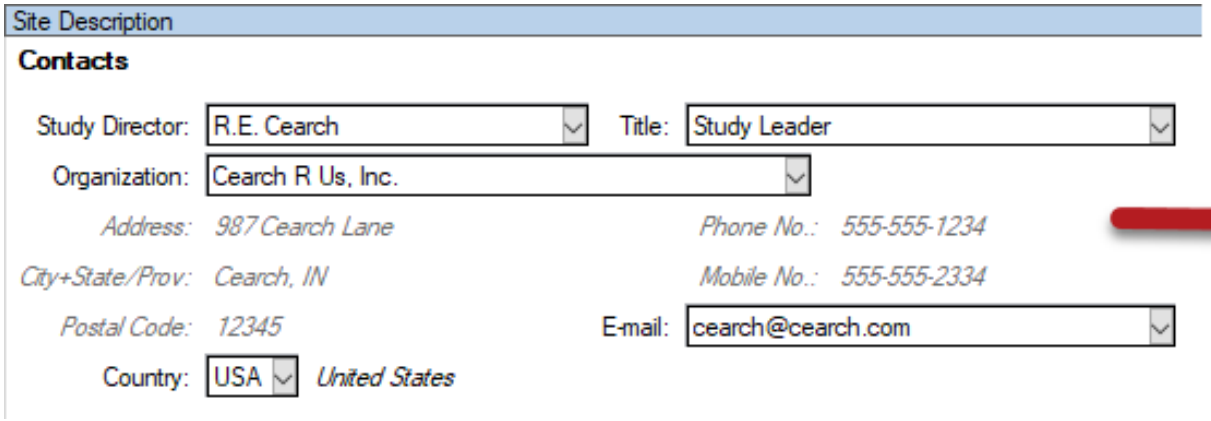


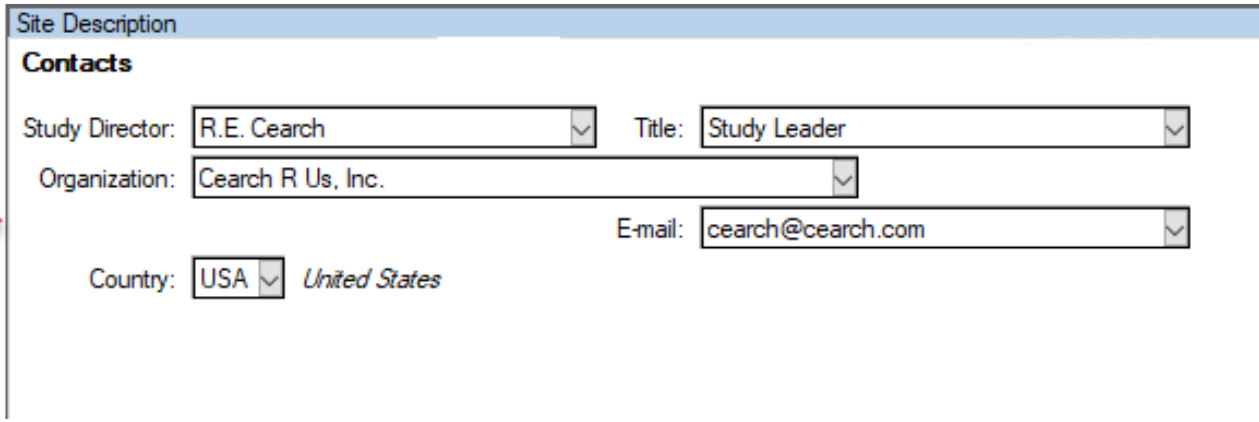
Hidden Fields

Feature in Action:



- Completely remove from view all user-hidden fields

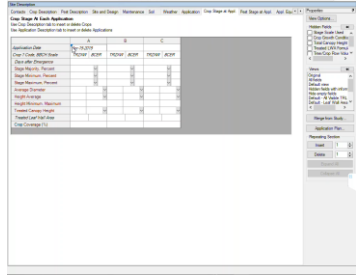




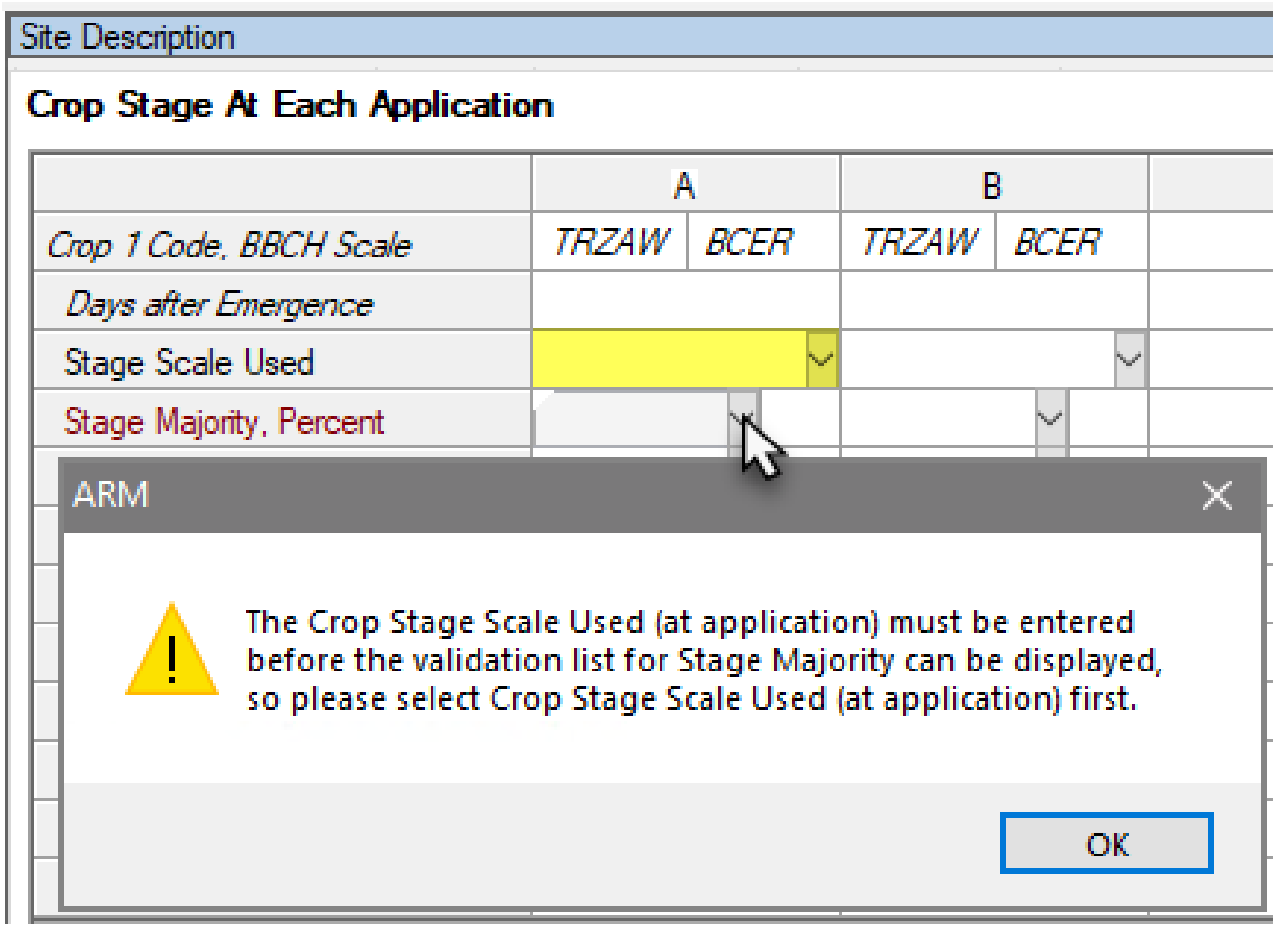
- Previously fields would simply be greyed out on-screen when hidden
- New option: Tools > Options > Editor > Completely hide user-hidden fields

Crop Stage Scale

Feature in Action:



- Scale for Crop Stage must be entered before Stage Majority/Minimum/Maximum are filled in.
- ARM now automatically opens Stage Scale list before entering the Stage

