



KDSmart Documentation

Release 3.0.x

DArT Team

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Note: You are viewing the PDF version of the KDSmart User Guide.

- Some features such as video will not visible however links to them are provided. They can be selected if you have Internet access or manually typed if you're viewing a printed copy.
- Please email us at kdsmart@diversityarrays.com if you find any omissions, errors or have suggestions for improvement in this user guide.

Welcome to the KDSmart application user guides. This user guide provides comprehensive information on KDSmart, out data collection application. Navigate this help by using the left hand menu and return to this page using the logo at the top left. Some sections of this help are also available as on-board help within the KDSmart application.

KDSmart is available for standalone use however, it forms an integral part of a bigger **Integrated KDDart Platform** as seen in the following image:

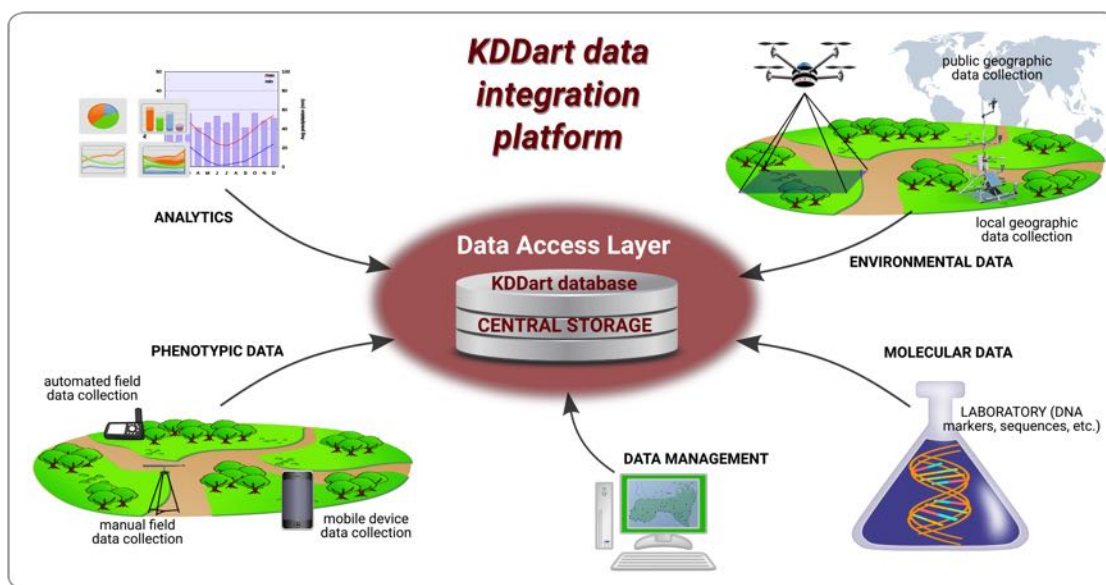


Fig. 1: KDDart System Design Principles - Integrated Platform

Both KDSmart and KDXplore can operate remotely, away from office networks and the internet as shown in the “KDDart Application Network Dependency” illustration.

KDDart Application Network Dependency

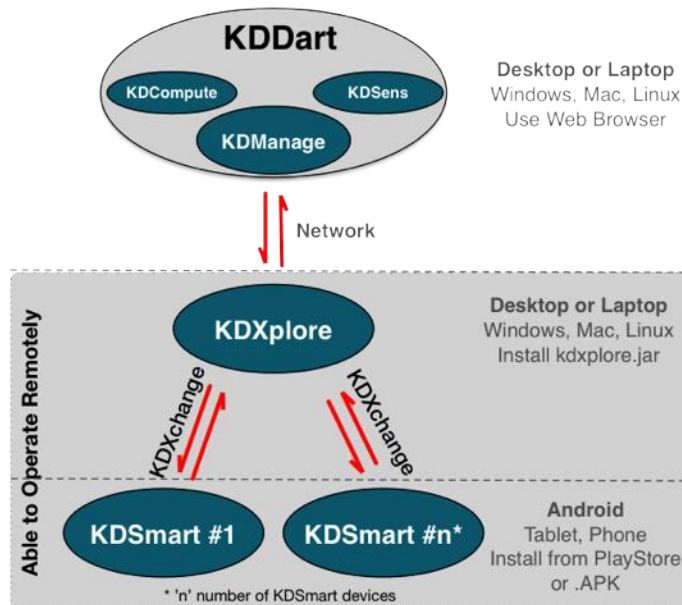


Fig. 2: KDDart Application Network Dependency

These images will help you gain a basic understanding of the platform and how KDSmart fits within the *breeding cycle* before getting started. The “Example of the Trial Data Workflow” illustration depicts a simple trial data workflow for KDDart, however look to the centre of the illustration to see KDSmart and KDXplore’s role in the workflow:

KDDart Trial Data Workflow

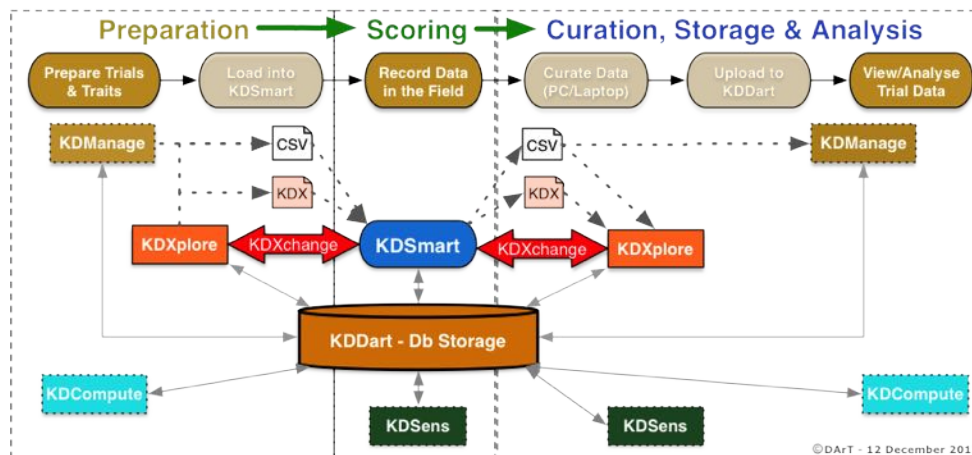


Fig. 3: Example of the Trial Data Workflow

KDSmart is available for free from the Google Play Store at the following link: <https://play.google.com/store/apps/details?id=com.diversityarrays.kdsmart>. KDSmart also supports Android 4.4 Kit Kat (Android SDK 19) and above as the minimum.

Before diving into details we strongly suggest taking a look at two brief overviews:

- Of the KDDart environment at: [Introduction to the KDDart Environment](#) ; followed by
- [The KDSmart Application](#)

For more information please explore the following websites:

- <http://www.kddart.org> (hosting site of these help pages)
- <https://www.diversityarrays.com>

For KDSmart tutorials (along with tutorials for our other applications), please see the [page](#).

Note:

- March 2019 - We are constantly improving KDSmart and welcome any feedback or queries. You can contact us by email at kdsmart@diversityarrays.com if you want to get in touch.
 - Sample files are now located on the [Sample Files](#) page.
-

GETTING STARTED

This page provides an introduction to the KDSmart application including its requirements and the basics of how to use it. Read this page first if you have not used KDSmart before. The following pages provide a more comprehensive guide to using KDSmart.

1.1 Purpose

KDSmart is an application that is used to collect phenotypic data from plants that are a part of trials. It allows the user to add information about a plot or sub-plot that they have observed (e.g. plant height), and then save that information in the trial. Data can then be exported and saved in the KDDart database.

1.2 Requirements

The following will be needed to run KDSmart:

- An internet connection to download or update the application (it can be used offline);
- Access to the Google Play Store;
- An Android device such as a phone or tablet with Android version 4.4 (Kit Kat) or above with the appropriate permissions accepted OR;
- A computer with Android SDK 19 or above installed.

Warning: Incorrectly set **Android permissions** will either prevent KDSmart completely from working or disable some features, e.g. taking pictures with the camera. Please see the [Android Permissions](#) topic for more information.

1.3 Data

There are three main types of items that are found in KDSmart. These are trials, traits, and tags (sometimes referred to as TTT).

- **Trial** - Contains data on the physical layout of a field and the plots and sub-plots within that field. Trials also have information such as planting date and traits that are included.
- **Trait** - The quality or characteristic being inspected, measured and recorded for the organism e.g. plant height. There are traits for both plots and sub-plots and can be used in multiple trials.

- **Tag** - Short text codes that provide a quick method of applying predefined classification or annotation to Plots or sub-plots e.g. BD is a tag that can refer to bird damage.

Trials are generally created in KDManage or KDXplore and then loaded onto a device with KDSmart such as a mobile phone. Once the KDSmart device has a trial to work with, the user can go into the field and collect information on traits of the plot and sub-plots (this is known as *scoring*). Tags can be applied to each plot or sub-plot to define any characteristics that are not measured by traits. The data collected with KDSmart can then be loaded into KDXplore for curation and storage. A guide for this basic workflow is outlined in the [KDTutorials](#) section.

1.4 Home Screen

KDSmart will open on the screen that is shown below. Please refer to the following table to learn more about KDSmart.

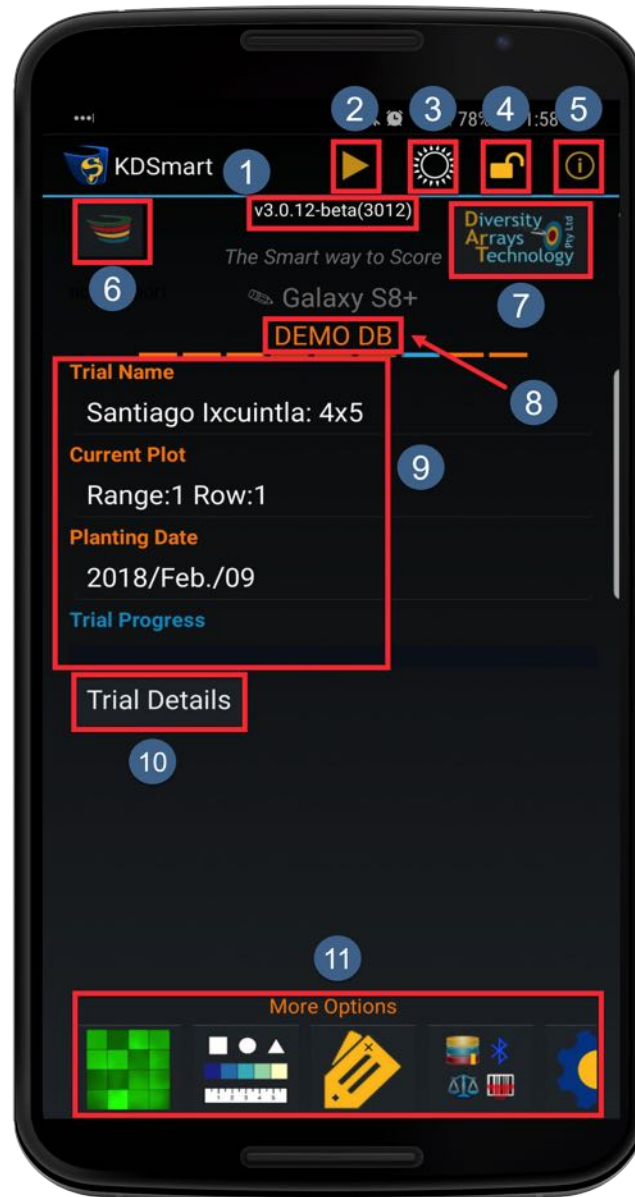
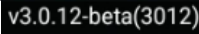









