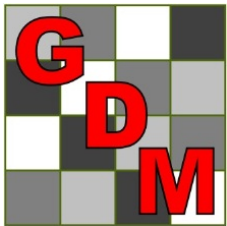


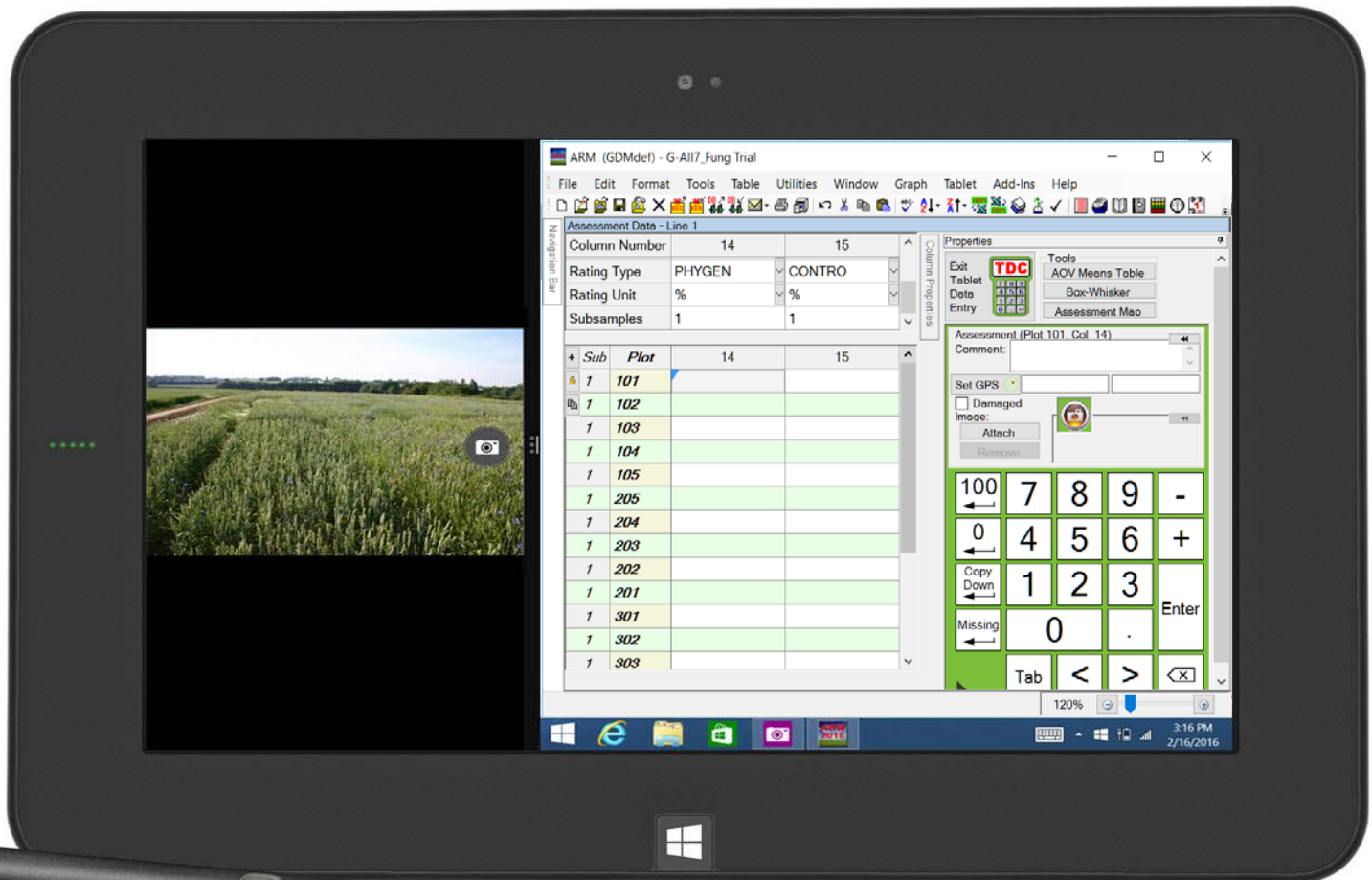
Collect Data, Photos, and GPS Coordinates with a Handheld Windows Tablet ARM Tablet Data Collector, Licensed as TDCx Add-In



Available from
Gylling Data Management, Inc.
and GDM Representatives

ARM Tablet Data Collector

Win 10 Pro
tablet
+
ARM
and
TDCx
licenses
=
special
ARM
tablet
features



January 2018



What is Tablet Data Collector?