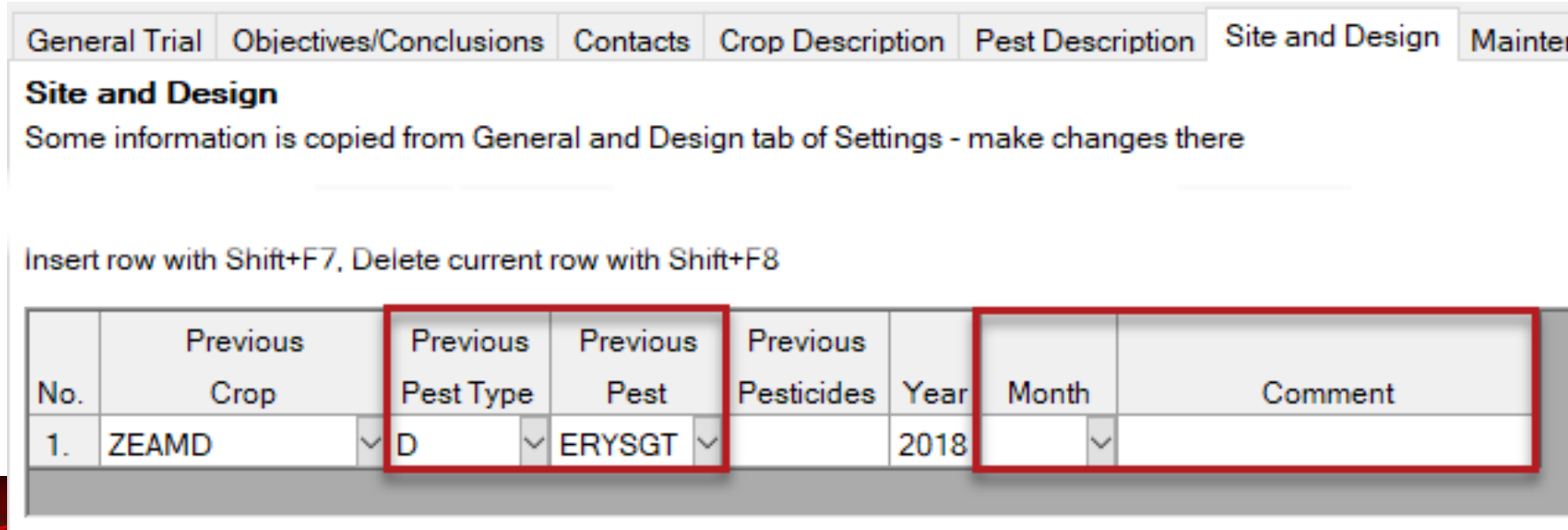


Previous Crops

Site and Design > Previous Crops table

Additional new fields to document previous conditions at the trial site.

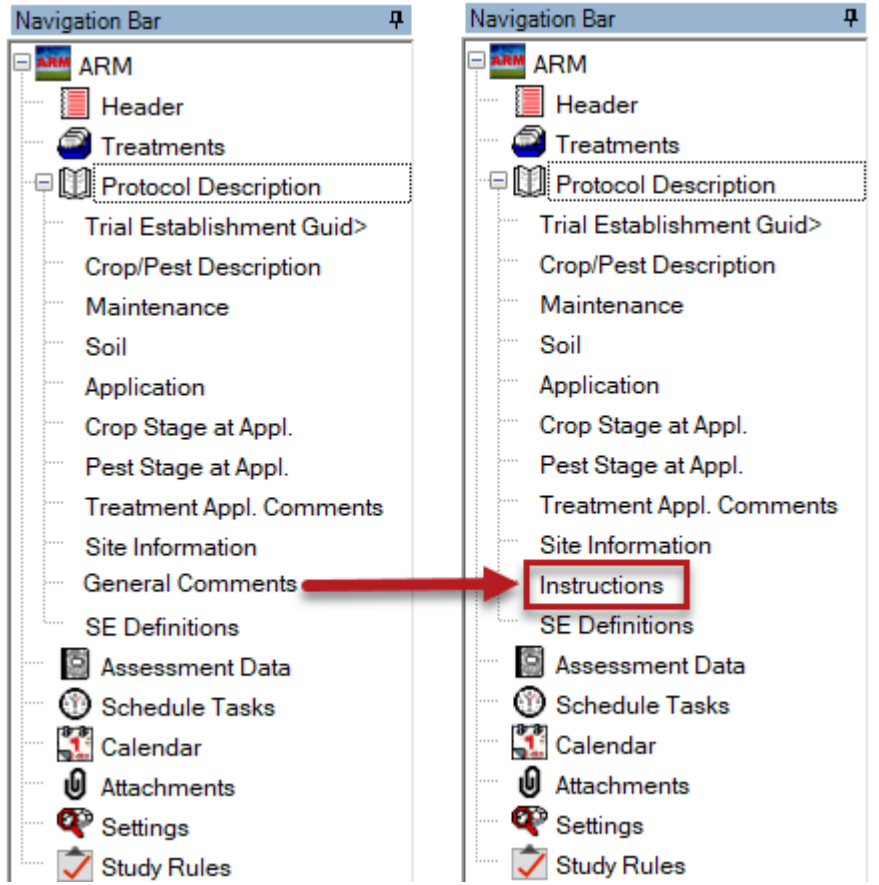
- Previous Pest
- Month (that crop/pest was present)
- Comment



Protocol Comments

Protocol Comments tab renamed to Instructions

- Protocol Description:
  from General Comments to Instructions
- Site Description:
  from Protocol Comments to Protocol Instructions



Treatments

New Treatment Type

- Added treatment type 'DEFO'
- **Defoliant** – herbicidal chemical sprayed or dusted, causing leaves to fall off

Treatments - Line 2

Trt Line	Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	
1	1	CHK	Untreated Check				
2	2						

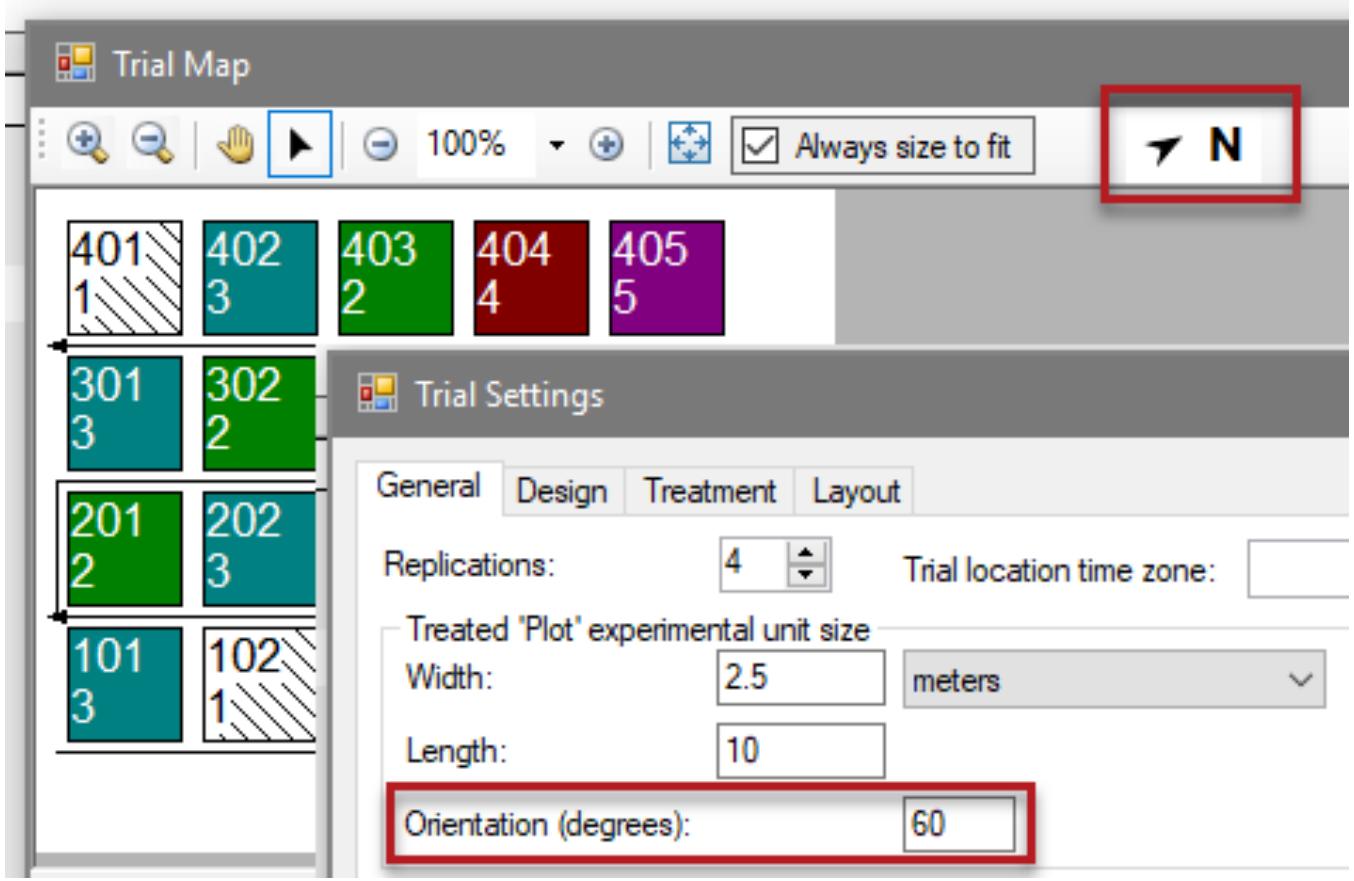
Type Personal List (C:\ProgramData\ARMdef\GDMdef\G-TrtTyp.lst)