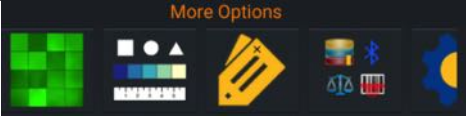


Fig. 1: KDSmart Home Screen

Table 1: KDSmart Home Screen

| Item Number | Icon/Image | Description |
|-------------|---|--|
| 1. |  | Displays the version of KDS that is being used. Check Google Play to see if any updates are available. |
| 2. |  | Starts scoring of the selected trial. |
| 3. |  | Changes the brightness settings from <i>Dark Mode</i> to <i>Light Mode</i> (Note that this has been deprecated in the current version - it is likely to come back in future versions). |
| 4. |  | Locks editing so that trials may not be edited. A password will be needed to unlock editing features. |
| 5. |  | Provides an in-app Help Guide, an About page, and information on licenses. |
| 6. |  | Navigates to the KDDart web page. |
| 7. |  | Navigates to the Diversity Arrays website. |
| 8. |  | Indicates that this is the Demo database. |
| 9. |  | This is the selected trial. |
| 10. |  | View more details on the selected trial. |
| 11. |  | Various options for KDS. An explanation of the options will be displayed in the table below. |

This link, https://youtu.be/PM_IWMbHnBc, is to a short KDSmart tour video where you can learn about some of the UI elements and features of KDSmart.

1.5 What now?

The rest of the KDSmart Help Guide will provide a more in-depth explanation of the features and uses of KDSmart. Refer to the navigation bar on the left for more information on scoring trials, exchanging data with KDXplore, sample files, etc.

SAMPLE FILES

This page contains links to example files that will assist with both learning and getting started using KDSmart and KDXplore. As a resource, you can use these files as templates for replacing with your own data (trials, traits or tags) which can then be imported into KDSmart or KDXplore.

Tip:

- In KDSmart your own terminology may be used to define plot, column and row - See **Settings** from the **KDSmart Home Screen** or **Menu**.
 - From these sample files, choose one most similar to your trial's organisation, e.g. using col and row, block IDs, sub-plots, etc.
 - The sample files can be used as templates by editing and substituting your own data.
 - To save CSV files you may need to right click the link and choose **Save Linked Content As...**
-

2.1 Column and Row Trial

This example file contains a *Column and Row Trial*.

For this type of trial, the combination of column and row is **unique for every plot** in the trial.

To download *KDSXsample1_Normal_Trial_X_Y.csv* select the following link:

http://www.kddart.org/public/KDSXsample1_Normal_Trial_X_Y.csv

| | |
|---------------------|--|
| Trial Type: | Column & Row (X, Y) |
| Description: | Each Column & Row (X, Y) combination is unique for every plot in the trial. |

2,0

2,1

2,2

2,3

1,0

1,1

1,2

1,3

0,0

0,1

0,2

0,3

Fig. 1: KDSmart Column and Row Trial Example

2.2 Traits File

To download the traits example file *KDSXsample3_wheat-traits.csv* select the following link:

http://www.kddart.org/public/KDSXsample3_wheat-traits.csv

Trait attributes that can be loaded in the file are described in the following table:

Table 1: Trait Attributes - CSV Column Headings and Descriptions

| Attribute (CSV Column Name) | Description |
|-----------------------------|--|
| TraitName | Must be unique and short for display in the Scoring Screen where space is limited on smaller devices (i.e. phones). |
| TraitAlias | An alternative trait name, useful when the trait name is too long for the screen. |
| TraitDescription | This is an optional longer explanation of the trait to assist in data entry. |
| TraitDataType | Constrains permitted values of traits. Types available are: <ul style="list-style-type: none"> • CATEGORICAL; • DATE; • ELAPSED_DAYS; • INTEGER; • DECIMAL; or • TEXT (default). For more details refer to Trait Data Types in the traits topic. |
| TraitUnit | An arbitrary term for the <i>unit</i> of the trait to assist with what value to enter when scoring (e.g. measurements in millimetres or centimetres). |
| TraitValidation | The validation rule optionally restricts the values being entered. The nature of the rule is dependent upon the selection of data type. |
| Barcode | Used to identify the trait when using a barcode scanner for scoring. |

More information about Traits can be found on the [Traits](#) help page.

Note: Traits loaded from CSV without a defined Datatype will default to TEXT.

2.3 Tags File

The following is a tags example file containing a tag and description.

To download the file *KDSXsample2_tags.csv* select the following link:

http://www.kddart.org/public/KDSXsample2_tags.csv

An additional tags example is provided below *Trial Containing Sub-Plot Tags* which contains sub-plot data tags.

The following table shows the required and optional headings for a CSV file.

Table 2: Tag Attributes - CSV Column Headings and Descriptions

| Heading | Alternatives | Mandatory | Description |
|------------------------|--|-----------|--|
| Label | TagLabel, Comment | Yes | Name of the tag e.g. BD for bird damage |
| Description | TagDescription, Desc, CommentDescription | Yes | Tag description |
| DatabaseLabelId | LabelId, Id | No | Useful for cross-reference to the originating database |

2.4 Plot Id Trial

In this example, Plot ID is unique for every plot in the trial.

To download the file *KDSXsample4_demo_trial_plot_id.csv* select the following link:

http://www.kddart.org/public/KDSXsample4_demo_trial_plot_id.csv

| | |
|---------------------|--|
| Trial Type: | Plot ID |
| Description: | The Plot ID for every plot in the Trial is unique |

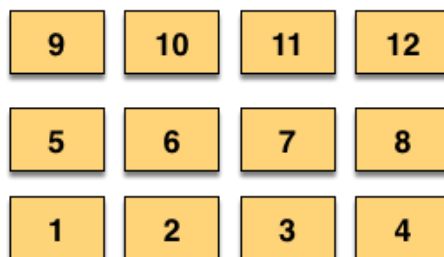


Fig. 2: KDSmart Plot Id Trial Example

2.5 Block Trial

A *Block Trial* is where the combination of block, column, row is unique for every plot within the trial.

To download the file *KDSXsample5_Block_Plots_Right.csv* select the following link:

http://www.kddart.org/public/KDSXsample5_Block_Plots_Right.csv

| | |
|---------------------|--|
| Trial Type: | Block |
| Description: | The combination of Block, X, Y for every plot is unique in the Trial. |



Fig. 3: KDSmart Block Trial Example

2.6 Excel Workbook Example Format

If you are creating CSV files for import into KDSmart the following Excel workbook may be useful:

To download the file *KDSmart_CSV_Import_Format.xlsx* select the following link:

http://www.kddart.org/public/KDSmart_CSV_Import_Format.xlsx

2.7 Sub-Plot Data Examples

The following examples illustrate different ways of importing sub-plot data.

2.8 Trial With Sub-Plot Data For a Particular Sub-Plot

Trial with sub-plot data for a particular sub-plot.

The first three plots in this example file have values for the trait *Plant_Height* for sub-plot 2.

To download the file *KDSXsample6_Specimen_Value_particular_subplot.csv* select the following link:

http://www.kddart.org/public/KDSXsample6_Specimen_Value_particular_subplot.csv

2.9 Trial with Sub-Plot Data For a Particular Sub-Plot and Trait Instance

This example file contains the first three plots with values for:

- The Trait *Plant_Height*: Instances 1 and 2; and
- Sub-plots 1 and 2.

To download the file *KDSXsample7_Specimen_value_particular_subplot_and_instance.csv* select the following link:

http://www.kddart.org/public/KDSXsample7_Specimen_value_particular_subplot_and_instance.csv

2.10 Trial with Sub-Plot Data For All Sub-Plots

The trial has a number of sub-plots specified by sub-plot count and contains data for every sub-plot. This example file contains the first three plots with values for:

- The trait *Plant_Height*: Instances 1 and 2; and
- All sub-plots.

To download the file *KDSXsample8_Specimen_Count_and_data_for_every_subplot.csv* select the following link:

http://www.kddart.org/public/KDSXsample8_Specimen_Count_and_data_for_every_subplot.csv

2.11 Trial Containing Sub-Plot Tags

This example trial illustrates importing tags to the sub-plot level.

- This feature is only available from version 3.0.
- If a new tag is being created with this trial import it will not have a description. If this is an issue, import (i.e. create) the tags first by importing using a tag definition file (see above [Tags File](#)).
- This Trial has no Traits.
- To import, at the import window the tags, be sure to select *Import As > Trait for Plot* for the Tags#1, Tags#2 and Tags#* rows in the import window.

This is a trial example file containing some sub-plot tags:

To download the file *KDSXsample9_wheat-with-data.csv* select the following link:

http://www.kddart.org/public/KDSXsample9_wheat-with-data.csv

TRAITS

KDSmart facilitates the recording or scoring of traits for trials and nurseries. Traits are usually phenotypic information although this arbitrary.

KDSmart scoring screens are designed to allow quick recording of measurements, usually with a single touch.

Traits can be defined with validation rules to facilitate strict data capture rules to assist in preventing recording errors. These rules can also be utilised to also make scoring more efficient by minimising the required keystrokes.

The **Traits Screen** (pictured below) provides a list of all available traits and options for management of traits including importing and exporting.

3.1 What is a Trait?

Traits are the quality or characteristic being inspected, measured and recorded for the organism. Within KDSmart, traits have the following characteristics and features:

- User definable;
- Defined by six different data types;
- Optionally lockable once scored to prevent accidental change;
- Importable and exportable;
- Can be grouped into bundles for easier management; and
- Are either plot level or sub-plot level.

A measurement is stored for each trait instance in each plot or sub-plot includes the:

- Date and time when the measurement was taken;
- GPS coordinates (if this is enabled); and
- Value of the measurement.

Some examples of traits include the height of a plant (this might be called Plant_Height) or the date that a plot was irrigated (which could be called Irrigated).

3.2 Trait Attributes

Each trait contains a set of attributes that define its characteristics. The following table lists the attributes of a trait:

Table 1: Trait Attributes

| Attribute | Description |
|------------------------|---|
| Trait Name | Must be <i>unique and short</i> for display in the Scoring Screen where space is limited on smaller devices (i.e. phones). |
| Alias | An alternative trait name, useful when the trait name is too long for the screen. |
| Description | This is an optional longer explanation of the trait to assist in data entry. |
| Data Type | <p>Constrains permitted values of traits. Types available are:</p> <ul style="list-style-type: none"> • CATEGORICAL, • DATE, • ELAPSED_DAYS, • INTEGER, • DECIMAL; or • TEXT; <p>For details refer to <i>Trait Data Types</i></p> |
| Unit | An arbitrary term for the <i>unit</i> of the trait to assist with what value to enter when scoring (e.g. measurement in millimetres or centimetres). |
| Validation Rule | The validation rule optionally restricts the values being entered. The nature of the rule is dependent upon the selection of a data type. |

Tip: Within the **Scoring Screen**, a *long press* of any trait name will:

- Display the trait details; and
 - Allow editing of the trait value if it is locked.
-

Note: Traits loaded from CSV all default to the *TEXT* data type unless they have previously been loaded or defined. Once loaded you may edit the trait definition to define its data type etc.

