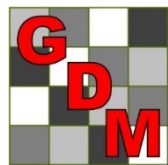




ARM 2018 Enhancements

NAICC 19th Tips & Techniques

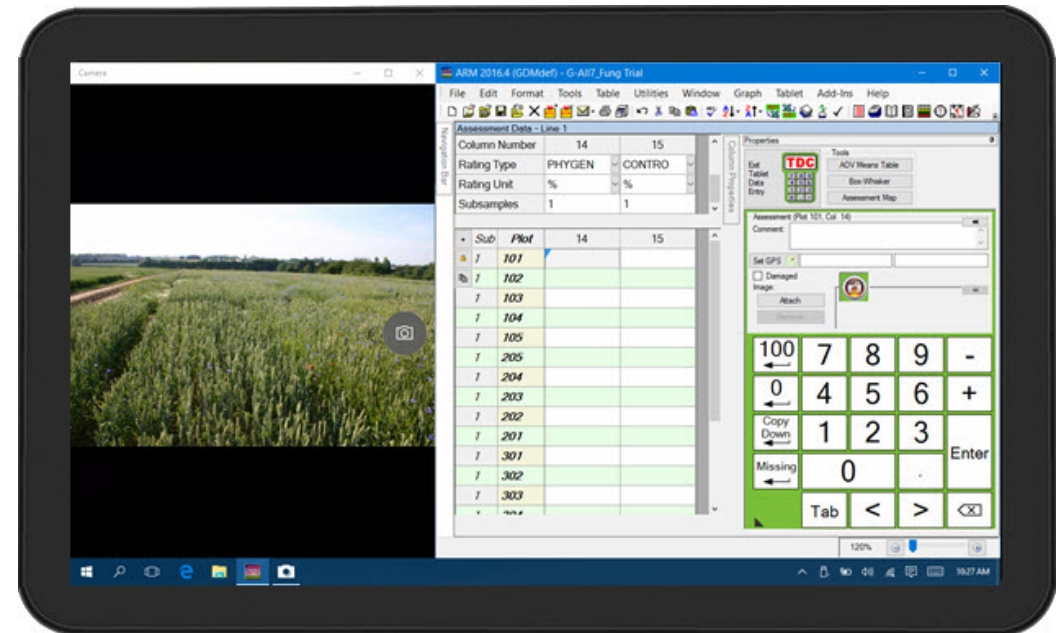


Gylling Data Management, Inc.

Introducing TDCx

TDCx is a new ARM add-in that includes Tablet Data Collector (TDC) features for:

- An activated ARM license serial number
- TDCx installs onto the same computer as ARM



The "x" in "TDCx" indicates that you:

Purchase a Windows tablet or touch-enabled laptop computer of your choice

Install and activate your ARM license on this computer - either:

- Transfer current ARM license to this computer and purchase TDCx, or
- Purchase an **ARM Field license**, an ARM Technician license plus TDCx



Choose your own hardware

GDM recommends the following for the minimal requirements to use TDCx:

- Windows 10
- 64+ GB internal storage
- 4+ GB RAM
- Touch screen
- Sunlight-readable display/screen protector
- Stylus or digitizer pen

Hardware not meeting the above may not perform as intended.

Choose your own hardware

In addition, core TDCx functions require certain hardware features.

To back up data and pictures:

- SD card or low-profile flash drive



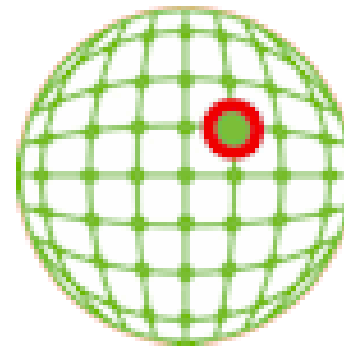
For taking plot pictures:

- Rear-facing camera, 6+ megapixel



To capture GPS coordinates:

- Integrated GPS



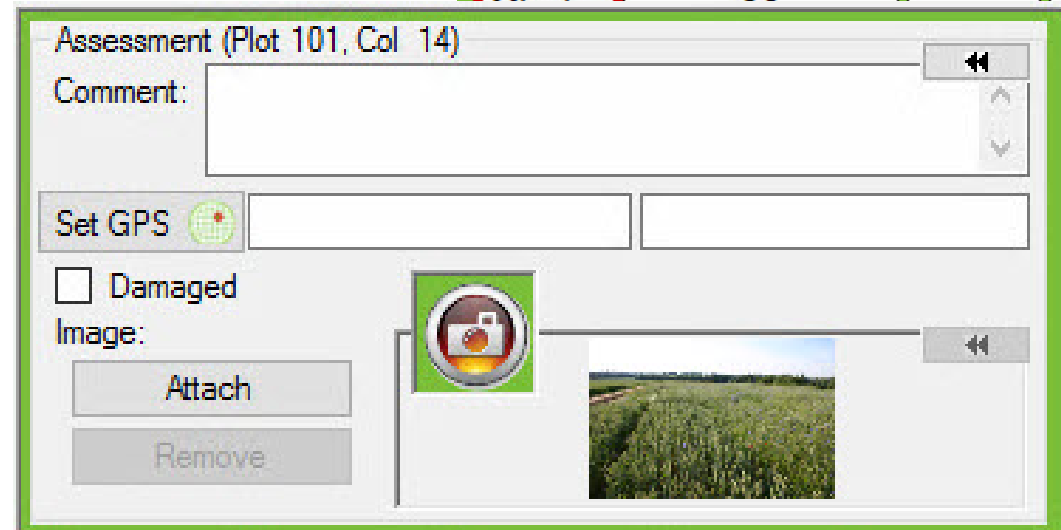
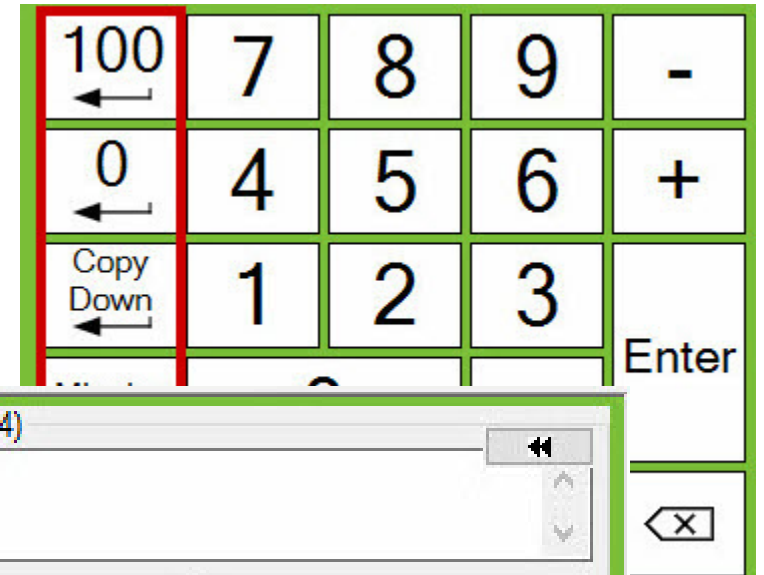
Other hardware considerations

- **Ruggedized units** are built to handle the tough conditions in a field
- **Battery life** for all-day data collection (tradeoff – weight)
- **Hand-strap** or **carrying case** to fight fatigue

- Using unit for more than just data collection:
 - **Processor power/speed** to run multiple programs at once
 - **Docking station** with second monitor

New name, same TDC features

- **Optimized display**
 - Touch keypad, pinch-to-zoom, align Camera app
- **Efficient** data collection
 - Single key-press entry, cursor order
 - Range checking for assessed values
- **Directly record GPS coordinates**
 - At plot and/or trial level



TDCx features, cont'd

Take plot pictures

- Copies image file to trial folder
- Renames image file
- Attaches image to current plot in ARM

The screenshot displays the ARM software interface. On the left, a table titled 'Assessment Data - Line 31' shows details for a plot. On the right, a window titled 'Assessment (Plot 104, Col 2)' shows a photograph of a field.