Type	Description
CULT	Cultural practice
DEFO	Defoliant: herbicidal chemical sprayed or dusted causing leaves to fall off
FERT	Fertilizer

Trial Map

Orientation

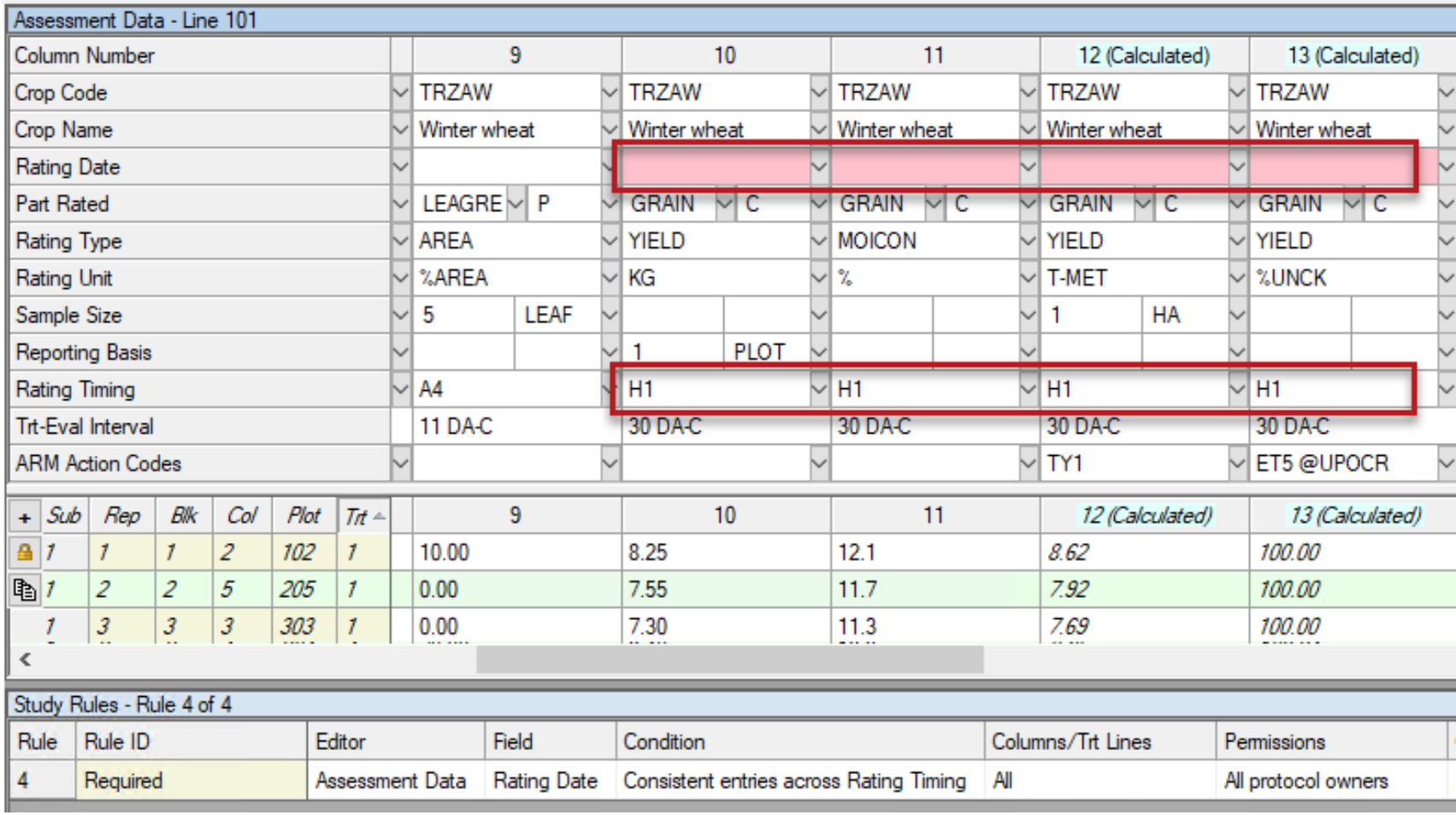
- Display orientation from North on Trial Map
- Orientation entered in General Settings
  - *Number of degrees from North for the left edge of the trial*



Study Rules

Consistent entries across Rating Timing

- New study rule
- Auto-fills and maintains same entry in chosen field, across the same Rating Timing value



Assessment Data - Line 101

Column Number	9	10	11	12 (Calculated)	13 (Calculated)
Crop Code	TRZAW	TRZAW	TRZAW	TRZAW	TRZAW
Crop Name	Winter wheat	Winter wheat	Winter wheat	Winter wheat	Winter wheat
Rating Date					
Part Rated	LEAGRE P	GRAIN C	GRAIN C	GRAIN C	GRAIN C
Rating Type	AREA	YIELD	MOICON	YIELD	YIELD
Rating Unit	%AREA	KG	%	T-MET	%UNCK
Sample Size	5 LEAF			1 HA	
Reporting Basis		1 PLOT			
Rating Timing	A4	H1	H1	H1	H1
Trt-Eval Interval	11 DA-C	30 DA-C	30 DA-C	30 DA-C	30 DA-C
ARM Action Codes				TY1	ET5 @UPOCR

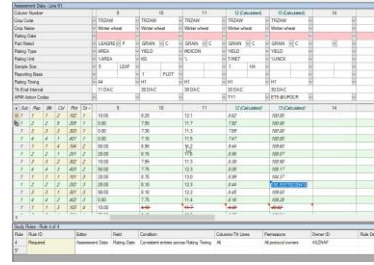
Sub	Rep	Blk	Col	Plot	Trt	9	10	11	12 (Calculated)	13 (Calculated)
1	1	1	2	102	1	10.00	8.25	12.1	8.62	100.00
1	2	2	5	205	1	0.00	7.55	11.7	7.92	100.00
1	3	3	3	303	1	0.00	7.30	11.3	7.69	100.00

Study Rules - Rule 4 of 4

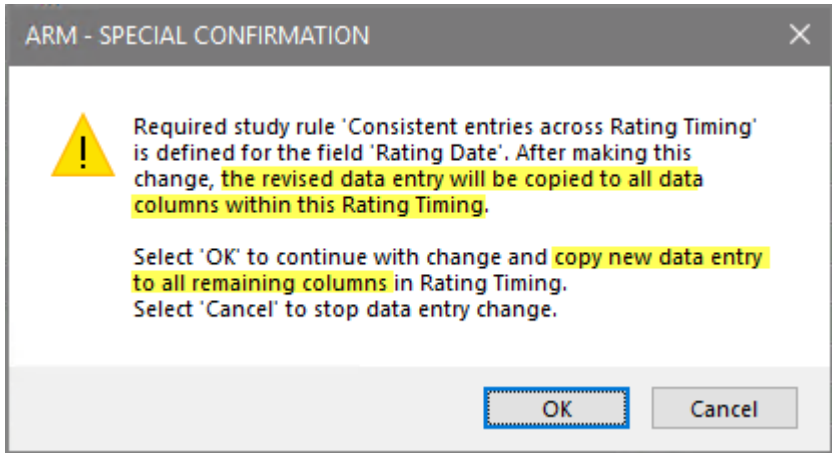
Rule	Rule ID	Editor	Field	Condition	Columns/Trt Lines	Permissions
4	Required	Assessment Data	Rating Date	Consistent entries across Rating Timing	All	All protocol owners