1. Windows 10 Professional tablet computer
2. ARM 2016+ software
3. TDCx (Tablet Data Collector) software
license for your ARM serial number

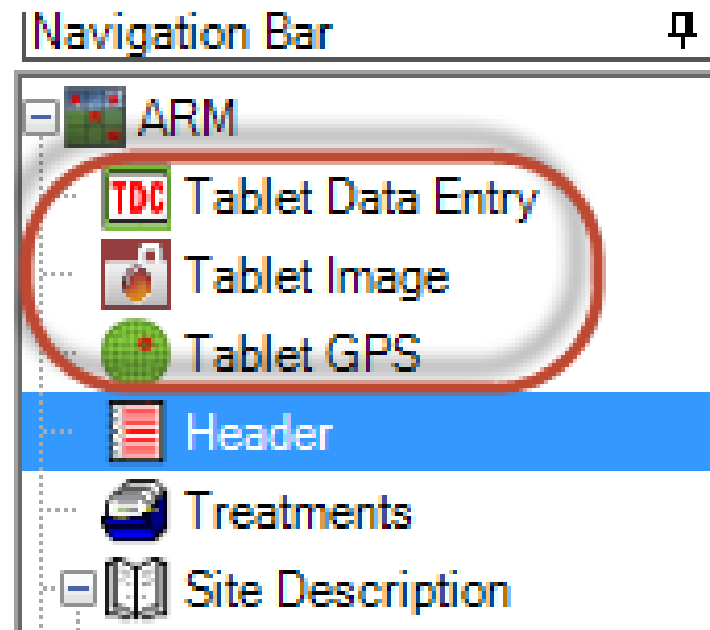
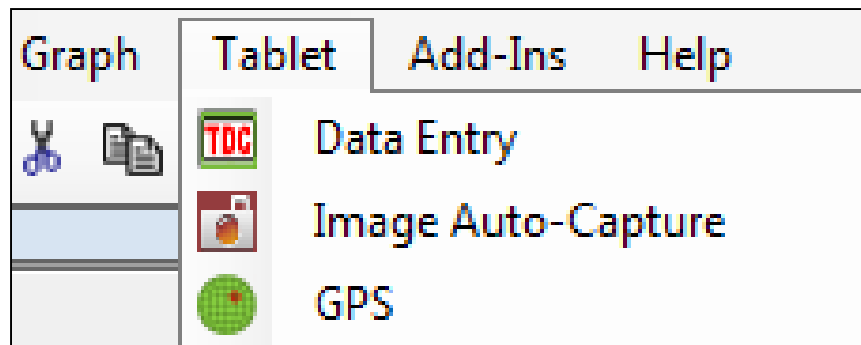
Install on the tablet computer:

- ARM software plus your ARM license
- SD backup card

Adds *unique features* available *only* in
Tablet Data Collector

Unique Features in a Licensed Tablet Data Collector (TDC)

- Tablet Data Entry
- Tablet Image Capture
- Tablet GPS





Actions that will Improve Assessment Quality

- Enter data only once to avoid transcription errors
- Employ appropriate range checking for assessed values
- Perform data quality checks before leaving trial site (analyze, graph)
- Include photographs that illustrate or support measurements & observations



Benefits of Using ARM Tablet Data Collector

Use ARM software at trial site on conveniently sized hardware that is readable in direct sunlight, plus:

- Optimized for collecting data
- Take photos directly into ARM trial file
- Record GPS coordinates into trial
- Perform data quality checks on-site
- Eliminates data transcription errors

Tablet Data Entry

- Component of Assessment Data editor
- Optimizes editor use on a small touch tablet computer

The screenshot displays the 'Tablet Data Entry' interface. On the left, a table titled 'Assessment Data - Line 5' lists various fields for data entry. Below the list is a grid with columns labeled 'Sub', 'Fp', 'Bk', and 'Col'. The grid contains numerical data, with some cells highlighted in green and others in yellow. On the right, a 'Properties' panel is visible, featuring buttons for 'View Options...', 'Ignore Match', and 'Refresh'. Below these buttons, there are sections for 'Hidden: Row' and 'Views'. The 'Views' section lists several options: 'Original', 'All fields', 'Hidden fields with information', 'Hide empty fields', 'Default - All visible', 'Default - Brief fields visible', 'Default - Data entry mode', 'Default - Fertilizer fields visible', 'Default - Non-pest fields visible', and 'My view'. At the bottom right, there is a 'Tools' section with buttons for 'AO' and 'As'. A red circle highlights a 'Tablet Data Entry' icon in the bottom right corner, which features a green keypad with numbers 1-9, 0, and a red 'TDC' logo.