Column Number	2
Crop Name	Winter wheat
Part Rated	PLANT C
Rating Date	Jul-15-2014
Rating Type	VIGOR
Rating Unit	%
Subsamples	1

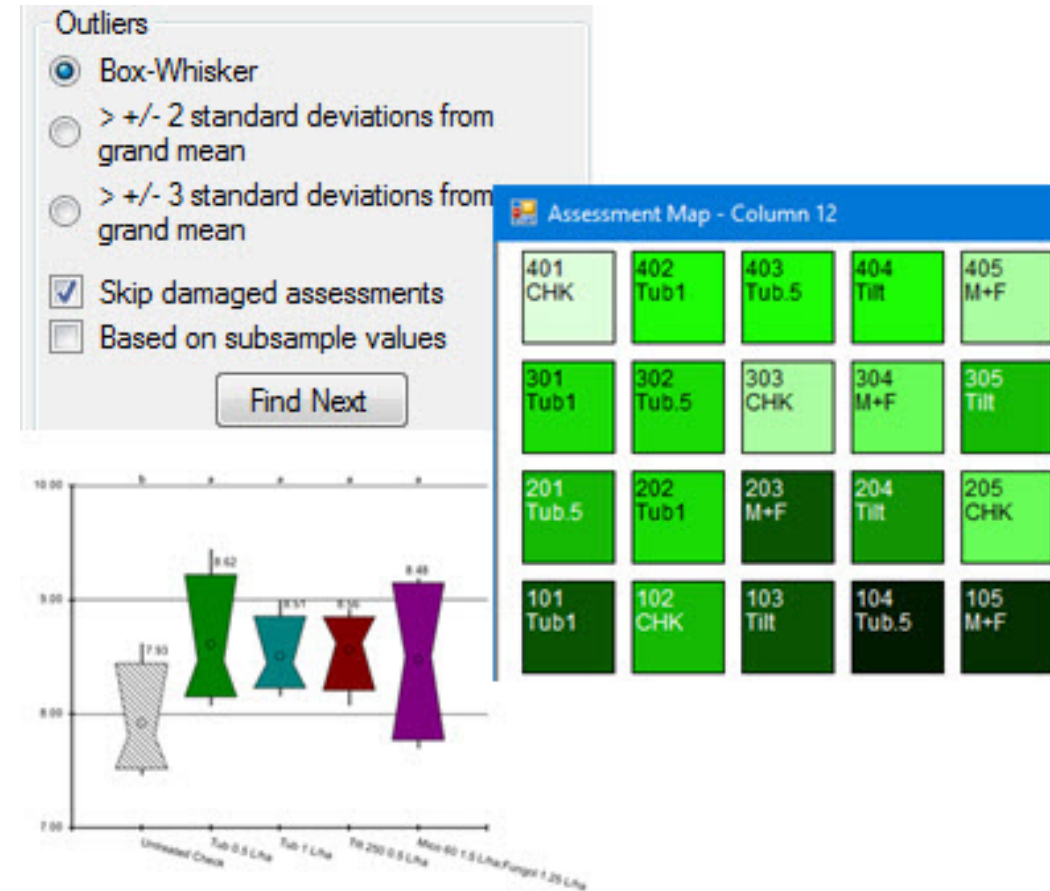
+ Sub	Plot	
1	101	100
1	102	100
1	103	50
1	104	100
1	105	
1	205	
1	204	
1	203	
1	202	

The photograph on the right shows a wide view of a green field with a dirt path on the left, under a clear sky.

TDCx features, cont'd

Improve **assessment quality** –
review data while still on site

- Check for outliers
- 'Heat map' of assessment values
- Box-whisker graph



Ordering TDCx

- Purchase **Field license bundle** – ARM Technician license plus TDCx features
 - Technician license – features focus on data entry, day-to-day tasks in trial; lower cost
- For all ARM features on data collector unit, purchase **Full license + TDCx**
- To use your data collector as your main ARM:
 - **Add TDCx** to existing ARM license, and
 - Transfer ARM activation to the unit





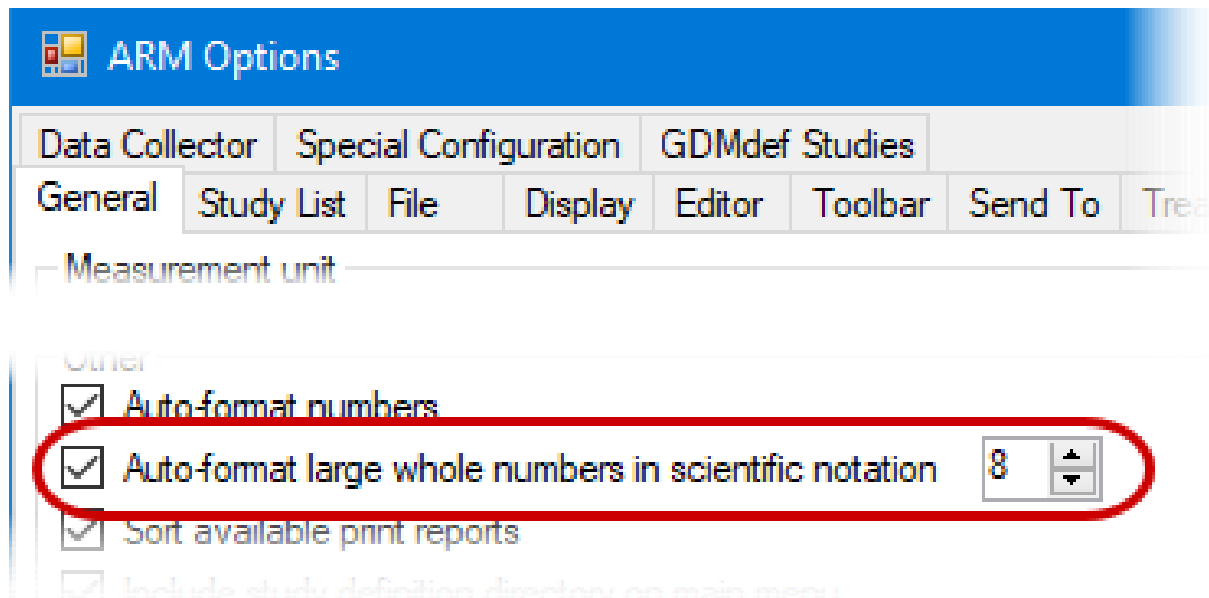
GDM Products Order Form

Please Note: Any field with an asterisk * is required to submit this form.

* Action	* Item
<p><input checked="" type="radio"/> New ARM license Order your first or additional new ARM license</p> <p><input type="radio"/> Add features Order add-ins for an existing license</p> <p><input type="radio"/> Upgrade Upgrade license to include all ARM features</p> <p><input type="radio"/> Reassign Change name on license to someone else</p> <p><input type="radio"/> Maintenance Request maintenance invoice or update contact info</p>	<p><input checked="" type="checkbox"/> ARM</p> <p><input type="radio"/> Full license Includes all available ARM features.</p> <p><input checked="" type="radio"/> Field license bundle Includes technician license plus Tablet Data Collector (TDCx) add-in. - Offers only features for persons setting up trials in the field and doing assesments. - Maximum of 2 Field bundles per each Full ARM license. - The full license holder creates trials and supports technician questions.</p> <p><input type="radio"/> Graduate student bundle ARM license for graduate student use, includes Table Data Collector (TDCx) add-in.</p> <p>Add-ins</p> <p><input type="checkbox"/> ST Summary across Trials (ST) is only available with a Full ARM license.</p> <p><input checked="" type="checkbox"/> TDCx Tablet Data Collector (TDCx) features are automatically included with this bundle. Recommended Minimum Hardware Requirements</p>

Auto-format large whole numbers in scientific notation

New option on General ARM Options tab to display large numbers on Treatments and Site Description editors in **scientific notation**.



Type	Treatment Name	Form Conc	Form Unit	Form Type
INSE	Test CFU	2570000000	CFU/ml	SC

Type	Treatment Name	Form Conc	Form Unit	Form Type
INSE	Test CFU	2.57E9	CFU/ml	SC

New Site Description fields

Minimum Mix/Treatment

Displays the minimum mix size needed for 1 treatment

Mix Overage

Specify the portion of the Mix Size that is the overage for each application

Application Equipment

		A	
Appl. Equipment:	AZO		▼
Equipment Type:			▼
Current:			▼
Spray Volume, Unit:	250	L/HA	▼
Minimum Mix/Treatment:	2.5	liters	
Mix Overage, Unit:	150	mL	▼
Mix Size, Unit:	2.65	liters	▼

Mix Size Calculator

Calculate mix size based on current application settings

Press the Tool button in Mix Size field to open this dialog

Define **overage** so ARM can better auto-calculate product amounts

- Specify in mL* or %
- * Recommended so ARM can better auto-adjust mix size in trials for multi-treatment applications or canopy height changes

Mix Size Calculator - Application A

Application volume: 200 L/ha

Mix Size

Treatments	1
Replicates	4
'Plot' EU size	38.75 m2
Application volume	200 L/ha
Mix size unit	liters
Minimum	3.1 liters
Overage	450 mL
Calculated mix size:	3.55 liters

User-defined mix size: 3.6 liters

OK Cancel

Mix Size, Unit: 3.6 liters

Application Plan

Display all fields necessary for mix size and leaf wall area calculations.