Consistent entries across Rating Timing

Feature in Action:



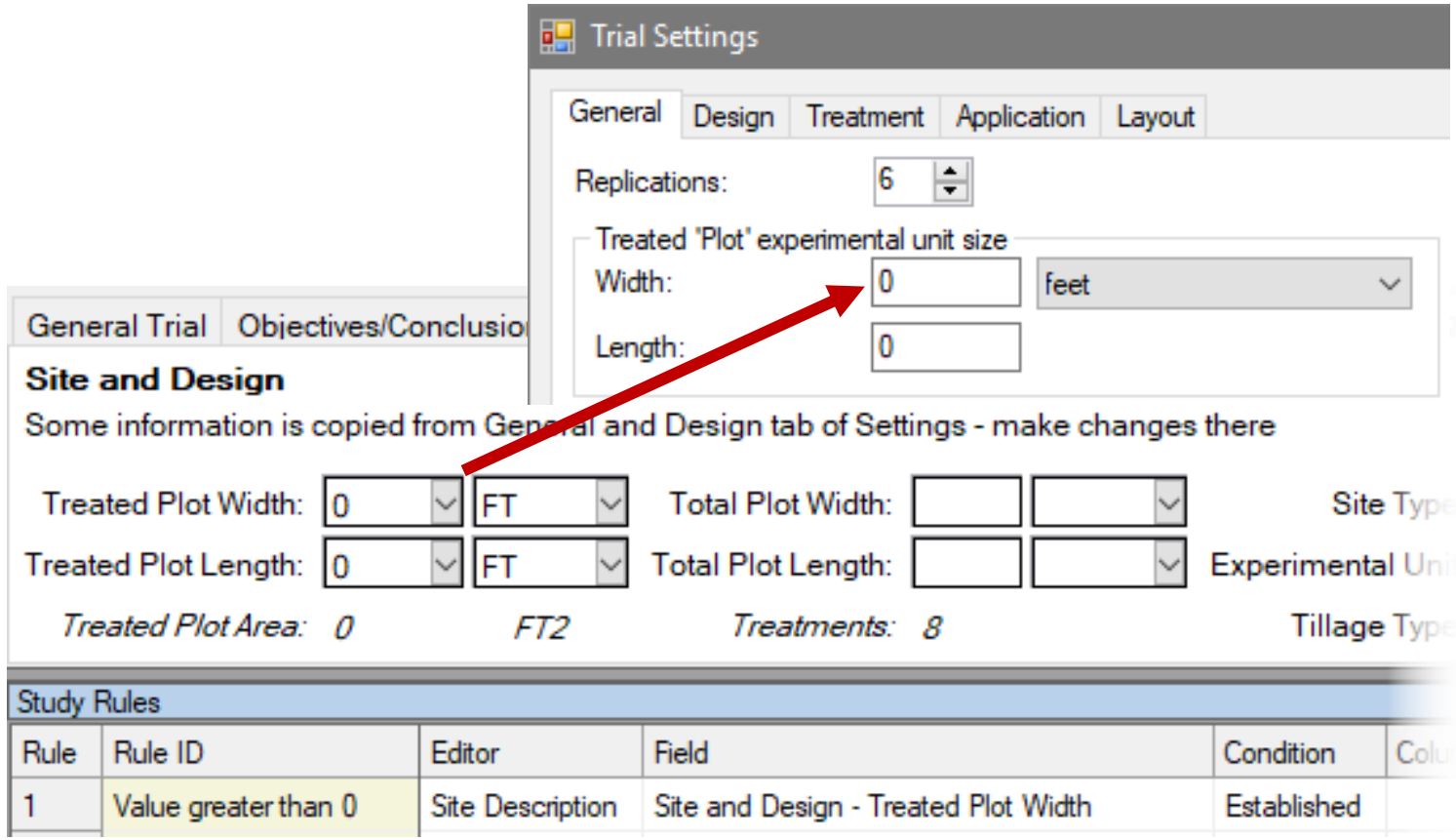
- Useful for fields that cannot differ at a single Rating Timing
- E.g. Rating Date, Crop information



Rating Date			Jul-3-2019		Jul-3-2019		Jul-3-2019		Jul-3-2019			
Part Rated	LEAGRE	P	GRAIN	C	GRAIN	C	GRAIN	C	GRAIN	C		
Rating Type	AREA		YIELD		MOICON		YIELD		YIELD			
Rating Unit	%AREA		KG		%		T-MET		%UNCK			
Sample Size	5	LEAF					1	HA				
Reporting Basis			1	PLOT								
Rating Timing	A4		H1		H1		H1		H1			
Trt-Eval Interval	11 DA-C		30 DA-C		30 DA-C		30 DA-C		30 DA-C			

Value greater than 0

- New study rule
- Require that a 'real' entry is entered when available
- Useful for fields that are auto-filled from Settings, so cannot leave blank



Permissions

- The default permissions is now "Everyone in my company" for new rules
- Easier for colleagues to also edit study rules, not just the study owner

Study Rules

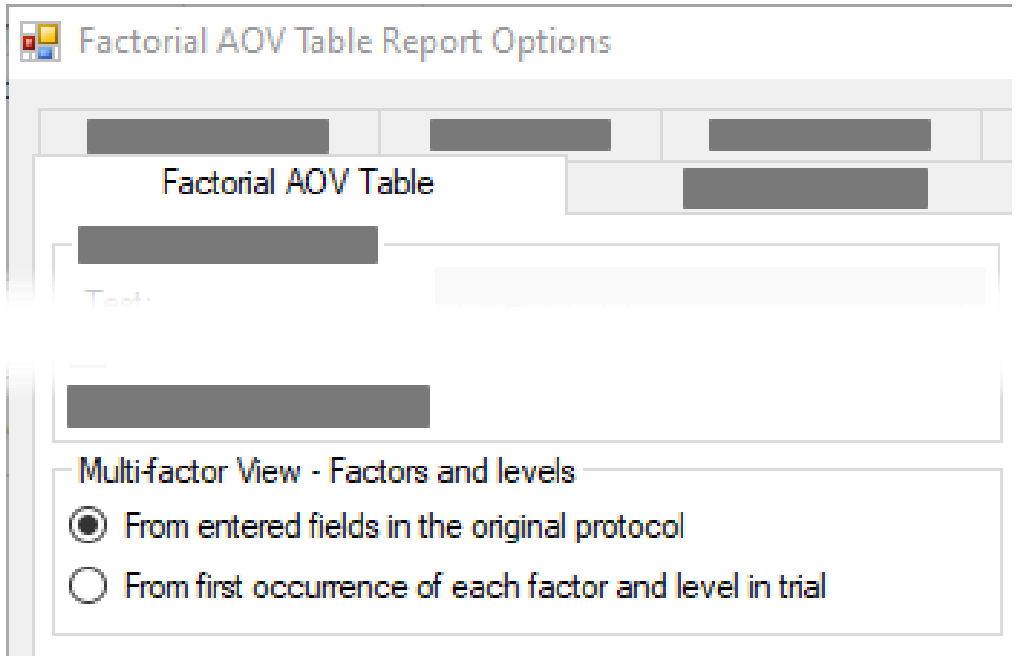
Rule	Rule ID	Editor	Field	Condition	Permissions
1	Limit validation list	Assessment Data Header	Crop & Pest in Site Description	Always	Everyone in my company

- *Note: ARM remembers the last Permissions chosen when adding new rules, so this default applies mainly to new installations*

Print Reports

Factorial AOV Table

- New **Multi-factor View** option
- Factors and levels printed:
  - Only information that was entered in original protocol
  - How they are currently entered in the trial



Trial Fact Sheet

- New report provides a trial synopsis
- Useful for trial tours, overview

PROTOCOL ID: G-All7_Fung

AUTHOR: Your Name **TRIAL ID:** G-All7_Fung

ORGANIZATION NAME: New Company

TITLE: An assessment of the efficacy of TUB and other fungicides for the control of Septoria Diseases in Soybeans

OBJECTIVES:

SITE INFORMATION:

Location: Gembloux

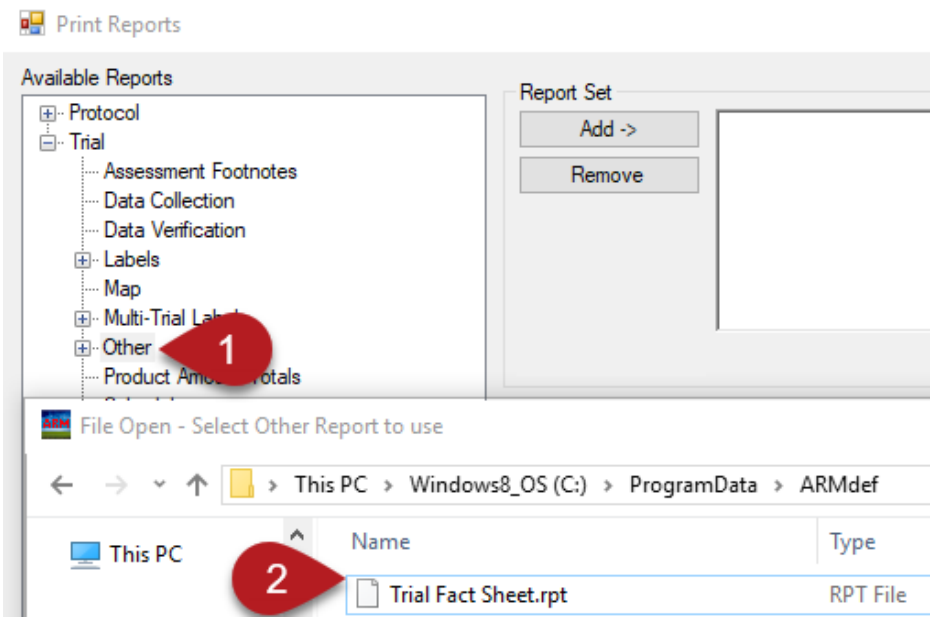
ADDRESS:

GEMBLOUX, NAMUR

SOIL TEXTURE: CL TILLAGE TYPE:

PLOT WIDTH: 2.5 m REPS: 4

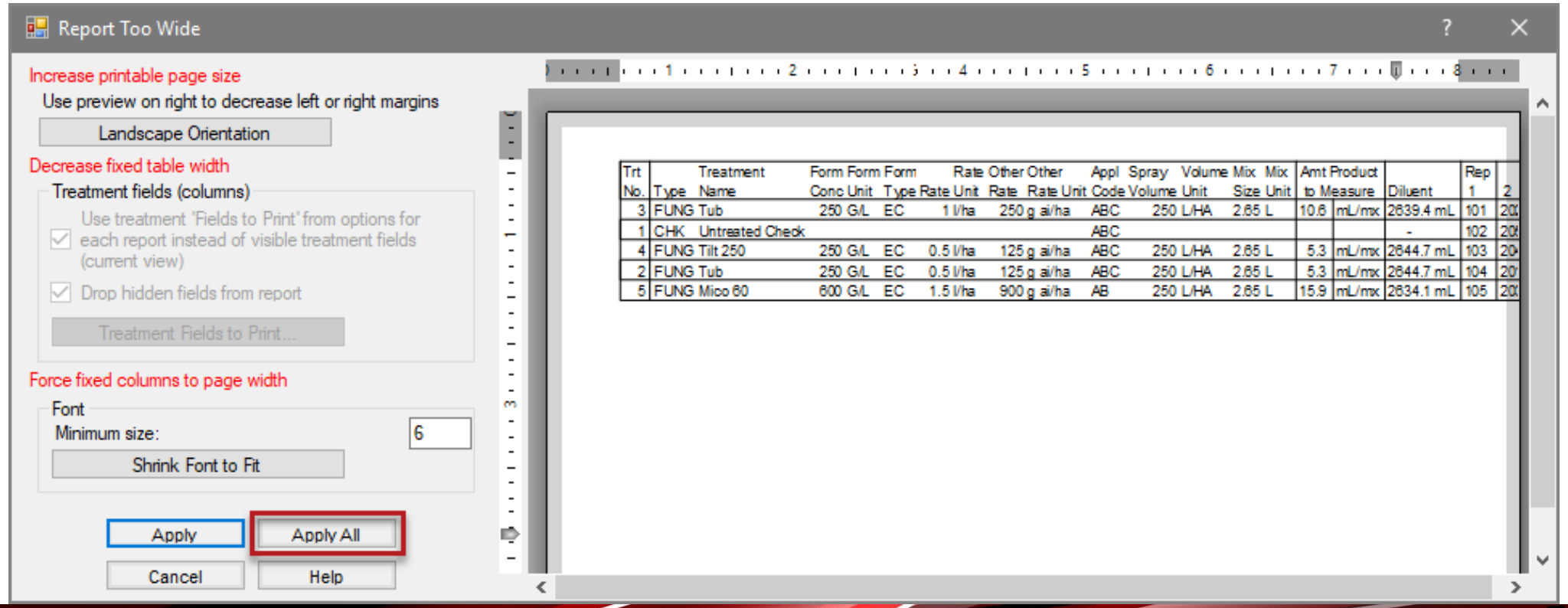
PLOT LENGTH: 10 m TREATMENTS: 5



1. Select 'Other' in Available Reports
2. Load *Trial Fact Sheet.rpt* from ARMdef folder

Report Too Wide

- **Apply All** button added to apply changes to all pages in report.
- Previously dialog appeared *for every* page.



Protocol Instructions

- Always include Protocol Instructions on Site Description reports
- Use 'Selected Tabs' report to hide these

(G-All7 Herb) Site Description Page 1 of 1

Gylling Data Management, Inc.

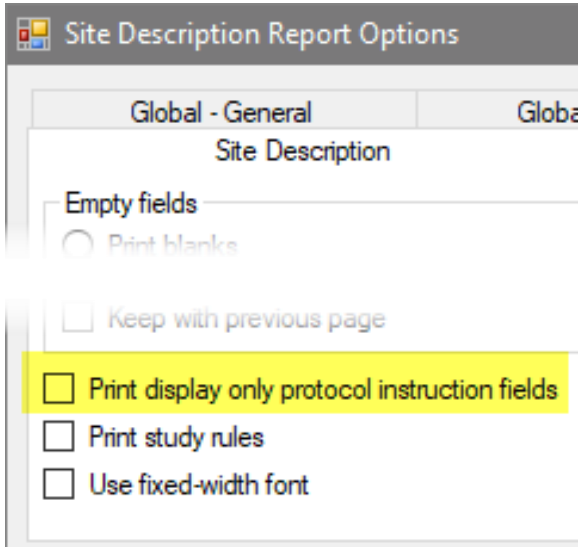
Determination of the efficacy and lowest effective dose rate of HERB 1 against monocotyle and volunteer grass weeds in Winter Rape when applied in Spring

Trial ID: G-All7_Herb Location: GERMANY Trial Year: 2014
Project ID: Dicamba Study Director: R.E. Cearch

Geographic Area/Environmental Considerations:
Typical area for the crop. Preceding crop preferably Winter wheat

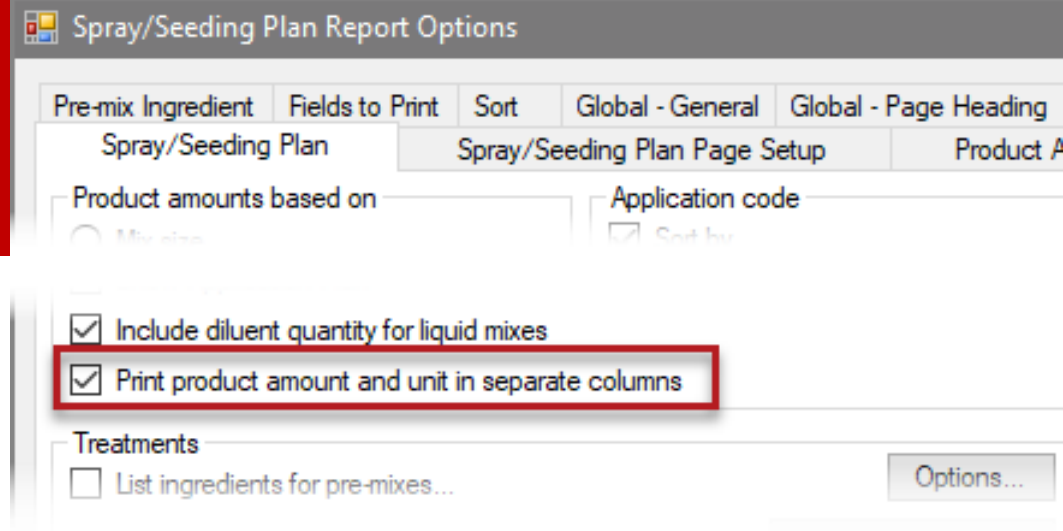
Cropping Considerations:
- Minimum tillage sites preferred
- Cultural conditions have to be uniform for all plots. The conditions in the trial should be conform and representative for the cultivation of the crop in the region.
- Report all other treatments in detail in the "crop maintenance" section of the DAT file.