Note: Unless specified in the CSV, traits loaded from CSV default to the *TEXT* data type. If the Trait already exists and is not yet scored unless they have previously been loaded or defined. Once loaded you may edit the trait definition to define its data type etc.

3.3 Trait Instances

A trial consists of plots and sub-plots which have traits for scoring. Furthermore, KDSmart allows you to score each trait multiple times - this is called a *Trait Instance*. The benefit of instancing traits is that they are easier to create and manage because only one trait needs to be managed rather than separate ones. Having separate traits also creates more work for data analysis and curation in KDXplore.

For example, you may wish to score PH_Soil three times: after 3 weeks, after 5 weeks and after 7 weeks. You can either:

- Define three different traits (e.g. PH_Soil1, PH_Soil2, and PH_Soil3).
- Define three instances of the single trait (e.g. PH_Soil #1, PH_Soil #2, and PH_Soil #3).

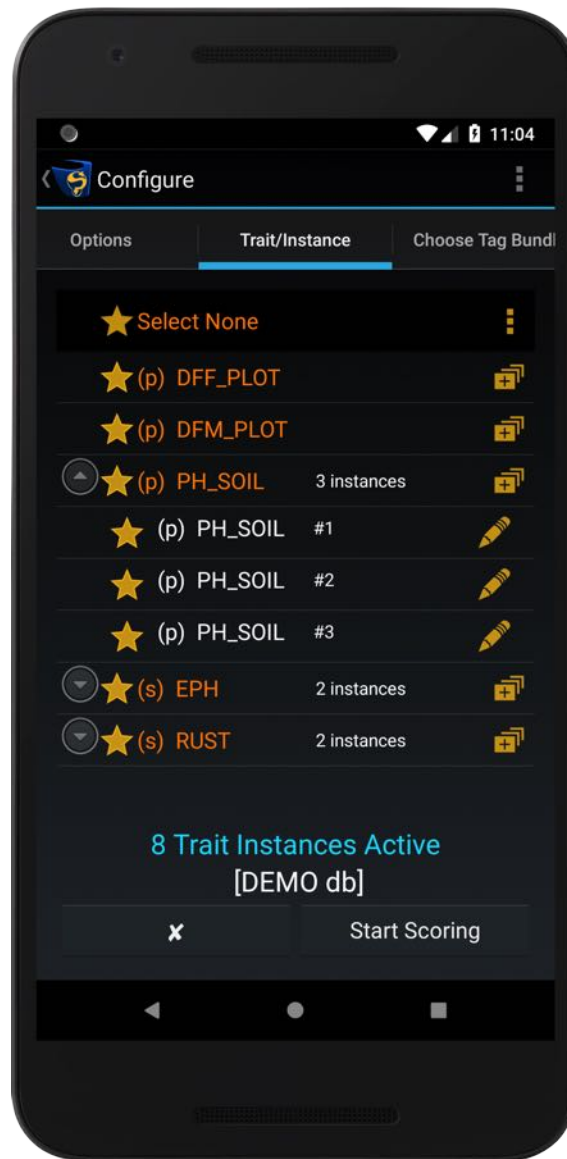


Fig. 1: Trait Instances

3.4 Trait Naming

When preparing traits it is recommended that the use spaces in trait names are avoided and underscores are used instead. For example instead of Plant Height use Plant_Height.

Should KDXplore software be used after scoring it has the ability to calculate trait values from other traits, however, is restricted if trait names contain spaces.

3.5 Trait Data Types

The following table describes the available data types for traits:

Table 2: Trait Data Types

| Data Type | Description | Data Entry Style | Example Validation Rule |
|--------------------|--|---|--|
| TEXT | No constraint on what may be entered. | A text input field with a full keyboard. | No rule required. |
| CATEGORICAL | Value is constrained to be one from a list of allowed values. Translations to other languages are supported. | A list of the allowed values is presented and the user touches the value desired. | Example: CHOICE(BLUE YELLOW RED) There must be at least two values provided in the pipe separated list (such as in the example above). In a later release, the format will support providing a description for each value. This will likely be of the form value:description To prevent future problems you should not use the colon (:) character in any current value. |
| DATE | Value is a date. | A calendar is presented from which to choose a date. | May be left blank or specified as date. |

Continued on next page

Table 2 – continued from previous page

| Data Type | Description | Data Entry Style | Example Validation Rule |
|---------------------|--|--|--|
| ELAPSED_DAYS | Value is the number of days since the trial's planting date. The range in the calendar is constrained by the start date and an optional upper limit. KDSmart stores the values as a date but presents the value as a number when required. | A list of days around the current date are presented and the user selects the desired value or chooses 'Other' to use a calendar to pick a date outside this range. The choices in the list (-3d, -2d, -1d, Today, +1d, +2d, +3d) may be presented in different languages depending on locale support. | May be left blank or specified as elapsed_days. To enforce a maximum value, use: elapsed_days_max=NNN. |
| INTEGER | Integer numeric values in a range specified. The range is specified as a lower and upper bound and whether or not the bounds are included in the range. | If the number of values is 'small' then the entry is similar to the categorical data type. Otherwise, a numeric keypad is presented (excluding a decimal point key). The changeover from categorical style to numeric keypad may be altered in the Settings Screen . For Example: RERANGE(1..5) presents as a list of choices: 1,2,3,4 but RANGE(1..500) presents a keypad. | Specify the range of values as: RANGE(min..max) or use <i>LERANGE</i> , <i>RERANGE</i> , <i>BERANGE</i> to exclude the left, right or both limits respectively. Example: RERANGE(-1..5) means the accepted values are -1, 0, 1, 2, 3, 4 Note: If you use a custom keyboard, this may affect the appearance of the numeric keypad. |

Continued on next page

Table 2 – continued from previous page

| Data Type | Description | Data Entry Style | Example Validation Rule |
|-----------|--|---|--|
| DECIMAL | Specify a lower and upper bound and whether or not the bounds are included in the range and the number of digits of precision that will be recorded. | Entry is done using a numeric keypad that includes the decimal point. NOTE: If you use a custom keyboard, this may affect the appearance of the numeric keypad. | RANGE(min..max) or use LERANGE, RERANGE, BE-RANGE. However, min and max must now contain a decimal point and at least one digit following the point. So: BE-RANGE(1.0..2.99) means accept values for x where $1.00 < x < 2.99$ (the greater number of digits after the “.” for min/max is the “precision” desired). |
| CALC | Calculated or Derived Trait. See <i>Calculated or Derived Traits</i> below for further description. | Data entry is not permitted for this type. Traits with this data type cannot be scored during data collection. | A simple calculated or derived trait is: CALC(max(PH_CM/5,1)) This calculation references a trait named PH_CM, dividing the value by 5 and returning the maximum of the division or 1, whichever is the greater. So a value of 17 for PH_CM gives a result of 3. Alternatively, CALC(max(PH_CM/5,1) , 1) will retain the result with one decimal place. In this case the value of 17 for PH_CM results in 3.4. |

3.6 Calculated or Derived Traits

The validation rule has either one or two components (with a comma separating them if required):

- The first component provides a formula that may reference other traits (by the trait name), using the operators

and functions listed below.

- If present, the second component indicates the number of decimal digits to retain in the computed result.

The functions available are in a table below. Arithmetic operators are:

$*$ / $\%$ (the last is the **modulo** operation) $+$ $-$ (unary minus is also supported) $^$ $**$ (for exponentiation).

Note: The comparison operators: $<$ $<=$ $=$ $!=$ $>$ $>=$ and the logical operators: $\&\&$ $\|\$ evaluate to either 1 or 0 representing **true** or **false** respectively. This is relevant for the `if(cond,a,b)` function.

3.6.1 Functions Available For CALC Data Type

The following table describes the functions available for the CALC data type.

Table 3: Functions Available For CALC Data Type

| Function Name(s) | Description | Example |
|---|---|---|
| sin cos tan asin acos atan | Trigonometric functions | |
| sinh cosh tanh | Hyperbolic functions | |
| abs round floor ceil sqrt exp ln log sign | Unary mathematical functions: ROUND, FLOOR and CEIL return an integral portion of the input. LN is the natural logarithm LOG is the logarithm to base 10 | round(1.5) returns 2.0 round(1.4) returns 1.0 floor(1.5) returns 1.0 ceil(1.5) returns 2.0 |
| pow min max | Binary mathematical functions | pow(2,3) returns 8.0 pow(3,2) returns 9.0 |
| rnd deg(radians) rad(degrees) | Other functions: rnd(a) returns the value of a multiplied by a random number satisfying the constraint RERANGE(0..1.0) i.e. a value x where: $0.0 \leq x < 1.0$ deg and rad convert between degrees and radians. | rnd(10) will return a value y satisfying: $0 \leq y < 10$ |
| if(expr , a , b) | Conditional expression: If the value of expr is 1 , the result is the expression a otherwise the result is expression b | if(PH_CM \leq 5 , 1 , 2) evaluates to 1 if the value of the trait PH_CM is 5 or less otherwise to 2 |

Tip: Why can't I import my CALC trait?!

- Ensure validation rules using comma's (e.g. `CALC(max(PH_CM/5,1) , 1)`) are wrapped by double quotes (e.g. `"CALC(max(PH_CM/5,1) , 1)"`). Excel handles this automatically.
- Ensure the number of opening and closing brackets match (It's an easy thing to miss at a glance).
- Trait names that use white spaces in their names cannot be used for derived CALC traits.

3.7 Categorical Traits

At times during scoring, the precision level required can vary. This may be dictated by a number of factors, e.g. sheer volume of specimens, time frame for data collection, reduced/limited people to perform the scoring, etc. In these instances, the *Categorical Data Type* may prove useful.

Typically *Categorical* is used for constraining the data entered to a predefined list of values, such as the following definitions:

- CHOICE(BLUE | YELLOW | RED); and
- CHOICE(White | Yellow | Purple | Variegated | Brown | Orange yellow | Mottled | White top | Red | Sun red | Blue | Other).

Note: In these examples, the pipe character ‘|’ is shown with a space character either side to improve legibility.

3.7.1 Using Categorical Traits

In some situations using a categorical data type may be more beneficial as this facilitates the use of selection ranges instead of data entry.

The following table illustrates the collection of plant height using both methods:

Table 4: Comparison Scoring Integer VS Categorical Trait Type - Required Precision 5cm

| | Trait Defined as Integer | Trait Defined as Categorical |
|------------------------|--|---|
| Entry Method | Plant height entered by selecting a value buttons. | Plant height entered by selecting a value range from a list. |
| Conditions | Trait validation with a minimum of 5 and maximum of 50 | Trait validation with six ranges defined (e.g. The unit of measure may be 5 centimetres). |
| Validation Rule | $5 \leq x \leq 50$ | CHOICE(5-10 10-15 15-20 20-25 25-30 30++). |
| Key Presses | Minimum 2 button press per sub-plot (single digit) then Accept Button . | Minimum 1 button press per sub-plot, unless a long condition list requires scrolling. |

Note: For a categorical trait, the number of choices may be limited to suit the circumstances of the trial stage.