Display from:

- Treatments editor
- Protocol/Site Description editor
- Spray/Seeding Plan report

Application Plan

Selected Applications	<input checked="" type="checkbox"/> A	<input type="checkbox"/> B	<input type="checkbox"/> C	<input type="checkbox"/> D	<input type="checkbox"/> E	<input type="checkbox"/> F
Settings						
Treated Plot Width	3.1 m	3.1 m	3.1 m	3.1 m	3.1 m	3.1 m
Treated Plot Length	12.5 m	12.5 m	12.5 m	12.5 m	12.5 m	12.5 m
Replications	4	4	4	4	4	4
Crop Information						
Crop	1 MABSD	1 MABSD	1 MABSD	1 MABSD	1 MABSD	1 MABSD
Row Spacing, Unit	3.10 M	3.10 M	3.10 M	3.10 M	3.10 M	3.10 M
Rows per Plot						
Treated Canopy Height, Unit	2 m	2.5 m	2.5 m	2.5 m	2.5 m	2.5 m
Total Canopy Height, Unit						
Treated Leaf Wall Area, Unit	12903 m ² /ha	16129 m ² /ha	16129 m ² /ha	16129 m ² /ha	16129 m ² /ha	16129 m ² /ha
Treated Leaf Wall Area per Plot, Unit	50 m ² /plot	63 m ² /plot	63 m ² /plot	63 m ² /plot	63 m ² /plot	63 m ² /plot
Application Information						
Application Date	Apr-2-2014	Apr-12-2014	Apr-23-2014	May-3-2014	May-12-2014	May-21-2014
Row Sides Applied	2	2	2			2
Spray Volume, Unit	200 L/ha	200 L/ha	200 L/ha			200 L/ha
Mix Overage, Unit	450 mL	450 mL				
Calculated Mix Size, Unit	3.55 liters	3.55 liters	3.5			3.5 liters
Mix Size, Unit	3.6 liters	3.9 liters				

Trt Line	Trt No.	Type	Treatment Name	Form Conc	Form Unit	Form Type	Specific Gravity	TGW g/100	Rate	Rate Unit	Other Rate	Other Rate Unit	Min # Appl	Appl Code	Crop ID Number
2	2	FUNG	Cyprodinil	750	G/KG	WG			0.20	kg/10000 m2 LWA				A-I	
3	3	FUNG	Cyprodinil	750	G/KG	WG			0.30	kg/10000 m2 LWA				A-I	
4	4	FUNG	Dodine 544 SC						0.05	L/ha/m CH				A-I	
5	5	FUNG	Syllit							L/10000 m2 LWA				A-I	
6	6	FUNG	Syllit							L/10000 m2 LWA				A-I	
7	7	FUNG	Cyprodinil							kg/10000 m2 LWA				A-I	
8	8	FUNG	Cyprodinil	750	G/KG	WG			0.75	kg/10000 m2 LWA				A-I	
9	9	FUNG	Syllit	400	G/L	SC			1.15	L/ha				A-I	
10	10	FUNG	Syllit	400	G/L	SC			1.5	L/ha				A-I	
11	11	FUNG	Cyprodinil	750	G/KG	WG			0.20	kg/ha				A-I	
12	12	FUNG	Cyprodinil	750	G/KG	WG			0.30	kg/ha				A-I	
1	1	CHK	Untreated												
15															

Adjust mix size and product amounts for Treated Canopy Height when LWA Application Volume unit is selected and there is a calculated Leaf Wall Area
 Identify entered Mix Sizes that are different from Calculated Mix Size +/- 5.0 %

Help Cancel Next



Adjust product amounts for LWA

New option to adjust product amounts for Leaf Wall Area

- when LWA Application Volume unit is selected,
- and there is a calculated Leaf Wall Area

Application Plan				
Applications	A	B	C	D

Properties

- Copy protocol Application Plan information to created trial(s)
- Adjust mix size and product amounts for Treated Canopy Height when LWA Application Volume unit is selected and there is a calculated Leaf Wall Area
- Identify entered Mix Sizes that are different from calculated mix size +/- 5.0 %

Leaf Wall Area in a protocol

Treated Leaf Wall Area not calculated in an ARM protocol

Enter an *estimate* of Leaf Wall Area instead

Press F9 for list of common estimated LWA values:

Crop Stage At Each Application

Treated Leaf Wall Area, Unit:		A					
Treated Leaf Wall Area, Unit Master List (LeafWallArea)							
Treated	Treated	Crop	Scientific Name	Crop Group	Category	Country	Mode LWA
25000	m2/ha	Stone fruits	Prunus sp.	12	high	PL, SK, UK	20000<
45000	m2/ha	Tomato in greenhouse	Solanum lycopersicum	8	low	PL, UK, DE,CZ, HU	35000-45000
65000	m2/ha	Tomato in greenhouse	Solanum lycopersicum	8	middle	AT	45000-65000

Leaf Wall Area in a protocol

Information on Application Plan is not copied to the trial by default

- The trialist needs to fill in the fields with actual data

Select 'Copy protocol Application Plan information to created trial(s)' option if entered LWA-related values are the same in the trial

Application Plan				
Applications	A	B	C	D

Properties

- Copy protocol Application Plan information to created trial(s)
- Adjust mix size and product amounts for Treated Canopy Height when LWA Application Volume unit is selected and there is a calculated Leaf Wall Area
- Identify entered Mix Sizes that are different from calculated mix size +/- 5.0 %

Mix Size for LWA

Mix Size is now entered as **total mix** for Leaf Wall Area and Canopy Height treatments,

- Previously was entered as the mix per 10000 m2 LWA, or per 1 meter canopy height.

Mix Size Calculator - Application A

Application volume: L/10000 m2 LWA

Mix Size

for Application	A
Treatments	1
Replicates	4
'Plot' EU size	38.75 m2
Application volume	200 L/10000 m2 LWA
Mix size unit	liters
Minimum	4 L/200 m2 LWA
Overage	<input type="text" value="450"/> mL
<input checked="" type="radio"/> Calculated mix size:	4.45 L/200 m2 LWA
<input type="radio"/> User-defined mix size:	<input type="text" value="4.5"/> liters

Spray/Seeding Plan report changes

When a LWA treatment is present:

- Include the **Treated Leaf Wall Area per Plot**
- The LWA portion of the mix size is now reported as **LWA per treatment**

Reps: 4 Appl Code: A Plots: 3.1 by 12.5 meters **Treated LWA per Plot: 50 m2/plot**
 Spray vol: 200 L/ha Mix Size: 3.5 L/200 m2 LWA (total for 4 plots, includes 400 mL overage)

Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate Rate Unit	Appl Code	Spray Volume Unit	Amt Product to Measure	Diluent	Rep 1	Rep 2
2	Cyprodinil	750 G/KG	WG	lwa	0.20 kg/10000 m2	A-I	200 L/HA	4.516 g/mx	3495.5 mL	102	206
3	Cyprodinil	750 G/KG	WG	lwa	0.30 kg/10000 m2	A-I	200 L/HA	6.774 g/mx	3493.2 mL	101	204
4	Dodine 544 SC	544 G/L	SC	ch	0.85 l/ha/m	A-I	200 L/HA	29.75 mL/mx	3470.3 mL	106	209



Spray/Seeding Plan report changes

- Include the amount of **mix overage** present in the listed mix size

Reps: 4 Appl Code: A Plots: 3.1 by 12.5 meters Treated LWA per Plot: 50 m²/plot
 Spray vol: 200 L/ha Mix Size: 3.5 L/200 m² LWA (total for 4 plots, **includes 400 mL overage**)

Trit No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate Rate Unit	Appl Code	Spray Volume Unit	Amt Product to Measure	Diluent	Rep 1	Rep 2
2	Cyprodinil	750 G/KG	WG	lwa	0.20 kg/10000 m ²	A-I	200 L/HA	4.516 g/mx	3495.5 mL	102	206
3	Cyprodinil	750 G/KG	WG	lwa	0.30 kg/10000 m ²	A-I	200 L/HA	6.774 g/mx	3493.2 mL	101	204
4	Dodine 544 SC	544 G/L	SC	ch	0.85 l/ha/m	A-I	200 L/HA	29.75 mL/mx	3470.3 mL	106	209



Spray/Seeding Plan report changes

- New option to print the **diluent quantity** for liquid treatments

Spray/Seeding Plan Report Options

Report Options Report Preview

Include diluent quantity for liquid mixes

Reps: 4 Appl Code: A Plots: 3.1 by 12.5 meters Treated LWA per Plot: 50 m²/plot
 Spray vol: 200 L/ha Mix Size: 3.5 L/200 m² LWA (total for 4 plots, includes 400 mL overage)