Data to Collect:
Provide weather data as follows (min. requirement):
as from 1 day before application up to the final assessment average, main and max temperature and precipitation on a daily basis. => Data from the nearest weather recording station should be attached as a file in standard format (for



- No more need for option to include the fields

Spray/Seeding Plan



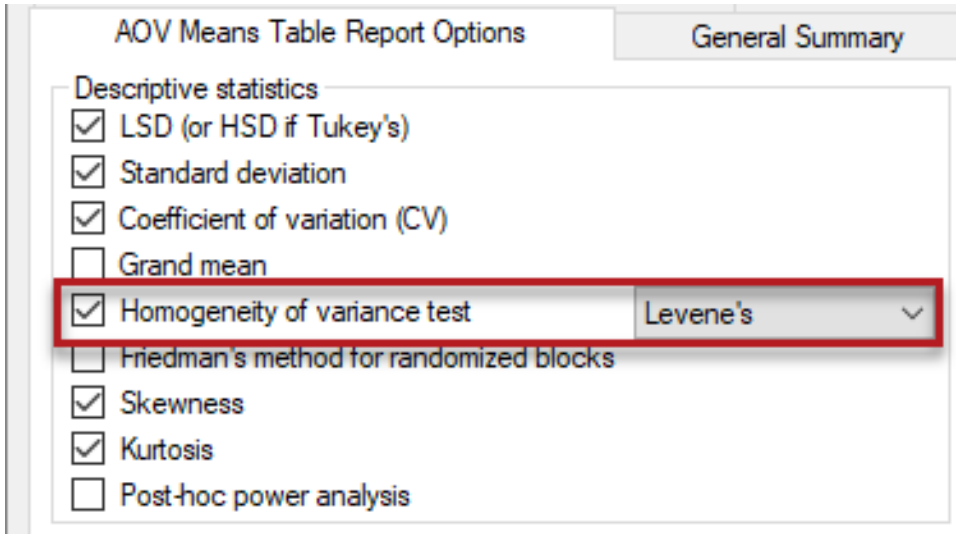
- Added option to print product amounts and units in separate columns.

Reps: 4 Appl Code: A Plots: 2.5 by 10 meters
Spray vol: 250 L/ha Mix Size: 2.65 L (total for 4 plots; minimum=2.5 L

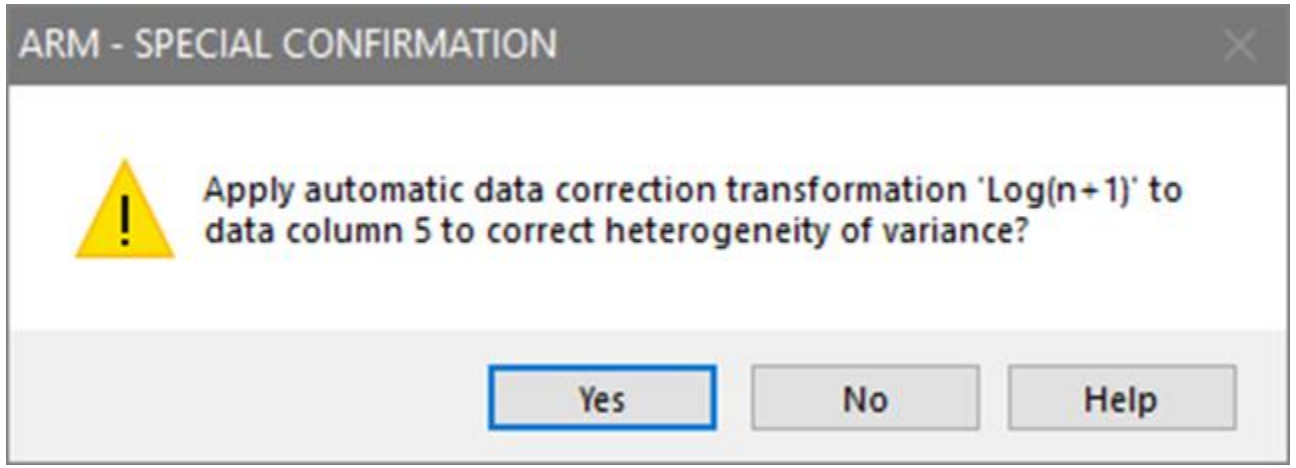
Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate	Rate Unit	Amt Product to Measure		Rep 1	2	3	4
3	Tub	250	G/L	EC	1	l/ha	10.6	mL/mx	101	202	301	402
4	Tilt 250	250	G/L	EC	0.5	l/ha	5.3	mL/mx	103	204	305	404
2	Tub	250	G/L	EC	0.5	l/ha	5.3	mL/mx	104	201	302	403
5	Mico 60	600	G/L	EC	1.5	l/ha	15.9	mL/mx	105	203	304	405

- Useful when printing to Excel, so amounts are in a separate column.

AOV Means Table



- Levene's homogeneity of variance test is now used for verifying assumptions of AOV to suggest data corrections to apply



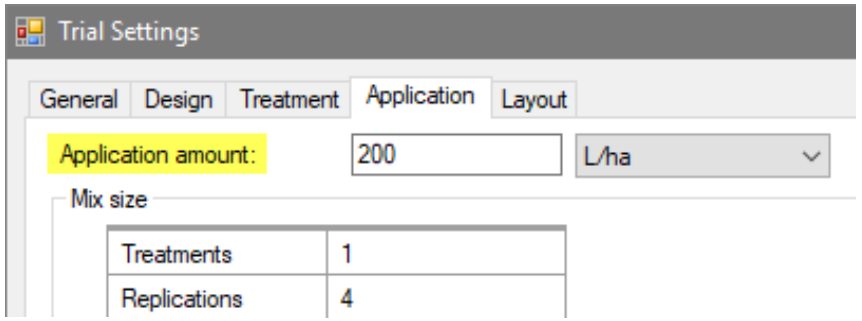
- Previously Bartlett's was used in check, regardless of option selection

ARM Window

Spray Volume

- Renamed to **Application Amount** to be more generic for all treatment/application types

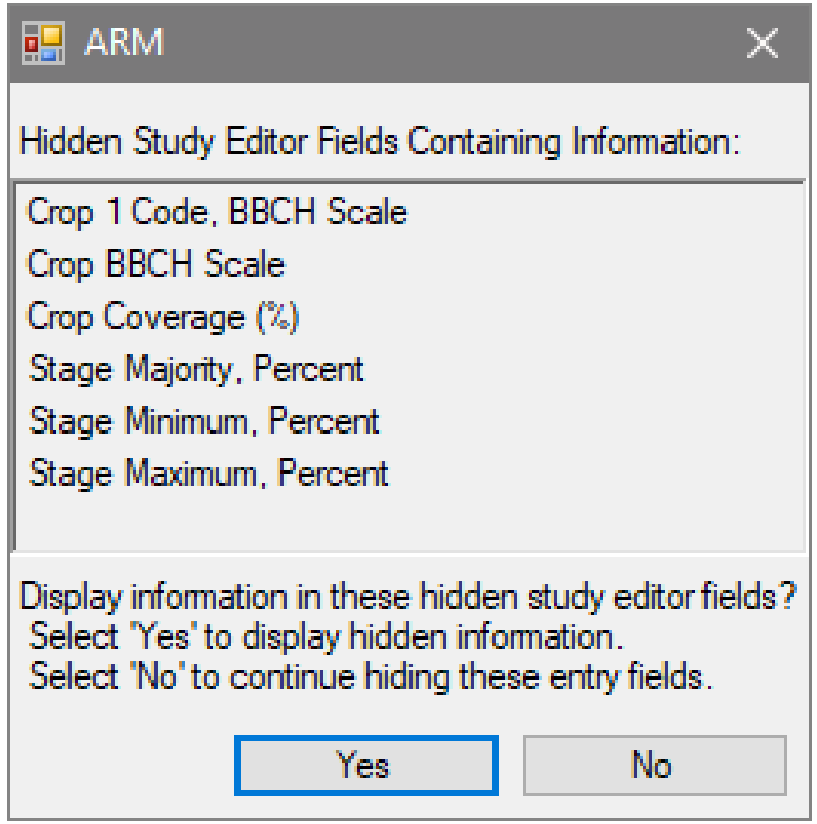
Appl Code	*Appl Amount*	*Amount Unit*	*Mix Size*	*Mix Unit*
ABC	*250*	*L/HA*	*2.65*	*Liters*
ABC	*250*	*L/HA*	*2.65*	*Liters*