Column Number	Pest Type	Pest Code	Pest Scientific Name	Pest Name	Crop Code	BBCH Scale	Crop Scientific Name	Crop Name	Crop Variety	Description
1	1	1	5	1	1	1	1	1	1	1
1	2	2	4	2	1	2	2	5	2	1
1	3	3	3	3	1	3	3	2	3	1
1	4	4	4	4	1	4	4	5	4	1
1	1	1	2	1	1	1	1	2	1	1
1	2	2	5	2	1	2	2	5	2	1
1	3	3	2	3	1	3	3	2	3	1
1	4	4	5	4	1	4	4	5	4	1

The screenshot shows a software interface with several components:

- Navigation Bar:** Located on the left side of the top panel.
- Assessment Data - Line 1:** A table with columns for Column Number (20, 21), Rating Date, Rating Type, Rating Unit (1-6ICR), and Number of Subsamples (1).
- Plot Table:** A table with columns for Sub (1), Plot (101, 102, 103), and Plot (20, 21).
- Properties Panel:** Located on the right, containing a TDC keypad, Tools (AOV Means Table, Box-Whisker, Assessment Map), and an Assessment (Plot 101, Col 20) section with a Comment field, GPS field, and an Image capture icon.
- Touch Keypad:** A large keypad at the bottom right with numbers 0-9, a decimal point, and various function keys like Copy Down, Missing, Tab, and Enter.
- Zoom Controls:** Located at the bottom center, showing a zoom level of 150% and navigation arrows.

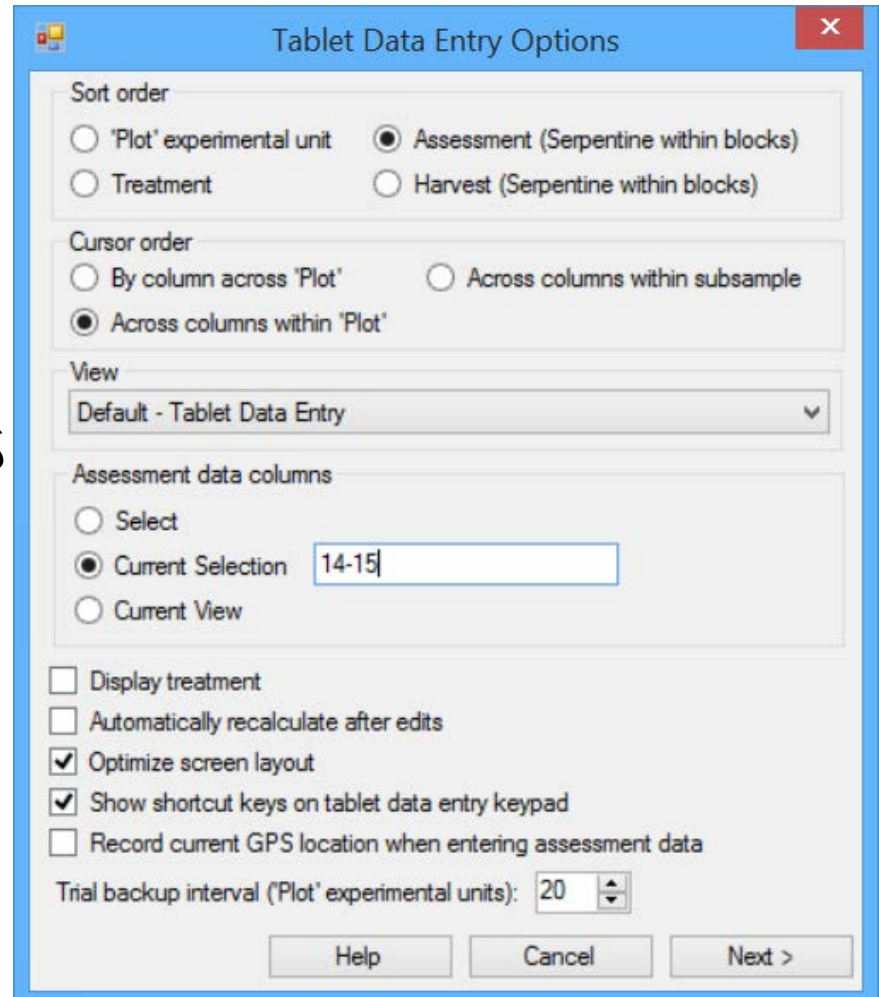
Red arrows point from the following list items to these specific features in the screenshot:

- Optimized screen
- Start image capture
- Shortcut keys
- Touch keypad
- Zoom

Tablet Data Entry Options

- Set plot order
- Enter 1 or more data columns
- Visible header rows
- "Blind" assessment
- Performance & screen optimized for tablet

January 2018





The screenshot shows a dialog box titled "Tablet Data Entry Options" with a close button (X) in the top right corner. The dialog contains several sections of settings:

- Sort order:** Three radio buttons:
☐ 'Plot' experimental unit
☒ Assessment (Serpentine within blocks)
☐ Treatment
☐ Harvest (Serpentine within blocks)
- Cursor order:** Three radio buttons:
☐ By column across 'Plot'
☐ Across columns within subsample
☒ Across columns within 'Plot'
- View:** A dropdown menu showing "Default - Tablet Data Entry".
- Assessment data columns:** Three radio buttons:
☐ Select
☒ Current Selection (with a text input field containing "14-15")
☐ Current View
- Checkboxes:**
☐ Display treatment
☐ Automatically recalculate after edits
☒ Optimize screen layout
☒ Show shortcut keys on tablet data entry keypad
☐ Record current GPS location when entering assessment data
- Trial backup interval ('Plot' experimental units):** A spinner box set to "20".
- Buttons:** "Help", "Cancel", and "Next >" at the bottom.