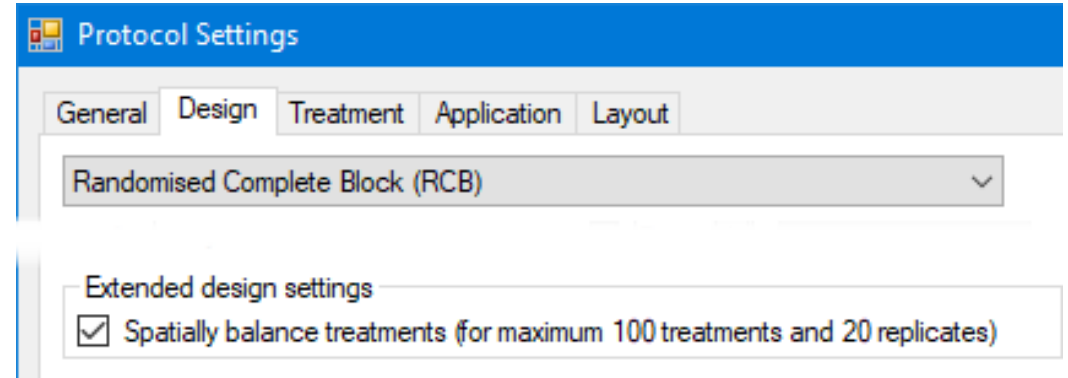
Trt No.	Treatment Name	Form Conc	Form Unit	Form Type	Rate Rate Unit	Appl Code	Spray Volume Unit	Amt Product to Measure	Diluent	Rep 1	Rep 2
2	Cyprodinil	750 G/KG	WG	WG	0.20 kg/10000 m ² lwa	A-I	200 L/HA	4.516 g/mx	3495.5 mL	102	206
3	Cyprodinil	750 G/KG	WG	WG	0.30 kg/10000 m ² lwa	A-I	200 L/HA	6.774 g/mx	3493.2 mL	101	204
4	Dodine 544 SC	544 G/L	SC	SC	0.85 l/ha/m ch	A-I	200 L/HA	29.75 mL/mx	3470.3 mL	106	209



Spatially balanced randomization

For RCB designs, use a randomization optimized to uniformly disperse treatments across the trial

Balances average distance between all treatment pairs across replicates (see Trial Map – Quality tab)

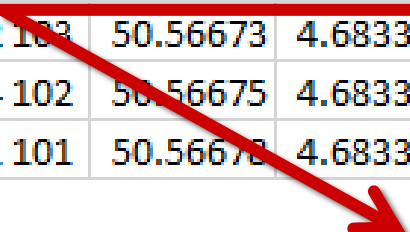


101 7	102 2	103 6	104 3	105 4	106 1	107 5
201 2	202 1	203 3	204 6	205 7	206 5	207 4
301 7	302 5	303 4	304 6	305 2	306 3	307 1
401 1	402 7	403 3	404 4	405 6	406 2	407 5
501 2	502 4	503 7	504 1	505 6	506 3	507 5

Paste Extended 'Plot' Information

Include Alternative Plot ID, Barcode, and GPS coordinates in experimental unit 'plot' description copy/paste with Excel

	A	B	C	D	E	F	G	H	I
1	Rep	Blk	Col	Plot	Trt	Alt Plot ID	PlotCode	Lat	Long
2	1	1	1	104	3	P4	G-All7_Fung 3 104	50.56671	4.68332
3	1	1	2	103	2	P3	G-All7_Fung 2 103	50.56673	4.68332
4	1	1	3	102	4	P2	G-All7_Fung 4 102	50.56675	4.68332
5	1	1	4	101	1	P1	G-All7_Fung 1 101	50.56678	4.68332

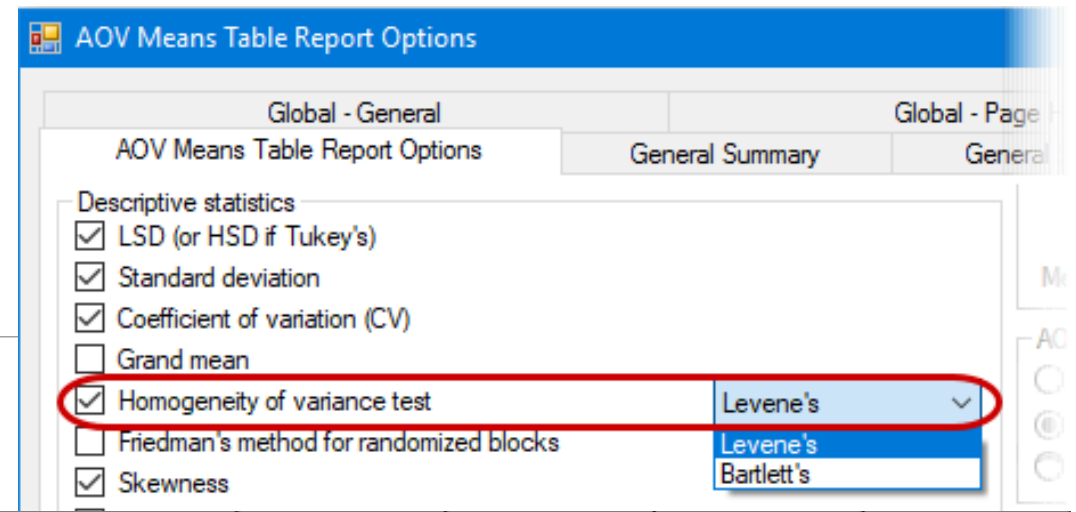


-	Sub	Rep	Blk	Col	Plot	Trt	Alt Plot ID	Barcode/RFID	Lat	Long
	1	1	1	4	P1	1	P1	G-All7_Fung 1 101	50.56678	4.68332
	1	1	1	3	P2	4	P2	G-All7_Fung 4 102	50.56675	4.68332
	1	1	1	2	P3	2	P3	G-All7_Fung 2 103	50.56673	4.68332
	1	1	1	1	P4	3	P4	G-All7_Fung 3 104	50.56671	4.68332

Levene's test for Homogeneity of Variance

Perform Levene's test for homogeneity of variance on AOV Means Table report.

- Included as a descriptive statistic on the report
- Levene's test is less sensitive to departures from normality than Bartlett's test, so is generally preferred



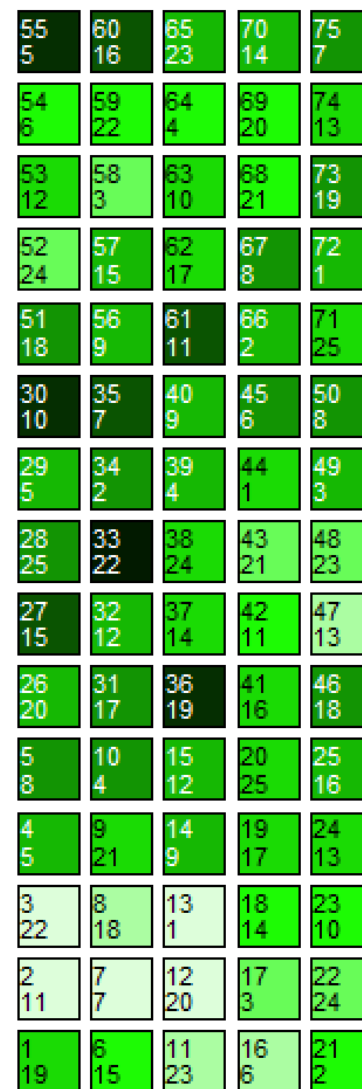
Pest Code	SEPTTR	SEPTTR	SEPTTR	SEPTTR
Pest Name	Speckled leaf >	Speckled leaf >	Speckled leaf >	Speckled leaf >
Part Rated	LEAF3 P	LEAF3 P	LEAF3 P	LEAF3 P
Rating Type	PE SSEV	PE SSEV	PESSEV	PESSEV
Rating Unit	%	%UNCK	%	%UNCK
Number of Subsamples	10	1	10	1
ARM Action Codes		TAB[3]		TAB[5]
Number of Decimals	2	2	2	2
Trt Treatment	Rate			
No. Name	Rate Unit	3	4	5
1 Untreated Check		4.55 a	0.00 b	8.25 a
2 Tub	0.5 Vha	1.93 b	57.98 a	1.83 b
3 Tub	1 Vha	1.53 b	67.06 a	1.46 b
4 Tilt 250	0.5 Vha	1.83 b	59.52 a	2.30 b
5 Mico 60 Fungol	1.5 Vha 1.25 Vha	2.70 b	39.92 a	1.67 b
LSD P=.05		1.264	28.202	2.598
Standard Deviation		0.821	18.305	1.686
CV		32.76	40.77	54.39
Levene's F		1.153	1.352	3.29
Levene's Prob(F)		0.37	0.297	0.04*
Skewness		0.4943	-0.4657	1.8499*
Kurtosis		-0.8027	-1.0584	2.6407*