	A		B	
Appl. Equipment	AZO		AZO	
Equipment Type				
Water Hardness (ppm CaCO3)				
Application Amount	250	L/HA	250	L/HA
Mix Overage	150	mL	150	mL
Mix Size	2.65	L	2.65	L

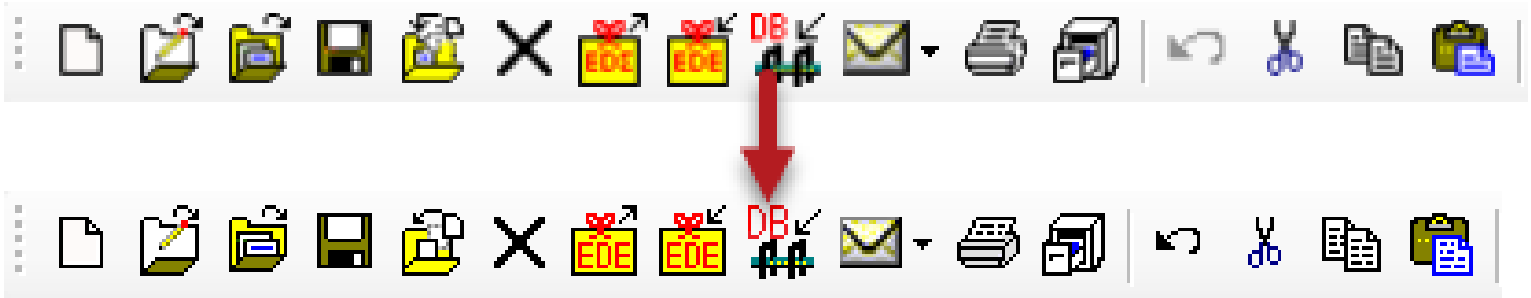
Hidden fields with info

- Automatically show fields that are hidden from view, but contain information
- Eliminates prompt when opening a study
- Ensures that all information is conveyed when opening a file for the first time



Toolbar

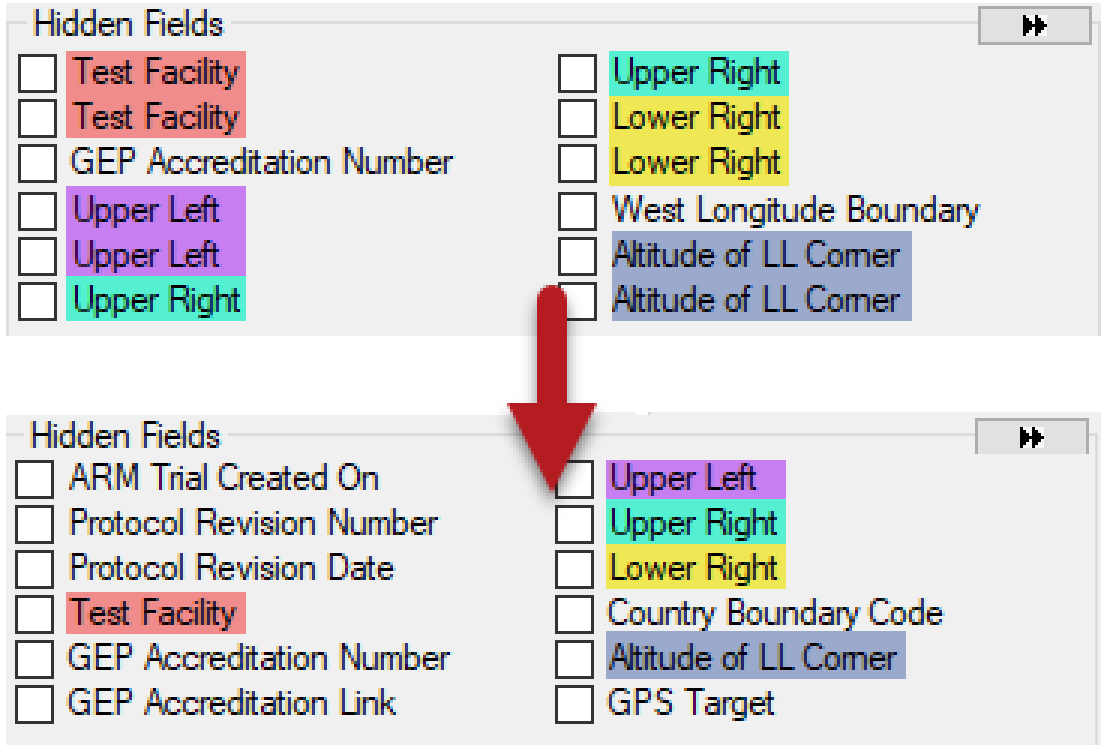
- Improved the appearance of toolbar buttons



- Cleaned up some missing pixels so we can actually tell what the image is supposed to be!

Properties Panel

- Field pairs display as single checkbox in Hidden Fields list
  - Value + Unit fields
  - Code + Description fields

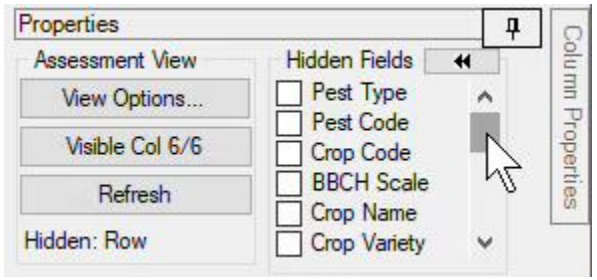


Treatments, Protocol/Site Description, Assessment Data editors

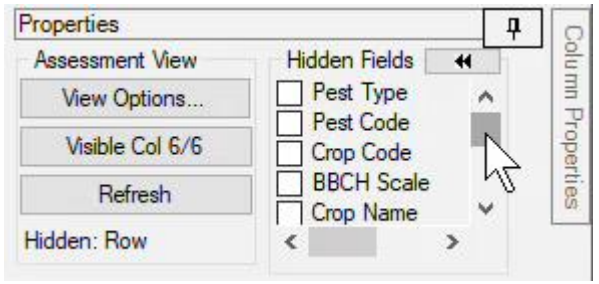
Hidden Fields

- Do not scroll back to the top of the list when selecting a field.
- Now much easier to make multiple fields visible at a time

Before:



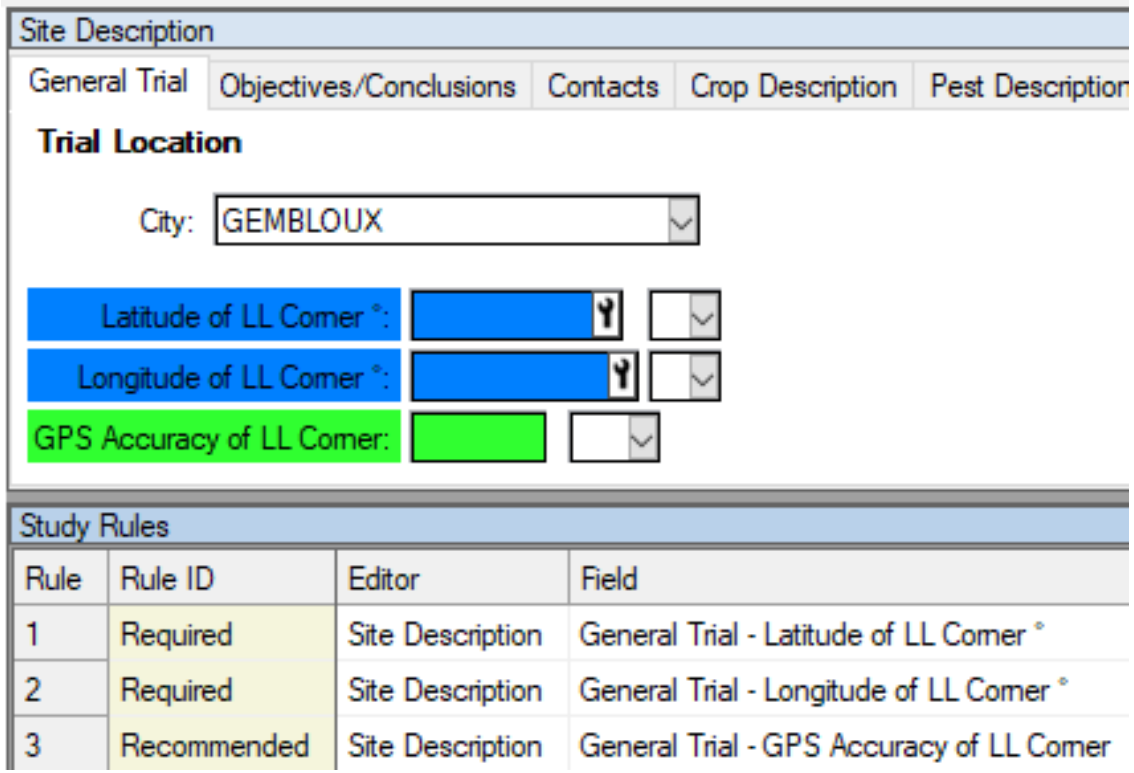
After:

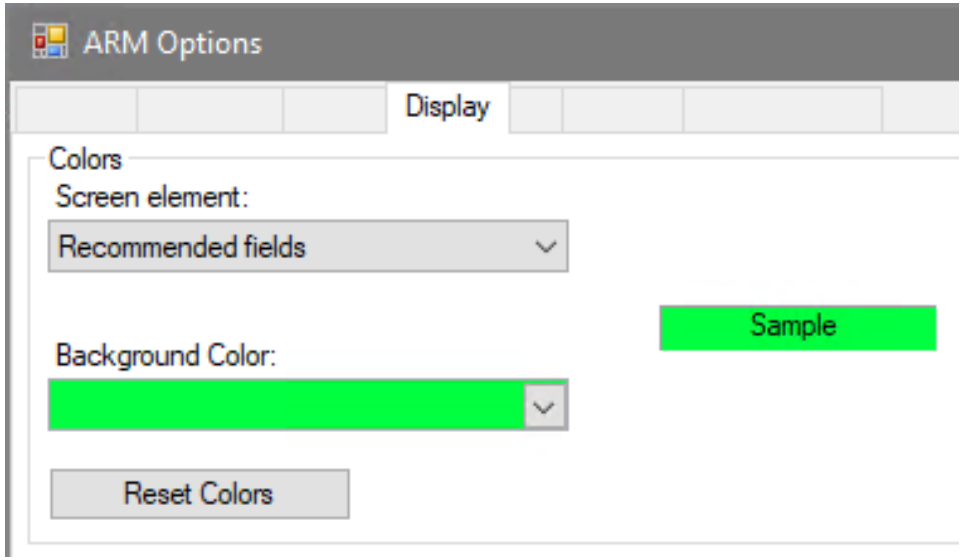


Display Options

Change rule colors

- Change the background color of required and recommend fields





- Tools > Options > Display tab > Colors

Font color fix

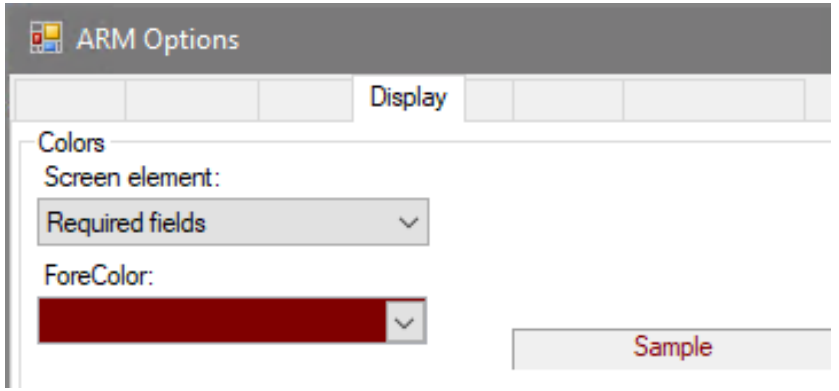
- Font Color option for Required fields now only applies to always-required fields (found in some customizations)

Treatments - Line 13

Trt Line	Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Description	Rate	Rate Unit	Other Rate	Other Rate Unit	Appl Code
2	2	FUNG	Tub	250	G/L	EC		0.5	L/ha	125	g A/ha	ABC
3	3	FUNG	Tub	250	G/L	EC		1	L/ha	250	g A/ha	ABC
4	4	FUNG	Tilt 250	250	G/L	EC		0.5	L/ha	125	g A/ha	ABC
5	5	FUNG	Mico 60	600	G/L	EC		1.5	L/ha	900	g A/ha	AB
6	5	FUNG	Fungol	200	G/L	S		1.25	L/ha	250	g A/ha	C
7												

Trt Line	Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Description	Rate	Rate Unit	Other Rate	Other Rate Unit	Appl Code
2	2	FUNG	Tub	250	G/L	EC		0.5	L/ha	125	g A/ha	ABC
3	3	FUNG	Tub	250	G/L	EC		1	L/ha	250	g A/ha	ABC
4	4	FUNG	Tilt 250	250	G/L	EC		0.5	L/ha	125	g A/ha	ABC
5	5	FUNG	Mico 60	600	G/L	EC		1.5	L/ha	900	g A/ha	AB
6	5	FUNG	Fungol	200	G/L	SC		1.25	L/ha	250	g A/ha	BC

- Previously other field pairs were also colored

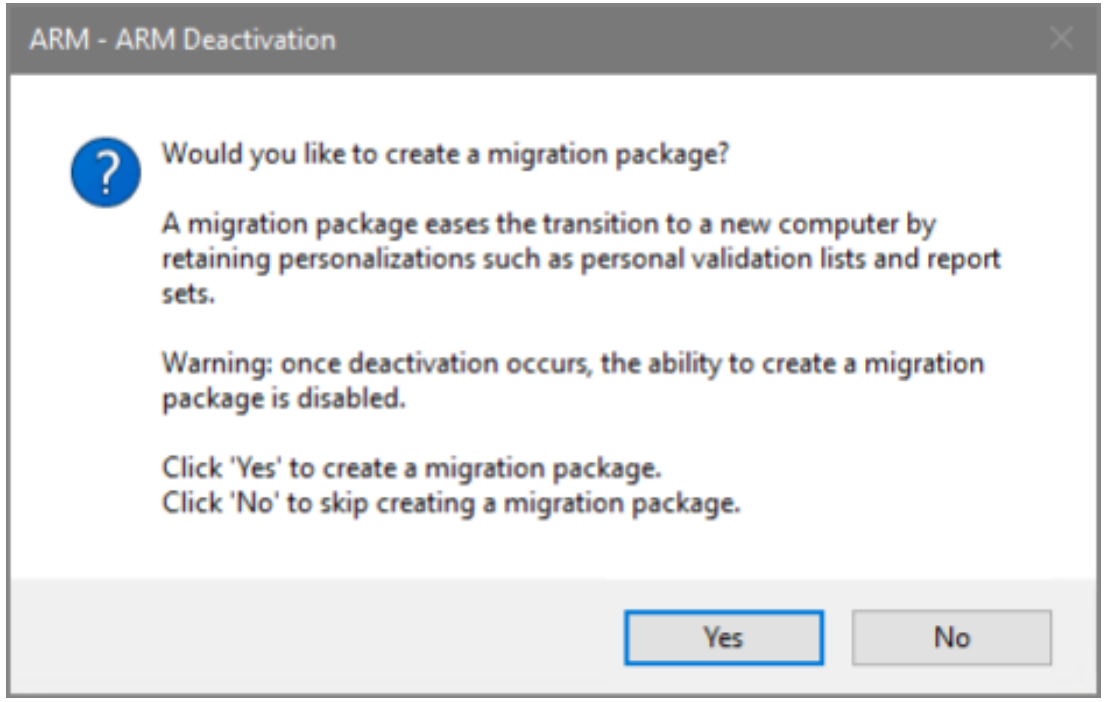


Migrate Settings

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.