TAGS

KDSmart scoring includes the use of tags for plots and sub-plots. This section provides more information on tags including how to create and use them.

4.1 What is a Tag?

Tags are short, text descriptions that are used to represent information about a plot or sub-plot (a cell) in a trial e.g. 'BD' which can mean 'bird damage'. They provide a quick method of applying predefined classifications or annotations to plots or sub-plots. They essentially work like reusable notes, such as.

Tags have the following characteristics:




- User definable;
- Consist of a short name and optional long description;
- New tags can be created in the field;
- Can be imported from a CSV file; and
- Are exportable to CSV file.

The main benefits of tags are that they:

- Are simple to use - selectable from a list makes them quick and easy to assign;
- User or project definable;
- Provide consistent annotation, avoiding problems with spelling or language; and
- Deployable across multiple users, devices and locations.

This means that the:

- Users spend less time writing and repeating notes in the field; and
- Data curators have more consistent, uniform recordings from multiple locations by different field workers.

When tags have been assigned to a plot or sub-plot they will appear as shown in the following image, which shows part of the **Scoring Screen** with two tags assigned at  which is above the trait column. Tags are assigned or reassigned using the  **Assign Tag Button** at .

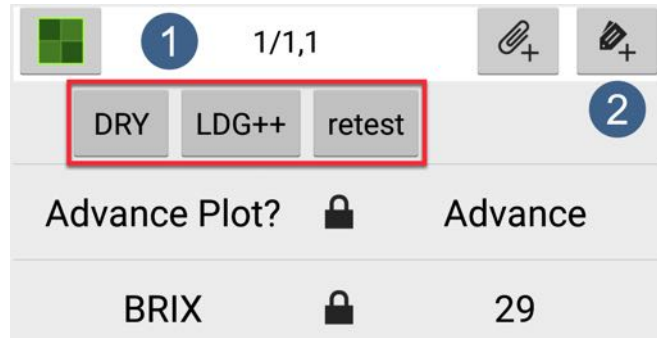



Fig. 1: Example of Two Applied Tags on the Scoring Screen

A few tag examples are shown in the following table:

Table 1: Example Tags

| Tag (Short Name) | Long Description |
|------------------|-----------------------------------|
| BD | Bird Damage |
| LDG+ | General Lodging in plots-mild |
| LDG++ | General Lodging in plots-moderate |
| WET | Waterlogging |

4.2 Tag Management

Tags are managed from the **Tags Screen** which can be accessed by selecting the  **Tags Button** on the **Home Screen** or through the **Menu**. The following actions can be performed at the **Tags Screen**:

- Add a new tag;
- Edit a tag description;
- Delete selected tag(s) (Note: Assigned/in use Tags cannot be deleted);
- Import tags from a CSV file; and
- Export selected tags to a CSV file.

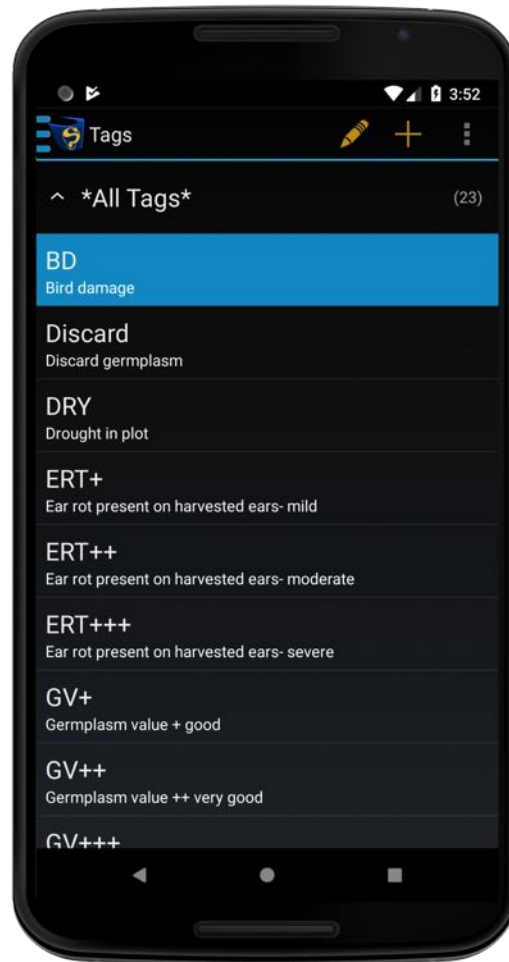



Fig. 2: Tags Screen

4.2.1 Adding Tags

Tags can either be created in KDSmart or imported. Follow the instructions below to create a new tag.

Table 2: Adding Tags

| Step | Action |
|------|--|
| 1. | Open the Tags Screen and select the  Add Tag Button . |

Continued on next page

Table 2 – continued from previous page

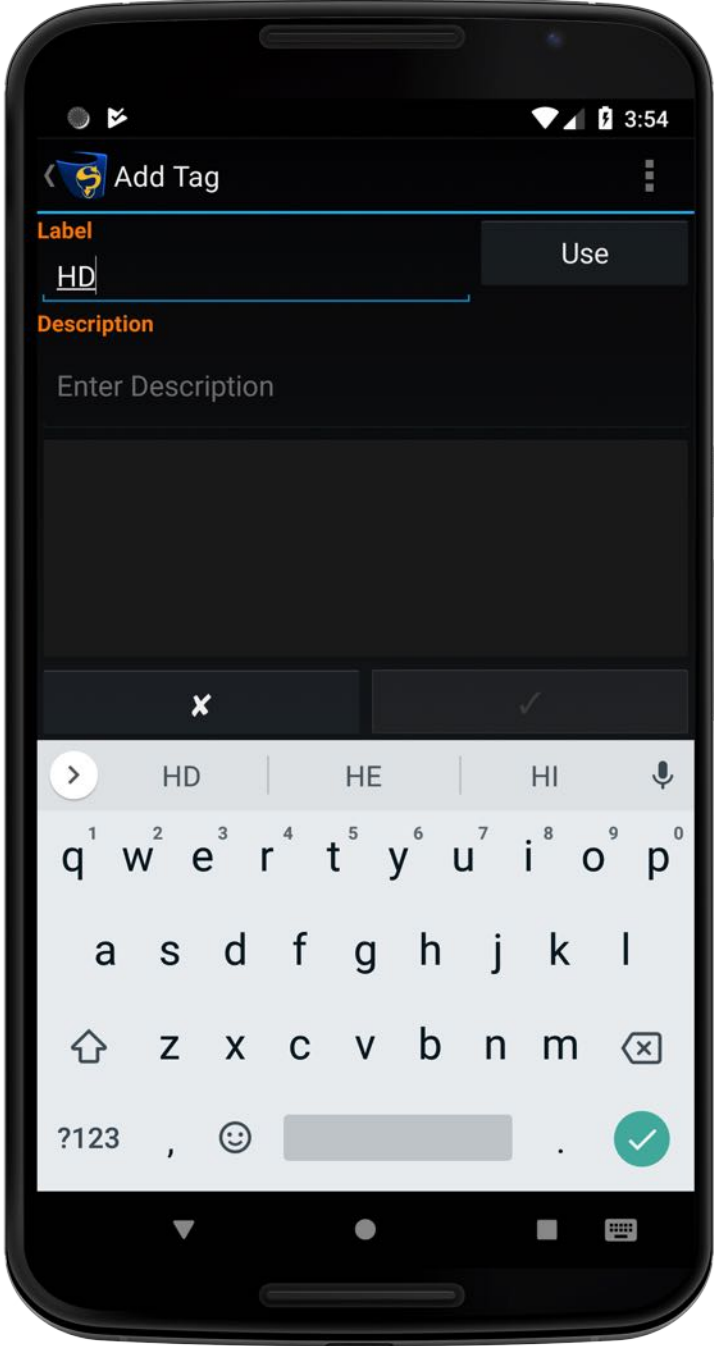
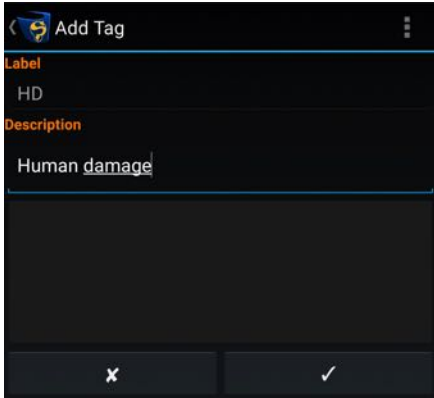
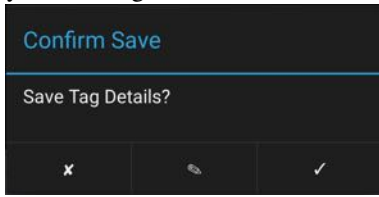
| Step | Action |
|------|---|
| 2. | <p>Enter a <i>Label</i> (tag name) such as ‘HD’ in the image below. Select the <i>Use</i> option to check if the name for the tag is free and confirm it.</p>  <p>The screenshot shows a smartphone screen with the 'Add Tag' application. At the top, there's a status bar with signal, Wi-Fi, and battery icons, and the time 3:54. Below that is a navigation bar with a back arrow, a logo, and the text 'Add Tag'. The main area has two sections: 'Label' and 'Description'. The 'Label' section has a text input field containing 'HD' and a 'Use' button to its right. The 'Description' section has a text input field with the placeholder 'Enter Description'. At the bottom, there's a keyboard with a search bar containing 'HD' and a green checkmark button on the right.</p> |

Fig. 3: Choosing a Tag Name

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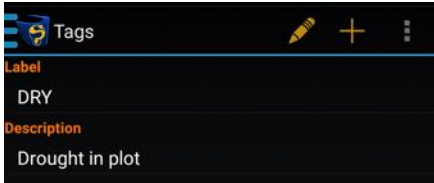
Table 2 – continued from previous page

| Step | Action |
|------|--|
| 3. | <p>A description can be added once the tag name has been confirmed. Enter the description into the text field and then select the Confirm Button (the tick) to confirm the name and description of the tag.</p>  <p>Fig. 4: Tag Description</p> |
| 4. | <p>A dialogue box will open and you will need to choose to cancel, edit, or confirm your new tag details.</p>  <p>Fig. 5: Saving a Tag</p> |

4.2.2 Editing Tags

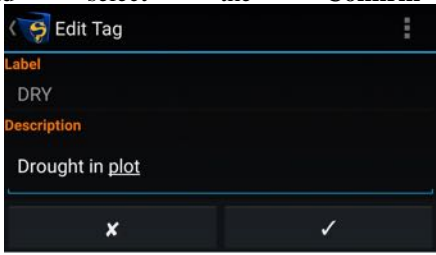
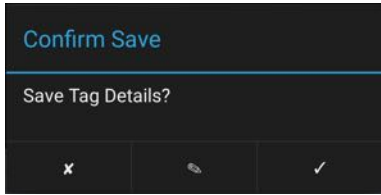
Tags can be edited once they have been created. The instructions below outline how to edit a tag.