Spatial Analysis

Attempts to recover information about hidden variables across a field

CRD + Quadratic spatial trend AOV For TRZAW Winter wheat GRAIN C					
Source	DF	Sum of Squares	Mean Square	F	Prob(F)
Total	18	5.170991 ^A			
Treatment Type III	4	1.441301	0.360325	7.676	0.0056
Blk	1	3.181476	3.181476	67.778	0.0001
Col	1	0.004818	0.004818	0.103	0.7560
Blk^2	1	0.053378	0.053378	1.137	0.3140
Col^2	1	0.055852	0.055852	1.190	0.3037
Blk:Col	1	0.011706	0.011706	0.249	0.6295
Error(adj)	9	0.046940			



Original

Neighbor-adjusted
Fertility

Spatial Analysis

Trend analysis

- Analyze effects across whole field

Nearest Neighbor analysis

- Analyze effects only in space adjacent to individual plots

Automatic – ARM will select best-performing model

- AIC – estimates relative quality of available models (lower is better)



AOV - Spatial Report Options

Report options: AOV Means Table | General Summary | Report Preview

Spatial Method: Automatic

Mean comparison test: LSD


Descriptive statistics

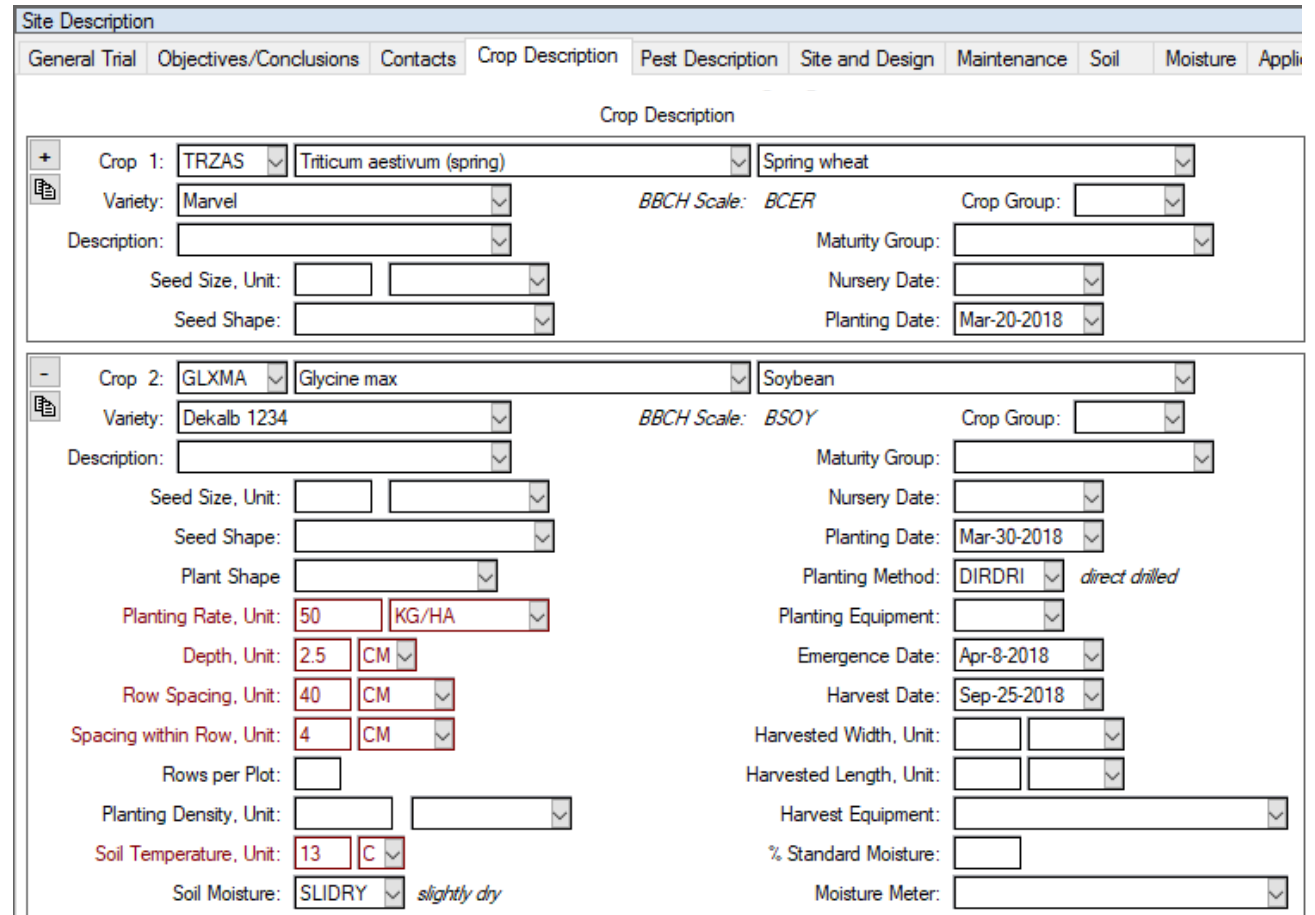
Spatial AIC

Crop Name	Part Rated	Rating Type	Rating Unit	ARM Action Codes	Winter wheat GRAIN C YIELD T-MET TY1
Trt No.	Treatment Name	Rate	Rate Unit		12*
1	Untreated Check				7.84 b
2	Tub	0.5	l/ha		8.53 a
3	Tub	1	l/ha		8.45 a
4	Tilt 250	0.5	l/ha		8.70 a
5	Mico 60	1.5	l/ha		8.48 a
LSD P= .05					0.347
Standard Deviation					0.217
CV					2.58
Randomized Complete Block (RCB) AIC					5.1456
Spatial AIC					SPa 3.6037
SPa = Quadratic spatial trend					

Collapsible Repeating Sections

 Collapse repeating sections to fit more sections on-screen

 Copy button copies all information in the section to clipboard



Site Description

General Trial | Objectives/Conclusions | Contacts | Crop Description | Pest Description | Site and Design | Maintenance | Soil | Moisture | Appli

Crop Description

+ Crop 1: TRZAS Triticum aestivum (spring) Spring wheat

Variety: Marvel BBCH Scale: BCER Crop Group: []

Description: [] Maturity Group: []

Seed Size, Unit: [] [] Nursery Date: []

Seed Shape: [] Planting Date: Mar-20-2018

- Crop 2: GLXMA Glycine max Soybean

Variety: Dekalb 1234 BBCH Scale: BSOY Crop Group: []

Description: [] Maturity Group: []

Seed Size, Unit: [] [] Nursery Date: []

Seed Shape: [] Planting Date: Mar-30-2018

Plant Shape: [] Planting Method: DIRDRI direct drilled

Planting Rate, Unit: 50 KG/HA Planting Equipment: []

Depth, Unit: 2.5 CM Emergence Date: Apr-8-2018

Row Spacing, Unit: 40 CM Harvest Date: Sep-25-2018

Spacing within Row, Unit: 4 CM Harvested Width, Unit: [] []

Rows per Plot: [] Harvested Length, Unit: [] []

Planting Density, Unit: [] [] Harvest Equipment: []

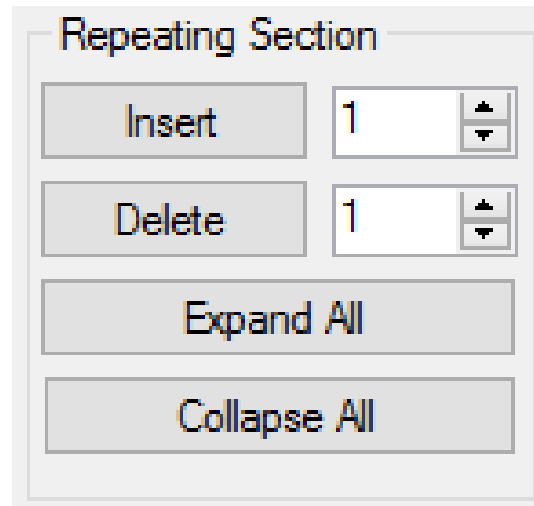
Soil Temperature, Unit: 13 C % Standard Moisture: []

Soil Moisture: SLIDRY slightly dry Moisture Meter: []

Collapsible Repeating Sections

Faster load time when there are many sections on the tab

Expand or Collapse all sections at once from the Properties Panel



New Study List fields

Added new fields to the study list:

- Soil %OM
- Soil pH
- Treatment Description
- Treatment Identification Code
- Number of Treatments
- Number of Assessment Columns
- Number of Assessment Columns with Data