Tablet Data Entry Features

- Automatically reads valid data range from assessment unit field
- For 1 digit scales from 0-9, cursor moves automatically to next assessment data cell (no pressing Enter)
- Trial is quick-saved to ARMbackup after data is entered in each plot

Assessment Data - Line 2		
Column Number	20	
Rating Type	DAMINS	
Rating Unit	1-6ICR	
Number of Subsamples	1	
 Sub	Plot	20
 1	101	3
1	102	

Tablet Data Entry Features

- Automatic limit dialog displays for out-of-range data, for immediately correcting an entry mistake

Rating Type	DAMINS	
Rating Unit	1-6ICR	
+ Sub	Plot	20
1	101	7
1	102	
1	103	
1	104	
1	105	
1	205	
1	204	
1	203	
1	302	
1	303	
1	304	
1	305	
1	405	
1	404	

ARM Request

Data out of bounds 1-6

7

8

9

-

1

2

3

4

5

6

0

.

Enter

Tab

<

>

<X

OK

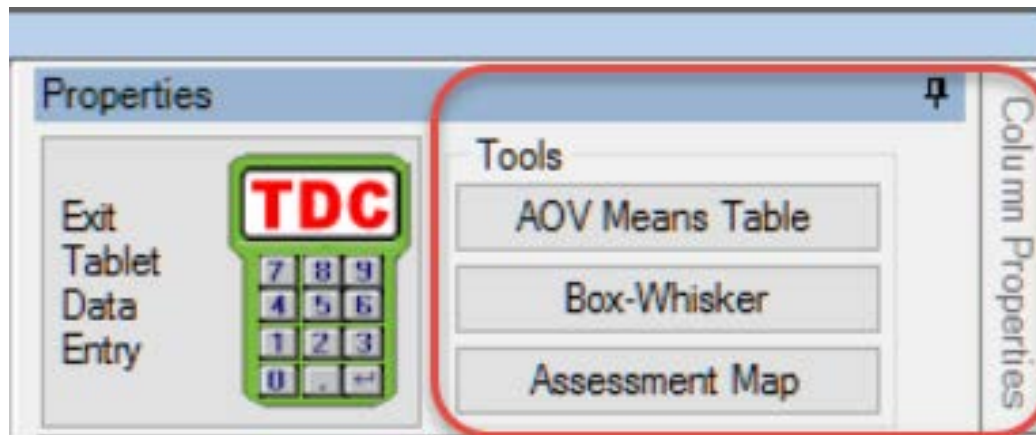
Cancel

More Tablet Data Entry Features



- Trial changes are automatically saved to a temporary backup trial copy after last value is entered in each plot, to preserve data in case of hardware failure
- Backup trial copy is in Temporary folder within ARMbackup on SD card, named as `nnn.backup.dat0` ('nnn' = trial name)
- Temporary file can be renamed and used to recover new tablet data entries

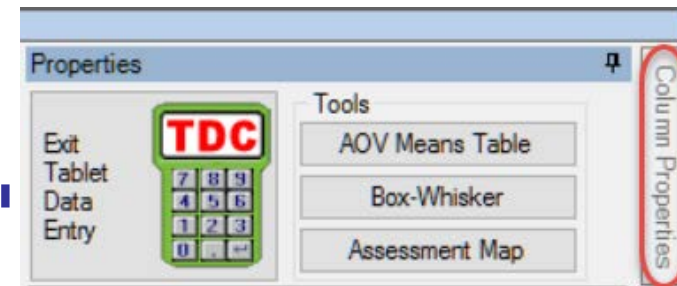
Tablet Data Review Tools



- Column Properties tab
- Data analysis (Analysis of Variance)
- Box-Whisker Graph
- Assessment Map

Assessment Data "Column Properties"

- Offers data overview
- Presents analysis of current data column
- Fixes violations of AOV assumptions
- Finds statistical outliers



Column Number	1
Crop Name	Spring wheat
Part Rated	PLANT P
Rating Date	06/30/2014
Rating Type	COUINS
Rating Unit	PLANT