Table 3: Editing Tags

| Step | Action |
|------|---|
| 1. | Open the Tags Screen and select a tag that you would like to edit. |
| 2. | <p>Select the  Edit Button as in the image below. This will present a screen like the Add Tag Screen</p>  <p>Fig. 6: Editing a Tag</p> |

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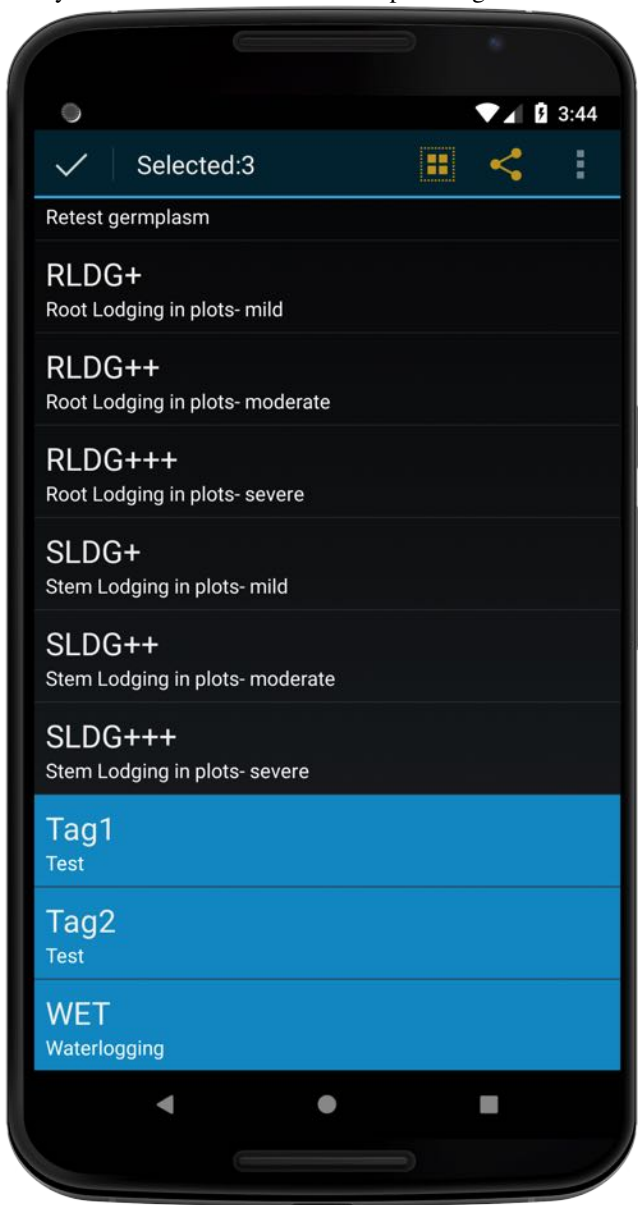

Table 3 – continued from previous page

| Step | Action |
|------|--|
| 3. | <p>Edit the tag name and/or tag description and select the Confirm Button.</p>  <p>Fig. 7: Confirming an Edited Tag</p> |
| 4. | <p>A dialogue box will open and you will need to choose to cancel, edit, or confirm the edited tag details.</p>  <p>Fig. 8: Saving a Tag</p> |

4.2.3 Deleting Tags


Tags can be deleted by either multi-selecting tags and deleting them or just deleting a single tag. Once a tag is deleted it is not possible to undo the action so it is best to keep tags in a CSV file.

Table 4: Deleting Tags

| Step | Action |
|------|---|
| 1. | <p>Select the tags that you want to delete by <i>long-pressing</i> it. <i>Short-pressing</i> any additional tags will allow you to multi-select multiple tags for deletion.</p>  <p style="text-align: center;">Fig. 9: Multi-selecting Tags</p> |
| 2. | <p>Select the  Menu Button to view additional options.</p> |
| 3. | <p>Select the <i>Delete Tags</i> option from the menu items.</p> |

Continued on next page

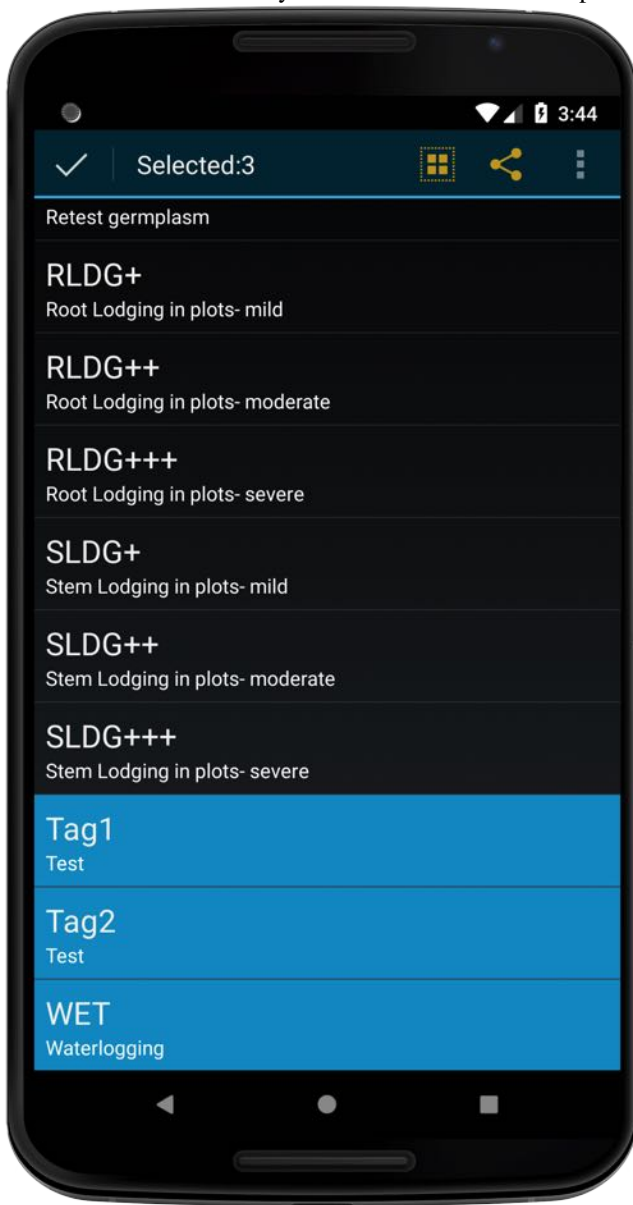

Table 4 – continued from previous page

| Step | Action |
|------|---|
| 4. | <p>A message will be displayed that will list any tags that cannot be deleted because they are currently being used in a trial. Select the</p> <p> Delete Button to delete any tags that are not being used in a trial.</p> |

4.3 Tag Bundles

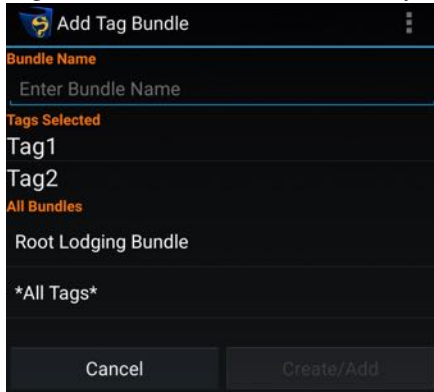
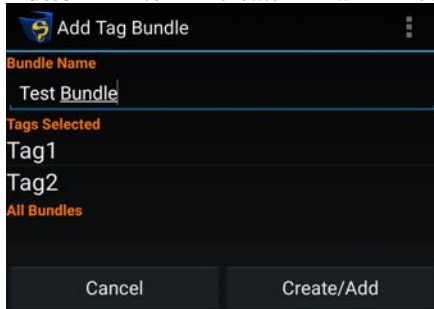
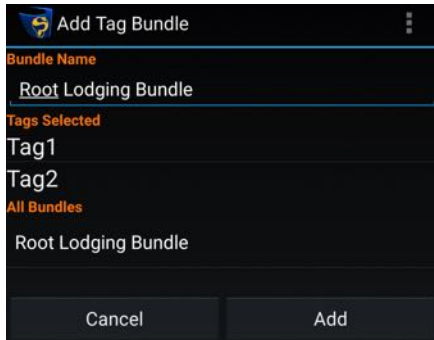
Tags can be grouped into bundles to assist with management. Tag bundles can be created in KDSmart and imported/exported from other devices as well. There will always be a bundle that is automatically created called *All Tags*. See the instructions below for how to create a new tag bundle in KDSmart.

Table 5: Creating a Tag Bundle and Adding to Tag Bundles

| Step | Action |
|------|---|
| 1. | <p>Select the tags that you want to create a bundle with by <i>long-pressing</i> a tag and then <i>short-pressing</i> any additional tags. This will allow you to multi-select multiple tags.</p>  <p>Fig. 10: Selecting Tags for a Bundle</p> |
| 2. | <p>Select the  Menu Button to view additional options.</p> |

Continued on next page

Table 5 – continued from previous page

| Step | Action |
|------|---|
| 3. | <p>Select the <i>Add Bundle</i> option from the menu items. This will take you to the Add Tag Bundle Screen which lists the selected tags and bundles that have already been created.</p>  <p>Fig. 11: Add Tag Bundle Screen</p> |
| 4. | <p>Enter a bundle name and then select the Create/Add Button to create a new bundle.</p>  <p>Fig. 12: Creating a New Bundle</p> |
| 5. | <p>You can also select a current bundle which will display a new Add Button. Select that button to add the selected tags to an existing bundle.</p>  <p>Fig. 13: Adding Tags to an Existing Bundle</p> |

4.4 Assigning Tags

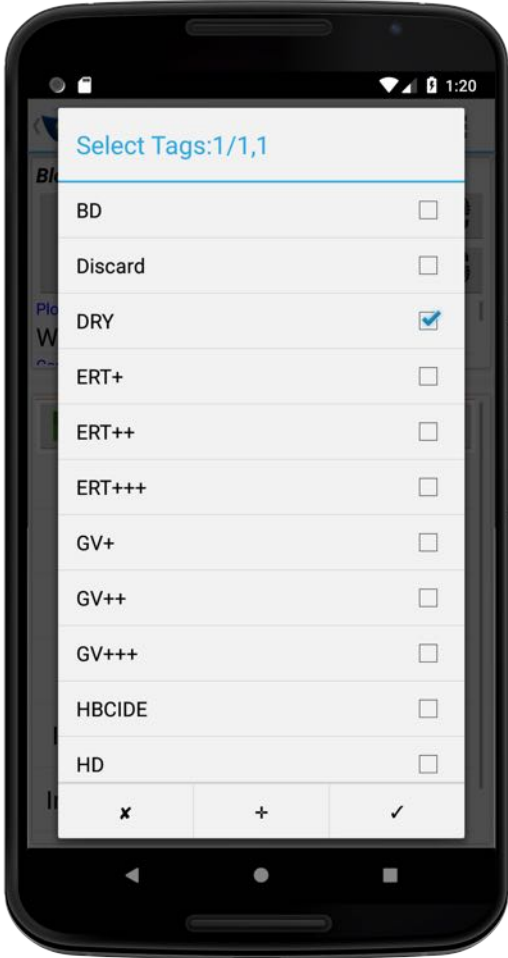
Along with scoring traits, assigning tags is a part of the scoring process. One or more tags may be assigned to a plot (or sub-plot) or reassigned if required. To assign a tag, follow these steps:

Table 6: Assigning Tags

| Step | Action |
|------|--|
| 1. | <p>Locate a plot or sub-plot to tag in the Scoring Screen.</p>  <p>Fig. 14: Tags on the Scoring Screen</p> |
| 2. | <p>Select the  Assign Tag Button.</p> |

Continued on next page

Table 6 – continued from previous page

| Step | Action |
|------|--|
| 3. | <p>Select one or more tags to assign them to a plot.</p>  <p>Fig. 15: Assigning Tags</p> |
| 4. | <p>Select the Confirm Button (tick) to save changes and return to the Scoring Screen. This displays the tag short name above the traits for the selected plot.</p> |

Assigning tags is often an integral part of scoring. For more information about scoring see the page.