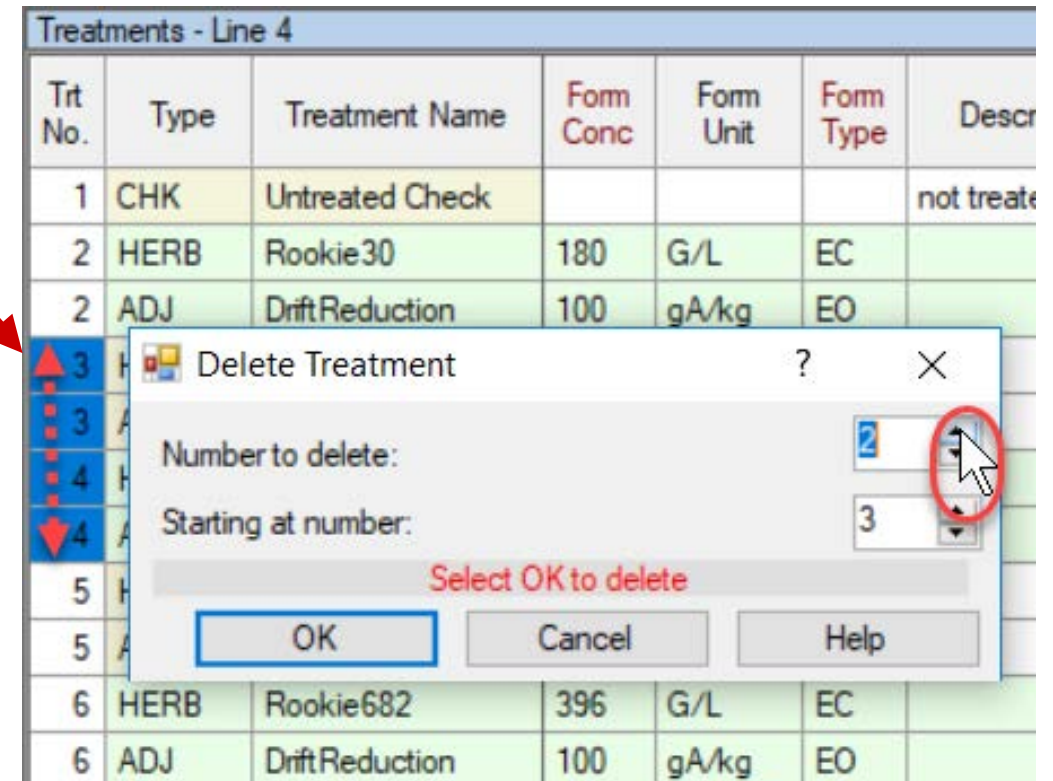
Selected	Study ID	Soil %OM	Soil pH	Trial	Cost	Treatments	Replicates	Assessment Cols	Assessment Cols With Data	Damaged
<input type="checkbox"/>	G-All7_Fung	1.3	4.9			5	4	13	13	5
<input type="checkbox"/>	G-All7_Herb_02	0.7	6.2			5	4	19	19	0



Edit - Delete Treatment

Delete Treatment dialog highlights the Trt. No column showing which treatments will be deleted when OK is selected

Remember "Undo" if any wrong treatments are accidentally removed



Crop Growth Stage Scales: VR and Feekes

VR and Feekes are new Crop Stage Scales in GDM Definitions

- Crop Stage at Application (in Site Description)
- Assessment Header

Contacts | Crop Description | Pest Description | Site and Design | Maintenance | So

Crop Stage At Each Application

Use Crop Description tab to insert

Use Application Description tab to insert

	A		B	
<i>Application Date:</i>	4/27/2017		6/1/2017	
<i>Crop 1 Code, BBCH Scale:</i>	GLXMA	BSOY	GLXMA	BSOY
<i>Stage Scale Used:</i>	▼ VR		▼	
<i>Stage Majority, Percent:</i>	▼	V1	▼	75
<i>Stage Minimum, Percent:</i>	▼	VC	▼	5
<i>Stage Maximum, Percent:</i>	▼	V2	▼	20

Stage Scale Used Master List (SART)

Stage Scale Used	Description
BBCH	BBCH uniform plant stages
DESC	descriptive growth stages
FEEKES	Feekes cereal growth stages
VR	Vegetative/Reproductive growth stages

Crop Growth Stage Scales: VR and Feekes

VR for corn (BCOR)

Stage Majority, Percent Master List (BBCH_GS)

Stage Majority, Percent	Description 1	Scale	Online Description
VE	Emergence (BBCH 9 = Emergence: coleoptile penetrates soil surface)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V1	First Leaf (BBCH 11 = First leaf unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V2	Second Leaf (BBCH 12 = 2 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V3	Third Leaf (BBCH 13 = 3 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V4	Fourth Leaf (BBCH 14 = 4 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V5	Fifth Leaf (BBCH 15 = 5 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V6	Sixth Leaf (BBCH 16 = 6 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V7	Seventh Leaf (BBCH 17 = 7 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V8	Eighth Leaf (BBCH 18 = 8 leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V9	Ninth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V10	Tenth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V11	Eleventh Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V12	Twelfth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V13	Thirteenth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V14	Fourteenth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
V15	Fifteenth Leaf (BBCH 19 = 9 or more leaves unfolded)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
VT	Tassel (BBCH 51 = Beginning of tassel emergence)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R1	Silking (BBCH 61 = tassel visible)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R2	Blister (BBCH 71 = Beginning of grain development)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R3	Milk (BBCH 73 = Early milk)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R4	Dough (BBCH 83 = Early dough: kernel content soft)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R5	Dent (BBCH 85 = Dough stage: kernels yellowish to yellow, about 55% dry matter)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta
R6	Black Layer (Physiological Maturity) (BBCH 87 = Physiological maturity)	BCOR	https://extension.entm.purdue.edu/fieldcropsipm/com-sta



Crop Growth Stage Scales: VR and Feekes

Can now change between VR and BBCH or Feekes and BBCH, and stages are auto-updated:

1

VR	Stage Scale Used Master List (SART)	
V1		
VC	Stage Scale Used	Description
V2	BBCH	BBCH uniform plant stages
	DESC	descriptive growth stages
	FEEKES	Feekes cereal growth stages
	VR	Vegetative/Reproductive growth stages

2

	A	B
Application Date:	4/27/2017	6/1/2017
Crop 1 Code, BBCH Scale:	GLXMA BSOY	GLXMA BSOY
Stage Scale Used:		BBCH
Stage Majority, Percent:		11 75
Stage Minimum, Percent:		10 5
Stage Maximum, Percent:		12 20

Crop Growth Stage Scales: VR and Feekes

VR for corn (BCOR) and soybean (BSOY) growth stage lists:

 Stage Majority, Percent Master List (BBCH_GS)

Stage Majority, Percent	Description 1	Scale	Online Description
V1	First Trifoliolate (BBCH 11 = First pair of true leaves unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V2	Second Trifoliolate (BBCH 12 = Trifoliolate leaf on the 2nd node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V3	Third Trifoliolate (BBCH 13 = Trifoliolate leaf on the 3rd node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V4	Fourth Trifoliolate (BBCH 14 = Trifoliolate leaf on the 4th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V5	Fifth Trifoliolate (BBCH 15 = Trifoliolate leaf on the 5th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V6	Sixth Trifoliolate (BBCH 16 = Trifoliolate leaf on the 6th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V7	Seventh Trifoliolate (BBCH 17 = Trifoliolate leaf on the 7th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V8	Eighth Trifoliolate (BBCH 18 = Trifoliolate leaf on the 8th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
V9	Ninth Trifoliolate (BBCH 19 = Trifoliolate leaf on the 9th node unfolded)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R1	Beginning Flowering (BBCH 60 = First flowers opened)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R2	Full Flowering (BBCH 65 = Full flowering: about 50% of flowers open)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R3	Beginning Pod (BBCH 69 = End of flowering: first pods visible)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R4	Full Pod (BBCH 75 = About 50% of pods have reached final length)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R5	Beginning Seed	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R6	Full Seed (BBCH 79 = Approx. all pods have reached final length)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R7	Beginning Maturity (BBCH 80 = First pod ripe, beans final colour, dry and hard)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf
R8	Full Maturity (BBCH 89 = Full maturity; pods are ripe, harvest)	BSOY	https://unitedsoybean.org/wp-content/uploads/52618-11_Kansas-Soybean-Growth-Chart.pdf

Crop Growth Stage Scales: Feekes

For Cereals (BCER) - can also interchange with BBCH

Stage Majority, Percent Master List (BBCH_GS)