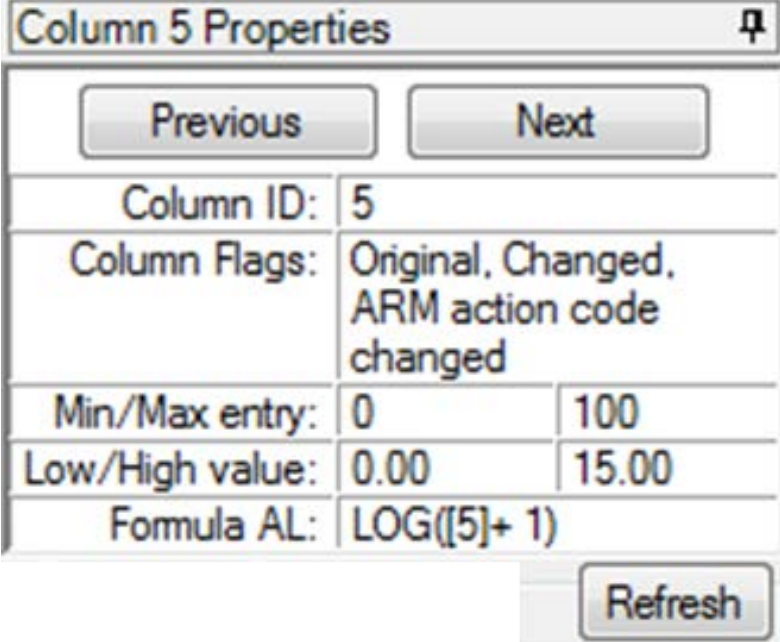
Sub	Plot	1
1	101	22
1	102	32
1	103	15
1	104	125
1	105	18
1	205	9
1	204	17
1	203	14
1	202	110
1	201	27
1	301	10
1	302	6
1	303	100
1	304	24
1	305	15
1	402	90

Column 1 Properties	
Previous	Next
Column Flags: Original	
Low/High value:	6 125
Descriptive Statistics Refresh	
LSD P=.05:	8.93
Standard Deviation:	5.80
CV:	17.03
Grand Mean:	34.05
P(Bartlett's X2):	0.016
P(Friedman's X2):	0.007
Skewness:	1.6078
Kurtosis:	1.0506
Replicate Prob(F):	0.0087
Treatment Prob(F):	0.0001
<div>Does not meet assumptions of AOV: data has heterogeneity of variance/skewness</div> <div>Fix</div>	
Outliers <ul style="list-style-type: none"> <input checked="" type="radio"/> > +/- 3 standard deviations from grand mean <input type="radio"/> > +/- 2 standard deviations from grand mean <input type="radio"/> Box-Whisker <input checked="" type="checkbox"/> Skip damaged assessments <input type="checkbox"/> Based on subsample values <div>Find Next</div>	

Assessment Data

"Column Properties"

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



Column 5 Properties

Previous Next

Column ID:	5	
Column Flags:	Original, Changed, ARM action code changed	
Min/Max entry:	0	100
Low/High value:	0.00	15.00
Formula AL:	LOG([5]+ 1)	

Refresh

Assessment Data

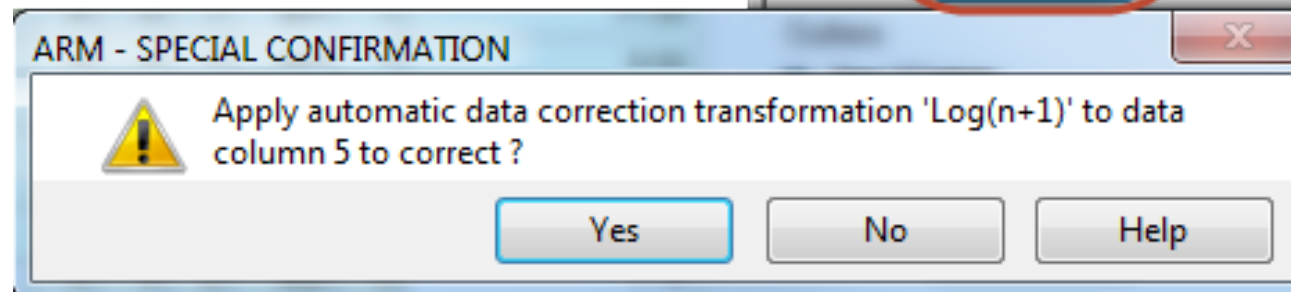
"Column Properties"

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

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

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

Fix



Assessment Data

"Column Properties"

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

5

9.5
15.00
10.00
8.00
5.50
7.90
8.00
7.00
12.00
15.00
1.90

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

Fix

Outliers

☐ Box-Whisker

☐ > +/- 2 standard deviations from grand mean

☒ > +/- 3 standard deviations from grand mean

☒ Skip damaged assessments

☐ Based on subsample values

Find Next

Assessment Map

Treatment

☐ Display current treatment

Assessment (Plot 205, Col 5)

Comment:

Barcode:

GPS:

☐ Damaged

AOV Means Table

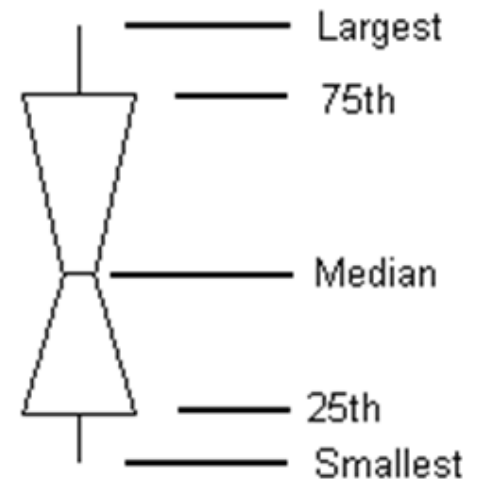
Rating Type ARM Action Codes	COUINS APC	
Trt Treatment No. Name	Rate Rate Unit	1
1 Untreated Check		106.3 a (0.0%)
2 Sure Kill NIS	250 g ai/ha 0.5 % v/v	13.5 bc (87.3%)
3 Super Stomp NIS	250 g ai/ha 0.5 % v/v	17.0 bc (84.0%)
4 Sure Kill NIS	375 g ai/ha 0.5 % v/v	9.5 c (91.1%)
5 Super Stomp NIS	375 g ai/ha 0.5 % v/v	24.0 b (77.4%)
LSD (P=.05)		8.93
Standard Deviation		5.80
CV		17.03
Bartlett's X2		12.244
P(Bartlett's X2)		0.016*
Skewness		1.6078*
Kurtosis		1.0506
Replicate F		6.201
Replicate Prob(F)		0.0087
Treatment F		197.210
Treatment Prob(F)		0.0001

- AOV=Analysis of Variance
- Treatment means
- Mean comparison test
- Descriptive statistics
- AOV assumption violations
- Evidence of significant treatment/rep. differences

Means followed by same letter do not significantly differ (P=.05, Student-Newman-Keuls)
 Mean comparisons performed only when AOV Treatment P(F) is significant at mean comparison OSL

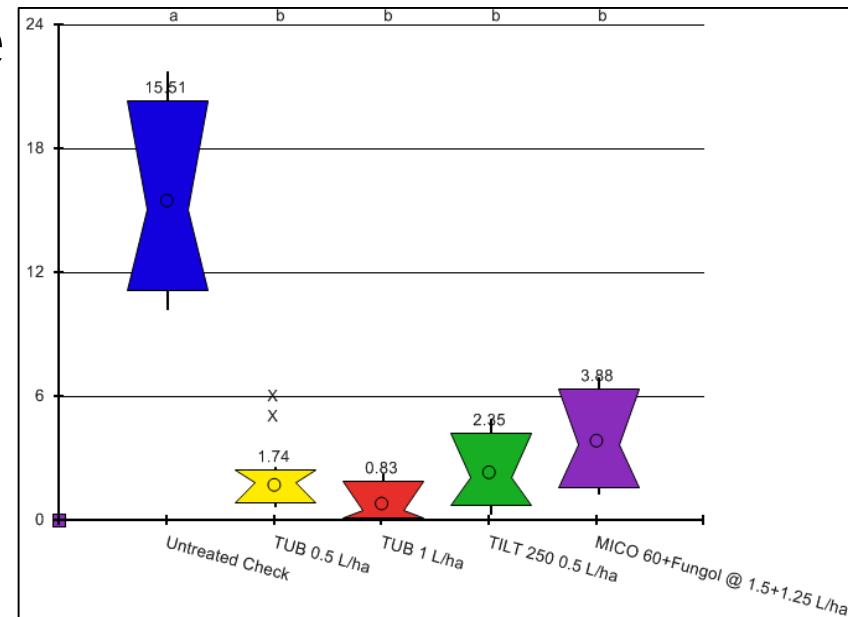
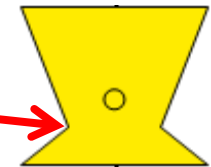
Box-Whisker Description

- Shows treatment "spread" around median
- **Box** is from 25th to 75th percentile, around median
- **Whiskers** extend to largest and smallest non-outlier values
- **Outliers** (X) are points outside of the box by more than 1.5 times box height