Note: Information on importing and exporting data such as tags can be found in the page.


PREPARING FOR SCORING


Trials that are scored in KDSmart will require some configuration so that users can score their trials in the way that that is best for their workflow. There are plenty of different configuration options in KDSmart so this section is a guide to preparing for scoring.

5.1 Demo vs Production - Where is Your Data Stored?

KDSmart contains two separate local databases on the device; the **Production Database** for your real work, and the **Demo Database** for experimenting with KDSmart.

KDSmart helps you identify which database is active in a number of ways:

- If you see the  **Lockdown Button** at the top of the **Home Screen** then you are using the **Demo Database**.
- When the **Scoring Configuration Screen** is presented, there is a *[DEMO db]* label at the bottom.

The  **Lockdown Button** sets KDSmart into **Lockdown mode**. This mode allows you to control the scoring task without enabling users the ability to change settings or trial attributes.

Use this mode when someone else is to perform the scoring and that is **ALL** they are to do.



To exit *Lockdown* mode, a four-digit passcode is required. When the **Production Database** is active, **Lockdown Mode** is enabled from the  **Settings Screen**.

Table 1: Demo vs Production Local Database

| | |
|------|--|
| Demo | <ul style="list-style-type: none">• Pre-installed demonstration data provided with KDSmart to allow users data to experiment and test KDSmart functionality before working with <i>real</i> data.• The Demo Database can be reset at any time from the Settings Screen; use the  Settings Button on the Home Screen or Main Menu to display the <i>Settings</i> and choose the Reset Demo Database Checkbox.• On return from the Settings Screen, KDSmart changes to the Demo Database and reinitialises the demo data. |
|------|--|

Continued on next page

Table 1 – continued from previous page

| | |
|-------------------|---|
| Production | <ul style="list-style-type: none">• The local KDSmart database to store your real <i>Production</i> work.• KDSmart installs with an empty Production Database.• Lockdown Mode can be used to prevent data loss - particularly when scoring is not performed by the breeder. |
|-------------------|---|



To change the database, select the **Settings Button** on the **Home Screen** or **Main Menu** to display the **Settings Screen**. Select the *Active Database* option then choose the *Production* or *Demo* radio buttons.

5.2 Trial Details

Trial details are the attributes of each trial such as trial layout, organism type, and traits. The **Trial Details Screen** can be accessed in two ways:

- Selecting a trial (with a short press) from the **Trials Screen**; and
- Swiping left/right on the **Home Screen** until the desired trial is found and then Selecting the **Trial Details Button**.

When viewing trial details, those trial attributes that can be edited will have an adjacent



Edit Button.

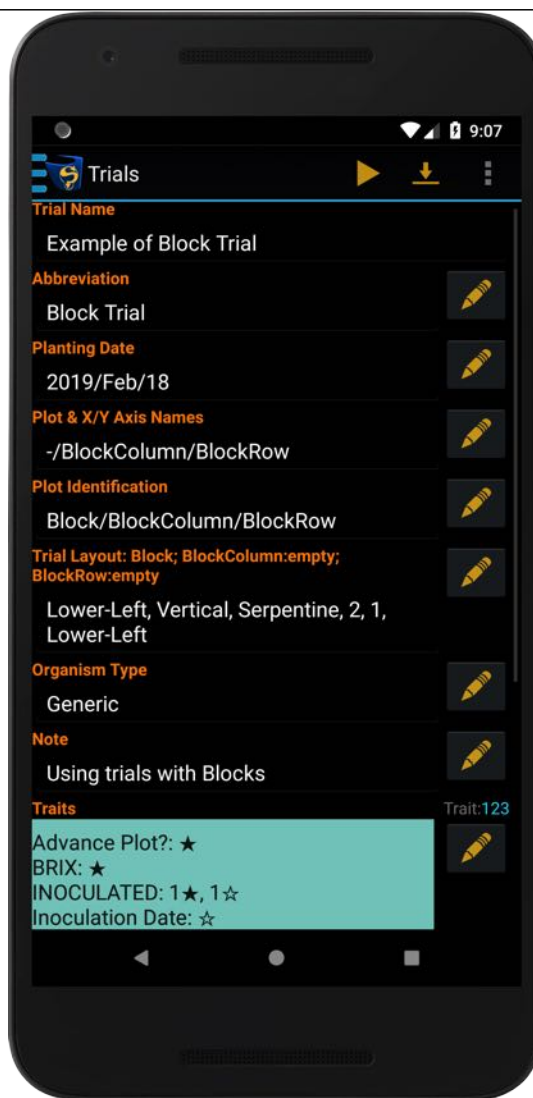





Fig. 1: Trial Details Screen

The table below provides information on each trial attribute:

Table 3: Trial Attributes

| Trial Attribute | Description |
|-----------------------|---|
| Trial Name | What the trial will be named in KDXplore or KDSmart. |
| Abbreviation | An abbreviated trial name for display purposes. |
| Planting Date | The date that planting occurred for the trial. Planting date must be set before scoring can commence as the <i>Elapsed Days</i> trait data type will not work unless it has been set. |
| Plot & X/Y Axis Names | Determines the trial element names that are to appear on scoring screens. These will be names for Plot and X/Y axes, depending upon what was imported. |
| Plot Identification | How plots are identified e.g. Block/Block Column/Block Row. |
| Trial Layout | At a minimum, there will be an option for choosing the plot origin (starting plot for scoring). Depending on the trial, there may be more options such as block plot origin. |
| Organism Type | Provides a choice of the symbol to represent the organism on screen. |
| Note | A text note for the trial. |
| Traits | <p>Trials may have many traits, however, it is not necessary or desirable for them all to be visible when scoring and traits can be made visible or hidden as required. Select the Edit Button to change traits that are used. The blue highlighted panel, near the bottom of the Scoring Configuration Screen lists the</p> <p>trait instances available in the trial showing:  Traits currently selected</p> <p>for scoring;  Not selected or hidden; and  Trait instance(s) selected.</p> |
| Trial Attributes | Non-editable from import |
| Plot Types | Non-editable from import |
| Plot Attributes | Non-editable from import |

5.3 Collection Parameters

Most of the important collection parameters (scoring options) can be found on the **Scoring Configuration Screen**. Swipe left and right between the tabs to view all of the options. The tables below outline the function or options available in each tab and the sections provide more in-depth information.

5.3.1 Options

Table 4: Options Tab Actions

| Options | Example Image |
|--|---|
| <p>Collection Order:</p> <ul style="list-style-type: none"> Which corner of the field to begin. The four quadrants separated by the grey bars identify the corner of the field where to begin walking. The direction of travel (horizontal or vertical). Whether you will be using a serpentine path or not; e.g. if you are not actually walking but are scoring plants in a tray in a greenhouse. <p>Scoring View:</p> <ul style="list-style-type: none"> Scoring views change the way that you score data. There is more information about these modes in the Scoring page at: http://www.kddart.org/help/kdsmart/html/kdsmarthelp.html <p> - Sheet Scoring Mode is a traditional spreadsheet view with added features;</p> <p> - Path Scoring Mode is the best choice for most users and allows for easy navigation between plots; and</p> <p> - Field Scoring Mode which represents the field from a top-down perspective.</p> <p> Plots per Group:</p> <ul style="list-style-type: none"> How many plots to score at one time e.g. scoring each plot to your left and right whilst walking along the field would be two plots. <p> Lock Scored Traits:</p> <ul style="list-style-type: none"> Select the Lock Scored Trait Checkbox to prevent accidentally overwriting traits that have already been scored. Measurements can still be changed but there will be a warning message. |  |

Fig. 2: Options Tab

5.3.2 Trait/Instance

Table 5: Trait/Instance Tab Actions







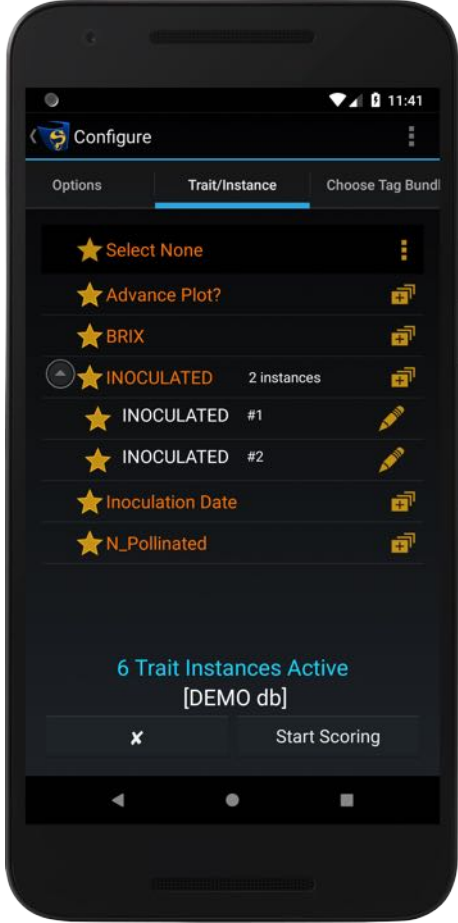









| Options | Example Image |
|---|---|
| <p>Selecting/Deselecting Traits: Star Icons can select or deselect a trait or trait instance for scoring (sets the trait as active or inactive). Setting a trait/instance as inactive does not remove the trait from the trial but removes it from the Scoring Screen to prevent unnecessary scrolling.</p> <ul style="list-style-type: none">  - Selected;  - Partially selected (at least one but not all trait instances are selected); and  - Not selected. <p> Menu Button: The Menu Button provides options for adding traits or changing the trait scoring order.</p> <ul style="list-style-type: none">  - The Add Traits Button enables you to select any of your saved traits to add to the trial; and  - The Trait Order Button option allows you to choose a trait scoring order. |  |