Stage Majority, Percent	Description 1	Scale
1.0	First leaf through coleoptile (BBCH 10 = First leaf through coleoptile)	BCER
1.1	First leaf unfolded (BBCH 11 = First leaf unfolded)	BCER
1.2	2 leaves unfolded (BBCH 12 = 2 leaves unfolded)	BCER
1.3	3 leaves unfolded (BBCH 13 = 3 leaves unfolded)	BCER
1.4	4 leaves unfolded (BBCH 14 = 4 leaves unfolded)	BCER
1.5	5 leaves unfolded (BBCH 15 = 5 leaves unfolded)	BCER
1.6	6 leaves unfolded (BBCH 16 = 6 leaves unfolded)	BCER
1.7	7 leaves unfolded (BBCH 17 = 7 leaves unfolded)	BCER
1.8	8 leaves unfolded (BBCH 18 = 8 leaves unfolded)	BCER
1.9	9 leaves unfolded (BBCH 19 = 9 or more leaves unfolded)	BCER
2.0	Main shoot and one tiller (BBCH 21 = Beginning of tillering)	BCER
3.0	Main shoot and six tillers (BBCH 26 = 6 tillers detectable)	BCER
4.0	Beginning of the erection of the pseudo-stem (BBCH 30 = Begin stem elongation)	BCER
5.0	Pseudo-stem strongly erected (BBCH 30 = Begin stem elongation)	BCER
6.0	First node of stem visible at base of shoot (BBCH 31=Node 1 cm above tillering)	BCER
7.0	Second node visible (BBCH 32 = Node 2 at least 2 cm above node 1)	BCER
8.0	Flag leaf visible, ear beginning to swell (BBCH 37 = Flag leaf visible, rolled)	BCER
9.0	Ligule of flag leaf visible (BBCH 39 = Flag leaf stage)	BCER
10.0	Ear swollen but not yet visible (BBCH 45 = Late boot stage)	BCER
10.1	First spikelet of head visible (BBCH 51 = Beginning of heading)	BCER
10.2	25% of heading completed (BBCH 53 = 30% of inflorescence emerged)	BCER
10.3	50% of heading completed (BBCH 55 = Middle of heading)	BCER
10.4	75% of heading completed (BBCH 57 = 70% of inflorescence emerged)	BCER
10.5	Heading completed (BBCH 59 = End of heading: inflorescence fully emerged)	BCER
10.51	Beginning flowering (BBCH 61 = Beginning of flowering: first anthers visible)	BCER
10.52	Flowering complete to top of head	BCER
10.53	Flowering complete at bottom of head	BCER
10.54	Kemel watery ripe (BBCH 71 = Watery ripe)	BCER
11.1	Milky ripe (BBCH 75 = Medium milk: grain content milky)	BCER
11.2	Mealy ripe: contents of kemel soft but dry, soft dough (BBCH 85 = Soft dough)	BCER
11.3	Kemel hard: difficult to divide with thumbnail (BBCH 89 = Fully ripe)	BCER
11.4	Ripe for harvest, straw dead (BBCH 92 = Over-ripe: grain very hard)	BCER



Crop Growth Stage Scales - BBCH

BBCH growth stage lists also include the VR and Feekes stages in the Description column for relevant crops, such as the VR stages in soybean (BSOY) list:

Stage Majority, Percent Master List (BBCH_GS)

Stage Majority, Percent	Description 1	Scale
11	First pair of true leaves unfolded (V1 = unifoliolate leaves on the first node)	BSOY
12	Trifoliolate leaf on the 2nd node unfolded (V2 = Second Trifoliolate)	BSOY
13	Trifoliolate leaf on the 3rd node unfolded (V3 = Third Trifoliolate)	BSOY
14	Trifoliolate leaf on the 4th node unfolded (V4 = Fourth Trifoliolate)	BSOY
15	Trifoliolate leaf on the 5th node unfolded (V5 = Fifth Trifoliolate)	BSOY
16	Trifoliolate leaf on the 6th node unfolded (V6 = Sixth Trifoliolate)	BSOY
17	Trifoliolate leaf on the 7th node unfolded (V7 = Seventh Trifoliolate)	BSOY
18	Trifoliolate leaf on the 8th node unfolded (V8 = Eighth Trifoliolate)	BSOY
19	Trifoliolate leaf on the 9th node unfolded (V9 = Ninth Trifoliolate)	BSOY
21	First side shoot visible	BSOY
22	2nd side shoot of first order visible	BSOY



ARM Options

Common ARM options now remain consistent when switching between sponsor customizations, including:

- Measurement unit and program language
- Date and time format, GPS coordinate format
- Fonts, color options
- Most Editor options
- Most Assessment Data View options

Previously ARM maintained separate options for each customization 'profile', allowing user preferences to differ between sponsor customizations. Now, user preferences will be consistent for entering and reporting dates, times, GPS coordinates, language, fonts, and colors.

Weather Data Integration

Weather analysis explains varying product performance within efficacy trials (year, location)

Sponsors may require it

Increased emphasis on developing biostimulants, plant health products – highly responsive to weather conditions.



Weather Data Integration

Iteris ClearAg Collaboration

Iteris ClearAg weather and environmental content is now available by subscription to GDM clients

Directly import ClearAg's **historical** and **current weather** information and **soil** data from around the world through ARM software

Request more information about ClearAg at:

<http://info.clearag.com/ARMinfo.html>



Weather Data Integration

Site Description – new fields added

Daily and 30-Year average:

- Precipitation
- Air Temperature – Min/Max/Average
- Wind speed – Min/Max/Average
- Sunlight (Shortwave Radiation)

Others:

- % Cloud Cover
- Soil Temp – Average
- Soil Moisture – Scaled 0-10cm or 0-200cm

Moisture	Unit	Type	30Y	Unit	Min	Max	Avg	Temp	30Y	30Y	30Y	Unit
Total			Precipitation		Temp	Temp	Temp	Unit	Min Temp	Max Temp	Avg Temp	
0.4	mm	RAIN	1.3	mm	17	29	22	C	13	23	18	C
17.4	mm	RAIN	1.4	mm	16	24	19	C	13	22	17	C

Min	Max	Avg	Unit	% Cloud	Avg Shortwave	Unit	Avg	Unit	0-10 cm Scaled	0-200 cm Scaled
Wind	Wind	Wind		Cover	Radiation		Soil Temp		Soil Moisture	Soil Moisture
1	14	6	kph	58	143	W/m2	24	C	0.08	0.34
2	21	10	kph	62	152	W/m2	21	C	0.49	0.39



Weather Data Integration

Trial GPS Coordinates

Required fields:

Site Description editor > General Trial tab >

Latitude of LL Corner° and Longitude of LL Corner°



Navigation Bar

Step 1

- ARM
- Header
- Treatments
- Site Description
- General Trial**
- Objectives/Conclusions

Step 2

Latitude of LL Corner °: 50.539096 N

Longitude of LL Corner °: 4.677259 E

Weather Data Integration

Weather API provider subscription

Tools > Import Weather Data

Settings > enter License ID (from subscriber) and Data Center

A screenshot of the "Weather Import Settings" dialog box. The dialog has a blue title bar and a close button (X) in the top right. It contains several fields: "Application:" with a dropdown menu showing "Iteris ClearAg"; "ID:" with a text box containing seven dots, highlighted with a red rectangle; and "Data Center:" with a dropdown menu showing "United States". Below these fields are three buttons: "OK", "Cancel", and "Help". At the bottom of the dialog, there is a checkbox for "Import missing application weather data for dates within last 2 years", a "Measurement unit:" section with radio buttons for "Metric" (selected) and "US standard", and a "Settings..." button highlighted with a red rectangle, along with "OK", "Cancel", and "Help" buttons.

Weather Import

Application: Iteris ClearAg

Weather Import Settings

Connection

Application: Iteris ClearAg

ID:

Data Center: United States

OK Cancel Help

Import missing application weather data for dates within last 2 years

Measurement unit: Metric US standard

Settings... OK Cancel Help

Weather Data Integration

Import current weather conditions

Fill in today's Application with current weather conditions

	D
Application Date:	May-8-2017
Appl. Start Time:	
Appl. Stop Time:	
Interval to Prev. Appl., Unit:	

Import Weather Data...

Insert Repeating Section...

Delete Weather Import

Save

Application: Iteris ClearAg

Import current weather data to application D (May-8-2017 12:00 PM)

Import weather data to blank weather fields

Import weather data from a specified date range

Import missing application weather data for dates within last 2 years

Measurement unit: Metric US standard

Settings... OK Cancel Help

	D
Application Date:	May-8-2017
Appl. Start Time:	11:15 AM
Appl. Stop Time:	
Application Method:	SPRAY
Application Timing:	POSPOS
Application Placement:	BROFOL
Applied By:	Bob Spray
Air Temperature, Unit:	14.0 C
% Relative Humidity:	66.0
Wind Velocity, Unit:	26.0 kph
Wind Direction:	WSW
Dew Presence (Y/N):	Y yes
Soil Temperature, Unit:	11 C
Soil Moisture:	MOIST
% Cloud Cover:	74.5
Next Moisture Occurred On:	
Time to Next Moisture, Unit:	

Weather Data Integration

Import hourly historical weather data

Fill in previous Application with hourly weather conditions at the specified date and start time.