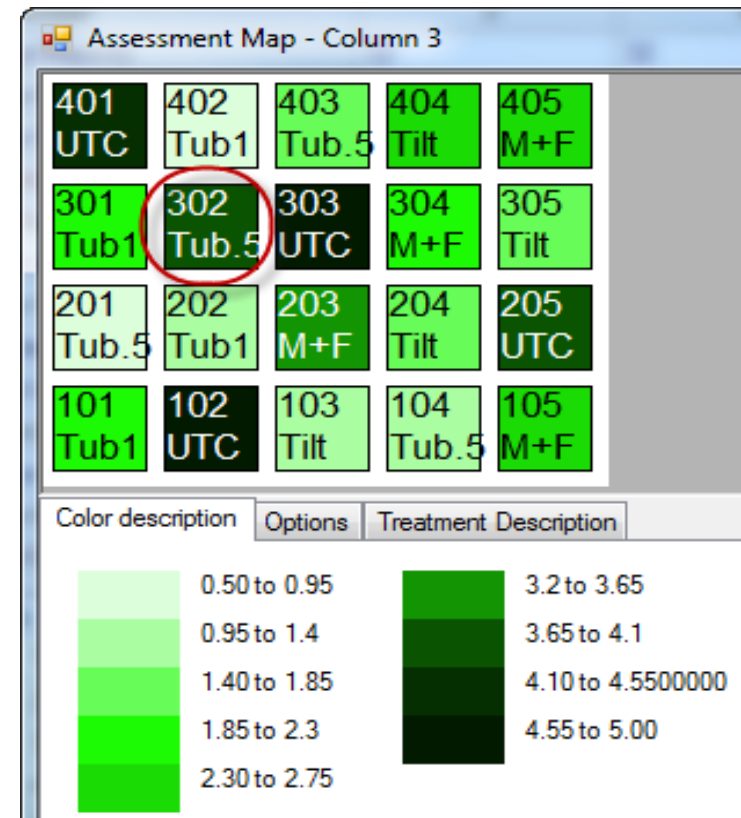
Box-Whisker Graph

- Box height shows treatment stability across replicates
- Skewed waist position shows a replicate difference
- Simplest method to view treatment variance(s)



Assessment Map

- Displays assessment values on trial map
- Values are indicated by color intensity
- Lower values display in lighter colors
- Color description is key to value colors



Tablet Image Auto-Capture

- Take a picture. ARM "captures" the image and links it to the current plot.

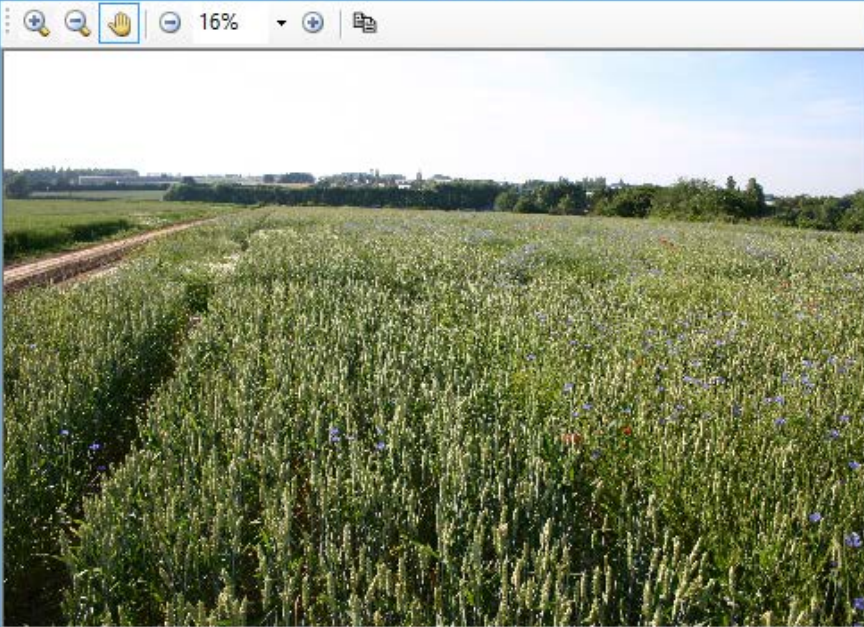
Assessment Data - Line 31

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	

Assessment (Plot 104, Col 2)

16%



Tablet Image Auto-Capture

- Automatically rename attached image
- Copy image to folder where trial is saved
- Set number of images to attach per plot, in each column