Fig. 3: Trait/Instance Tab

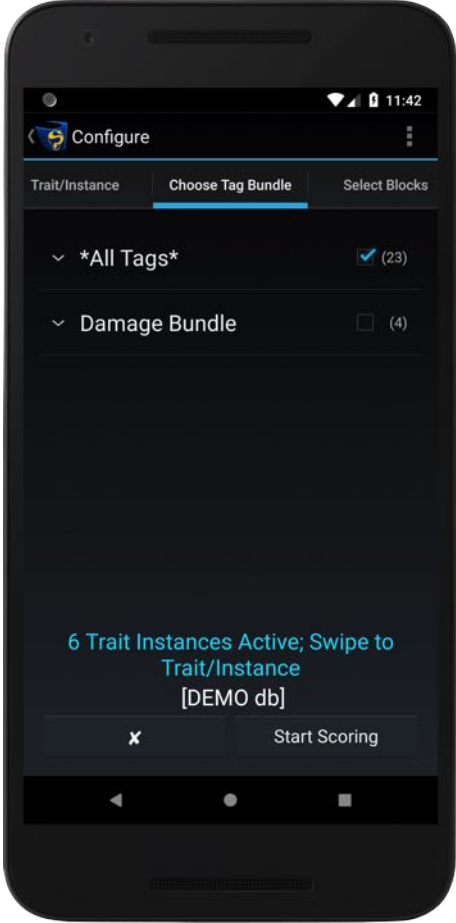
Continued on next page

Table 5 – continued from previous page

| Options | Example Image |
|---|-----------------|
|  <p>Manage Trait Button: Enabled management of traits that are to be scored.</p> <ul style="list-style-type: none">  - Add a trait to the trial with the Add Trait Button;  - The Move Up Button allows you to move the selected trait up in the scoring order;  - The Move Down Button allows you to move the selected trait down in the scoring order;  - Add a trait description with the Edit Description Button; and  - Remove a trait from the trial with the Remove Button. | See above image |
|  <p>Edit Trait Instance Button (the edit icon next to a trait instance): Options for editing or removing trait instances.</p> <ul style="list-style-type: none">  - Add a trait instance description with the Edit Description Button; and  - Remove a trait instance from the trial with the Remove Button. | See above image |

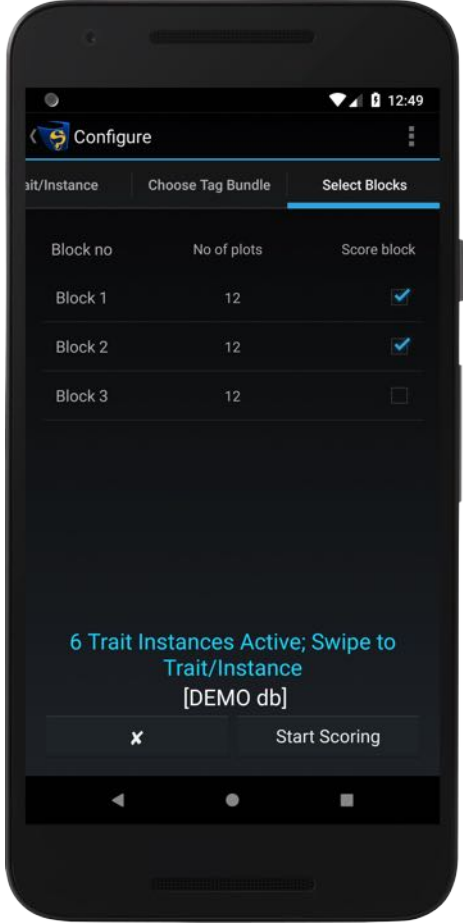
5.3.3 Choose Tag Bundle

Table 6: Choosing a Tag Bundle

| Options | Example Image |
|---|---|
| <p>Choose a Tag Bundle:</p> <ul style="list-style-type: none">Any listed tag bundle can be added with the checkboxes. More tag bundles can be imported or created in the Tags Screen. | <div></div> <p>Fig. 4: Choose a Tag Bundle</p> |

5.3.4 Select Blocks







Table 7: Selecting Blocks

| Options | Example Image |
|--|--|
| <p>Select Blocks:</p> <ul style="list-style-type: none"> Any block trial will have all blocks listed and selectable with the checkboxes. At least one must be chosen. This option will only be available for block trials. |  <p>Fig. 5: Select Blocks</p> |

5.4 Start Scoring

Scoring can be started in a variety of ways in KDSmart as outlined in the table below:

Table 8: Selecting Blocks

| Method | Action |
|---|--|
| Quick-start from the Home Screen | <p>Swipe left and right between the displayed trials until you find the trial that you want to score. Select the  Start Button to immediately start scoring. If you have scored this trial before then this will resume scoring from where you were before. If this is a new trial you will be taken to the Scoring Configuration Screen where you need to confirm collection parameters, then select the  Start Button to begin.</p> |
| Trial Details from the Home Screen | <p>Swipe left and right between the displayed trials until you find the trial that you want to score. Select the Trial Details Button and change any of the details if you wish then select the  Start Button. If you have scored this trial before then this will resume scoring from where you were before. If this is a new trial you will be taken to the Scoring Configuration Screen where you need to confirm collection parameters, then select the  Start Button again to begin.</p> |
| Quick-start from the Trials Screen | <p>If there is currently a trial selected, select the  Start Button to be taken to the Scoring Configuration Screen where you can choose collection parameters and then select the Start Scoring Button to begin scoring.</p> |
| Trial Details from the Trials Screen | <p>Select a trial to immediately display the Trial Details Screen. Select the  Start Button to be taken to the Scoring Configuration Screen where you can choose collection parameters and then select the Start Scoring Button to begin scoring.</p> |

Once all configuration options have been set, scoring can begin. See the Scoring page at: <http://www.kddart.org/help/kdsmart/html/kdsmarthelp.html> for more information.

SCORING

Scoring is the collecting of data for a trial with KDSmart. It mostly involves applying values to predefined traits in that trial, but could also include adding tags, notes, and attachments to plots or sub-plots as well.

This page will provide information on how to score trials, as well as some scoring options and features.

For more information on scoring and how it works within the context of the KDDart Platform, see the *KDSmart* section of the Tutorials page at: <http://www.kddart.org/help/kdtutorials/html/KDSTutorial.html>

6.1 The Scoring Screen

The **Scoring Screen** that you will be presented with when you start scoring will depend on the *Scoring View* that you choose when configuring the collection parameters of your trial. For more information see the *Collection Parameters* section of the Trial Details Page at: <http://www.kddart.org/help/kdsmart/html/preparation.html#collection-parameters>

6.1.1 Sheet Scoring Mode

Sheet Scoring Mode is a simple-sheet style view, similar to CSV or Excel document. This mode presents all traits for plots and sub-plots in a spreadsheet and selecting a cell will allow for entering of data. It has limited plot navigation features and can be slower to score, but many users find the view familiar and easy to use.

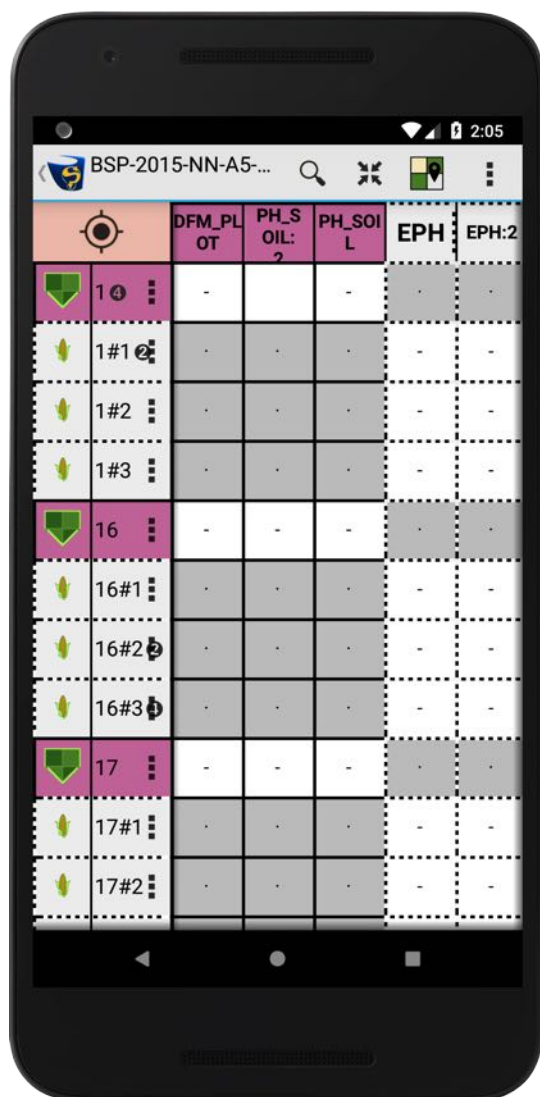


Fig. 1: Sheet Scoring Mode

6.1.2 Path Scoring Mode

In **Path Scoring Mode**, you will only select one plot at a time, for which you will be able to see all plot info, including plot traits, sub-plots, sub-plot traits, tags, etc. This mode is designed for easy navigation between plots as you physically walk through a field, score the traits, then move to the next plot on the **Scoring Screen**. This also allows the user to choose the **Auto-Advance Mode** which is the quickest way to score but will be explained further below. Additionally, **Path Scoring Mode** includes **Field View** which displays a top-down view of your field.



Fig. 2: Path Scoring Mode

6.1.3 Field Scoring Mode

Note: Coming soon with KDSmart version 3.1 in June 2019!

6.1.4 Screen Orientation

The **Scoring Screen** in KDSmart (in **Path Scoring Mode**) can be oriented to best suit the user who is scoring. You can choose between **Portrait** or **Landscape Orientation**, and **Left-handed** or **Right-handed Mode**. The default is **Right-handed/Portrait Orientation** but this can easily be changed.

To change screen orientation, select the **Menu Button** and then the **Change Screen Orientation Button**. You will have a few seconds to physically tilt your device into the **Landscape** or **Portrait Orientation** and the orientation will be set.