Weather Import

Application: Iteris ClearAg

Import weather data to blank weather fields
 Import daily weather data for specified date range

Options

Import daily weather data prior to starting date 14 days
 Import daily weather data after ending date 1 days
 Import missing application weather data for dates within last 2 years

Measurement unit: Metric US standard

Settings... OK Cancel Help

	D	
Application Date:	May-8-2017	
Appl. Start Time:	10:00 AM	
Appl. Stop Time:		
Application Method:	SPRAY	
Application Timing:	POSPOS	
Application Placement:	BROFOL	
Applied By:		
Air Temperature, Unit:		3 C
% Relative Humidity:		97
Wind Velocity, Unit:		12 kph
Wind Direction:		E
Dew Presence (Y/N):		
Soil Temperature, Unit:		4 C
Soil Moisture:		
% Cloud Cover:		100
Next Moisture Occurred On:		
Time to Next Moisture, Unit:		
Moisture 1 Week after Appl.:		0 mm

Weather Data Integration

Import daily historical weather conditions

Add a row to the Weather table in Site Description for each day in the specified range.

Imports daily averages or totals for moisture, temperature, wind, and soil conditions.

Weather Import

Application: Iteris ClearAg

Import weather data to blank weather fields

Import daily weather data for specified date range

From: Apr-15-2017

To: Aug-7-2017

Options

Import daily weather data prior to starting date 14 days

Import daily weather data after ending date 1 days

Import missing application weather data for dates within last 2 years

Measurement unit: Metric US standard

Settings... OK Cancel Help

Weather Data Integration

Import daily historical weather conditions

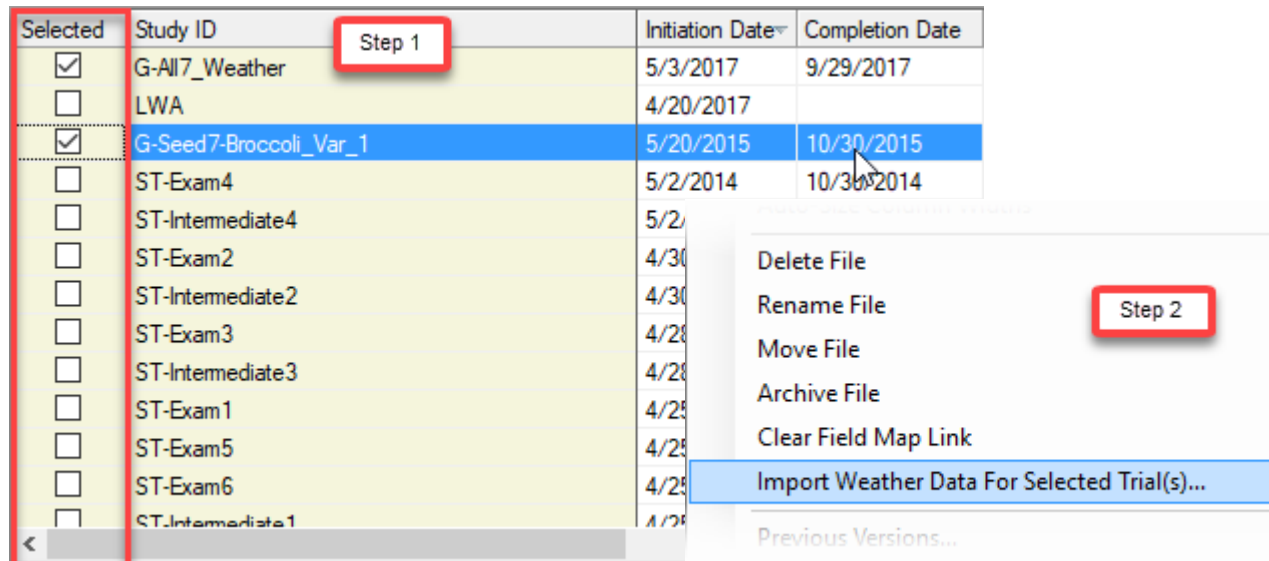
No.	Date	Moisture Total	Unit	Precipitation	Unit	Type	Min Temp	Max Temp	Avg Temp	Temp Unit	% Relative Humidity	Min Wind	Max Wind	Avg Wind	Unit	% Cloud Cover	Avg Shortwave Radiation	Unit	Avg Soil Temp
1.	Apr-1-2018	0	mm	0	mm	RAIN	-15	4	-4	C	68	0	14	6	kph	31	217	W/m2	-4
2.	Apr-2-2018	0	mm	0	mm	RAIN	-8	0	-4	C	85	1	37	13	kph	51	128	W/m2	-4
3.	Apr-3-2018	0	mm	0	mm	RAIN	-13	1	-6	C	83	0	14	6	kph	36	186	W/m2	-4
4.	Apr-4-2018	0	mm	0	mm	RAIN	-9	4	-2	C	82	4	32	17	kph	54	131	W/m2	-4
5.	Apr-5-2018	0	mm	0	mm	RAIN	-4	-2	-4	C	92	2	26	15	kph	100	61	W/m2	-4
6.	Apr-6-2018	0	mm	0	mm	RAIN	-4	2	-1	C	89	0	20	7	kph	100	107	W/m2	-3



Weather Data Integration

Batch import historical weather

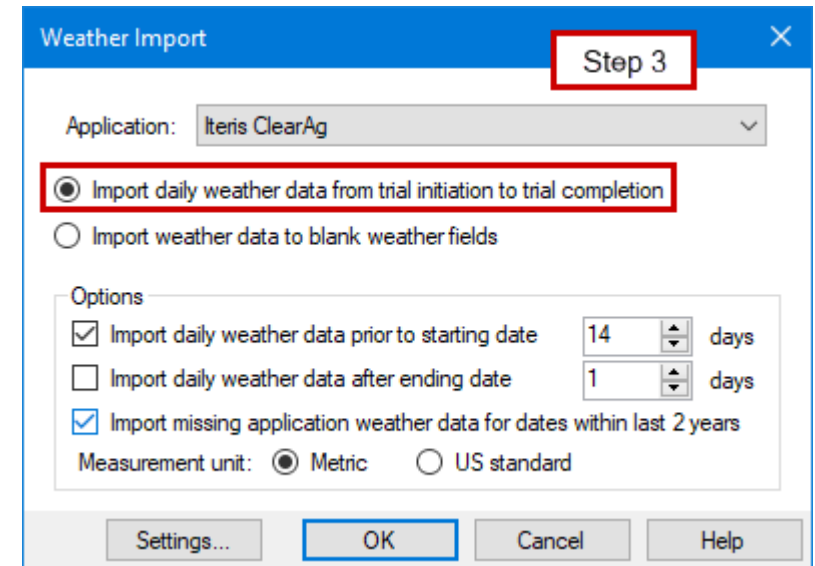
Import weather data into multiple trials, based on Trial Initiation and Trial Completion dates of each trial.



Selected	Study ID	Initiation Date	Completion Date
<input checked="" type="checkbox"/>	G-All7_Weather	5/3/2017	9/29/2017
<input type="checkbox"/>	LWA	4/20/2017	
<input checked="" type="checkbox"/>	G-Seed7-Broccoli_Var_1	5/20/2015	10/30/2015
<input type="checkbox"/>	ST-Exam4	5/2/2014	10/30/2014
<input type="checkbox"/>	ST-Intermediate4	5/2/2014	
<input type="checkbox"/>	ST-Exam2	4/30/2014	
<input type="checkbox"/>	ST-Intermediate2	4/30/2014	
<input type="checkbox"/>	ST-Exam3	4/28/2014	
<input type="checkbox"/>	ST-Intermediate3	4/28/2014	
<input type="checkbox"/>	ST-Exam1	4/25/2014	
<input type="checkbox"/>	ST-Exam5	4/25/2014	
<input type="checkbox"/>	ST-Exam6	4/25/2014	
<input type="checkbox"/>	ST-Intermediate1	4/25/2014	

Context menu options:

- Delete File
- Rename File
- Move File
- Archive File
- Clear Field Map Link
- Import Weather Data For Selected Trial(s)...
- Previous Versions...



Weather Import

Application: Iteris ClearAg

Import daily weather data from trial initiation to trial completion

Import weather data to blank weather fields

Options

Import daily weather data prior to starting date 14 days

Import daily weather data after ending date 1 days

Import missing application weather data for dates within last 2 years

Measurement unit: Metric US standard

Settings... OK Cancel Help