Tablet Data Entry - Image Options

☒ Copy to trial folder ☒ Rename image

File name components

☒ Trial ID: 1 ☒ Plot: 4

☒ Tit: 2 ☐ Sub: 5

☒ Asm. Date: 3

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

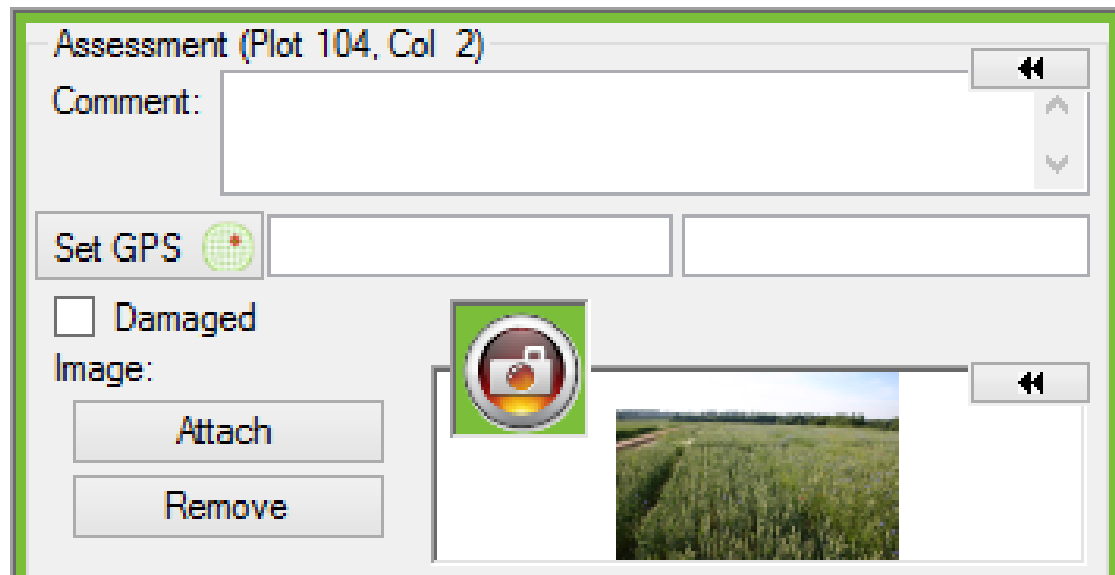
G-All7_Fung_T0003_Feb-16-2016_P101

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

Cancel < Back Finish

Tablet Image Auto-Capture

- Select "Remove" to delete from plot
- Images are backed up into ARMbackup



Suggested Camera Position

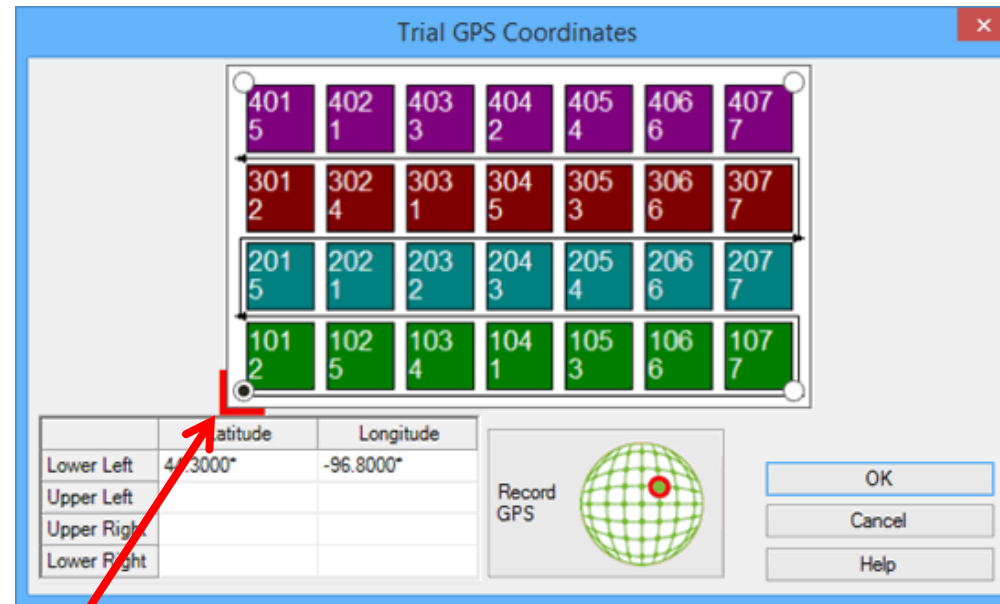
The screenshot displays the ARM 2016.1 (GDMdef) - G-AI17_Fung Trial software interface. On the left, a photograph of a field with rows of green plants is shown. A camera icon is overlaid on the photo, indicating the suggested camera position. The main window contains a table with the following data:

Sub	Plot	Column Number	Rating Type	Rating Unit	Subsamples
1	101	14	PHYGEN	%	1
1	102	15	CONTRO	%	1
1	103				
1	104				
1	105				
1	205				
1	204				
1	203				
1	202				
1	201				
1	301				
1	302				
1	303				
1	304				
1	305				
1	405				
1	404				
1	403				
1	402				

The right side of the interface shows the Properties panel with a TDC (Tablet Data Entry) button and a numeric keypad. The keypad includes buttons for digits 0-9, a decimal point, a minus sign, a plus sign, an enter key, and a missing data key. The bottom status bar shows the date and time: 3:16 PM, 2/16/2016.

Tablet GPS

- Reads current GPS coordinates from tablet hardware into Latitude and Longitude site description fields
- Touch Record GPS button to read current position for indicated corner (e.g. LL)





Data Transfers with Main PC

- Use USB cable for direct tablet-to-PC connection (purchased separately)
 - Simple file synchronization
 - Avoids Windows network support issues
 - Recommended, GDM supported method
- Use “cloud-based” file sharing
- Transfer on USB stick/flash drive
- Transfer on micro SD card



ARM Tablet Data Collector

- An optional component of ARM
- Provides special tablet data collector features not offered in standard ARM
- Licensed to one (1) Windows tablet per TDCx license
- One (1) TDC per each ARM license

Pricing & Ordering Information

- Email your local GDM Representative,
- Or see <http://gdmdata.com/Support/Write to Us/#request>