Table 1: Landscape Orientations

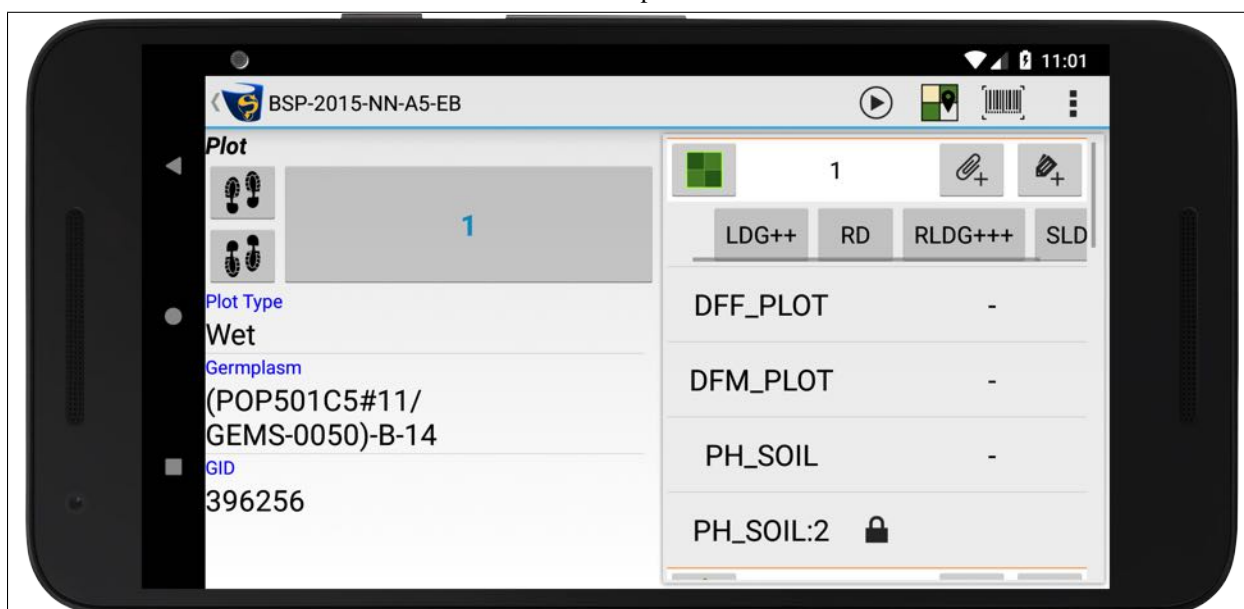


Fig. 3: Right-handed/Landscape Orientation

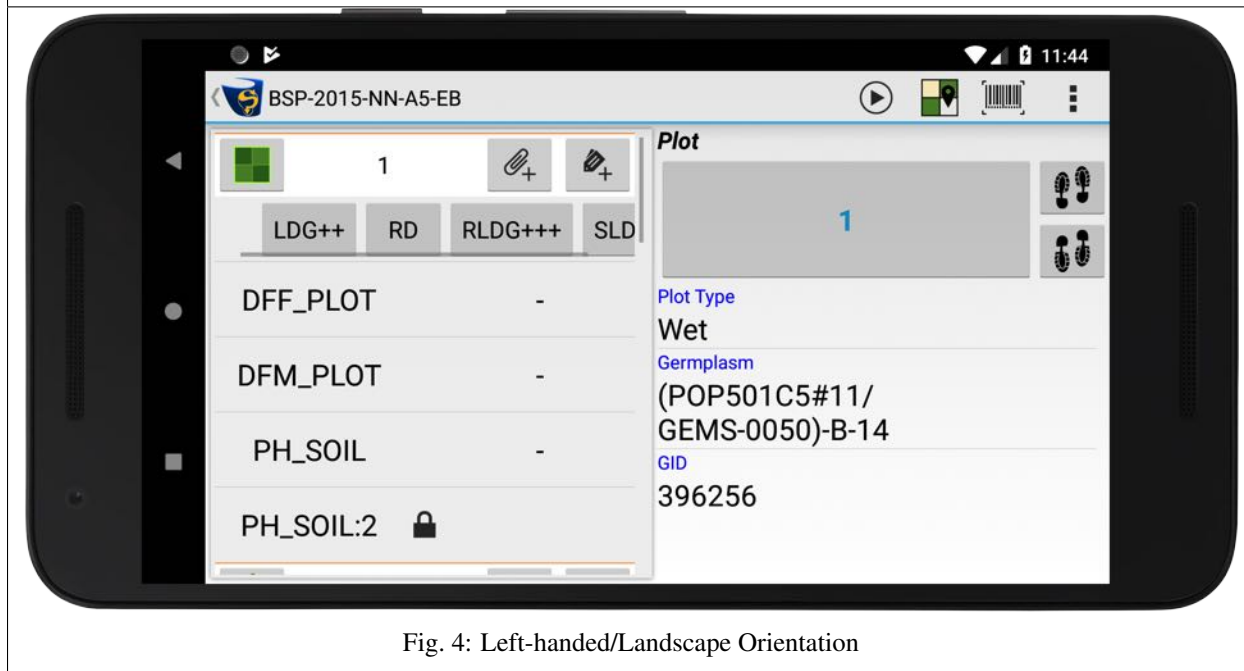


Fig. 4: Left-handed/Landscape Orientation

Select the **Menu Button** in the top right-hand corner of the **Scoring Screen** to be presented with menu options. Select the **Swap Sides Button** to swap between **Right-handed** and **Left-handed Mode**.

Table 2: Portrait Orientations




Note: Sheet Scoring Mode and the upcoming Field Scoring Mode can operate in **Portrait** or **Landscape Mode** but there is no **Left-handed** or **Right-handed Mode**.

6.2 Applying a Trait Value

Applying trait values is the primary function of scoring trials. Selecting a trait to score will be different depending on what scoring mode you are using, however applying traits will always be the same as each scoring mode utilises the same **Trait Measurement Screen**. Follow the instructions below to learn how to score a trait.

Table 3: Scoring









| Step | Action |
|------|---|
| 1. | <p>To open the Trait Measurement Screen, select any trait on the Scoring Screen.</p> <p>You can choose a trait with no value such as the trait outlined at 1 in the below image, or a trait that already has a value such as the trait outlined at 2.</p>  <p>Fig. 7: Selecting a Trait to Score</p> |

Continued on next page

Table 3 – continued from previous page

| Step | Action |
|------|--|
| 2. | <p>The screen below is the Trait Measurement Screen which allows you to choose a trait value. This will be different depending on the trait data type - this example is of an <i>elapsed days</i> trait. You can also swipe right to see more information about the current plot. Either select a value or choose one of the trait scoring options at the bottom of the screen e.g. Reverse Button to go to the previous trait. The table below provides information on the scoring options.</p>  <p>Fig. 8: Selecting a Trait to Value</p> |
| 3. | <p>After applying a trait, you will be taken back to the Scoring Screen. Select another trait to choose a value for it and repeat the process until you have scored all traits.</p> |

Table 4: Scoring Options of the Trait Measurements Screen

| Button | Action |
|---|---|
|  Cancel Button | Cancels the scoring of the selected trait. Cancelling will return the user to the Scoring Screen |
|  Delete Value Button | Deletes a current value and returns the user to the Scoring Screen . |
|  Missing Value Button | Applies the value of <i>Missing</i> to a trait instance. This can be used if the actual value is missing. |
|  Not Applicable Button | Applies the value of <i>Not Applicable</i> to a trait instance. This can be used when the trait does not need to be scored for the selected plot or sub-plot. |
|  Accept Value Button | Accepts and applies a value that has been entered such as confirming a decimal trait. |
|  Date Button (only available for <i>elapsed days</i> traits) | Opens a <i>Date Picker</i> so that a date can be chosen. |
|  Reverse Button (only available in Auto-Advance Mode) | Navigates to the previous trait instance. |
|  Forward Button (only available in Auto-Advance Mode) | Navigates to the next trait instance by skipping the current trait. |

The video available at <https://www.youtube.com/embed/2qilBe2xGwM> is a demonstration of scoring at trial in KDSmart. You will be able to see how trait values are applied to trait instances. Please note that whilst this video demonstrates scoring in **Path Scoring Mode**, the application of trait values is done from the same **Trait Measurement Screen** in any scoring mode.

Additionally, the sections below provide further information on navigation between plots.

6.3 Navigating Between Plots

It is crucial that users are able to navigate between plots quickly so that trials can be efficiently scored. This is why there are plenty of options for navigating between plots. The video referenced above (Scoring a Trial in KDSmart) also outlines the navigation methods in **Path Scoring Mode**. See the sub-sections below for more information on navigation between plots.



Fig. 9: Navigation Options

Table 5: Navigation Options in Path Scoring Mode

| Button | Action |
|--------|-----------------|
| 1 | Advance/Retreat |
| 2 | Plot Selection |
| 3 | Field View |

Note: The information in this section is about navigation in **Path Scoring Mode**. Scoring in **Sheet Scoring Mode** is simpler, as you only need to select a cell to score it, but it can also be slower than using **Path Scoring Mode**.

6.3.1 Advance/Retreat

Advancing and retreating is moving to the next or previous plot that is determined by your collection order. For example, if you are starting on plot 1, you can advance to plot 2 and then retreat back to plot 1. The **Advance Button** will move you to the next plot and the **Retreat Button** will move you to the previous plot.

6.3.2 Plot Selection

Plot selection is directly entering the number or x/y coordinates of a plot to navigate to it. Selecting the **Plot Button** as outlined in 2 in the image above will display the **Plot Selection Window** as below:



| Select Plot | |
|--|----------------------------|
| <input checked="" type="radio"/> Use X,Y | <input type="radio"/> Plot |
| Column | Row |
| 8 | 8 |
| 1 | 1 |
| 2 | 2 |
| X | Go |

Fig. 10: Plot Selection Window

You can navigate to a plot by either choosing it's x/y coordinates or the plot number and then selecting the **Go Button** to confirm.

6.3.3 Field View

Field View is a top-down look at the field which offers an alternative way to navigate between plots, search plots, and produce heatmaps. It will provide different information depending on the level that it is being viewed at (how zoomed in/out you are). At a minimum, the collection order (the arrows in each plot) and the percentage of each plot scored

(the grey bar in each plot) will be displayed. Select the  /  **Zoom In/Out Button** to reach higher or lower level views. Lower level views have more information about tags, traits, trait values, etc. The image below is an example of **Field View** at the *highest* level:

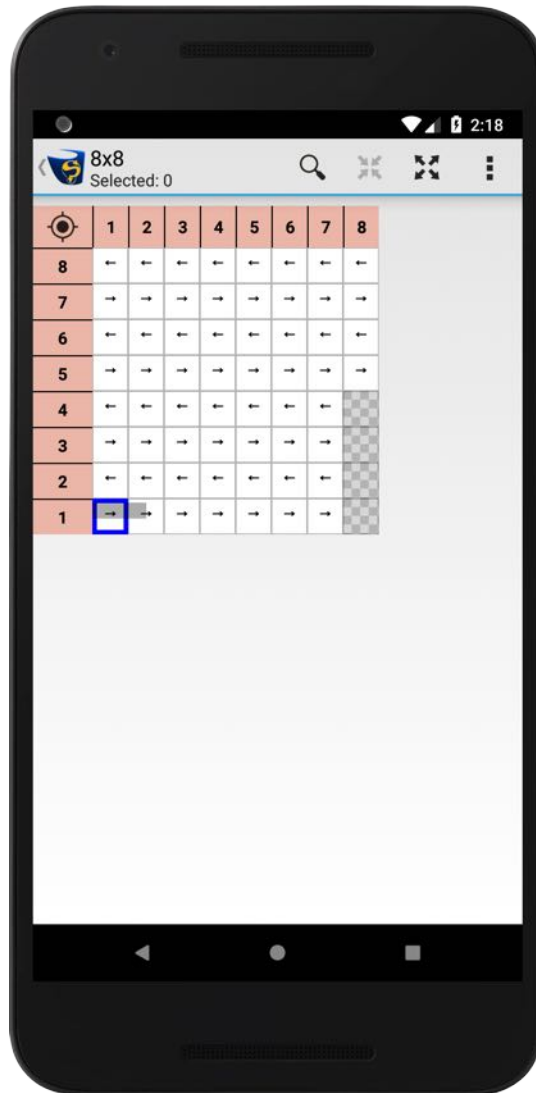


Fig. 11: Field View

A *long press* on a plot will reveal a window with information on that plot. A *short press* will provide both plot information and options for selecting multiple plots and navigating to that plot (as seen in the image below). Select the **Go To Button** to navigate to the selected plot.

Plot:16

Plot Type: Wet
 Traits scored: 8 of 16
Specimens: 3
Tags: BD LDG+ RD RLDG++ RLDG++
 + WET
Traits (Plot):
 • DFF_PLOT=39 days
 • DFM_PLOT=39 days
 • PH_SOIL=6 ph
 • PH_SOIL:2=6 ph
Traits (S#1):
 • EPH=0.2 ratio
 • EPH:2=0.2 ratio
Traits (S#3):
 • RUST=- rust scale
 • RUST:2=4 rust scale
Attributes:
 • Germplasm= (POP501C5#11/
 GEMS-0019)-B-26
 • GID= 396188

✕ ++ Jump to

Fig. 12: Field View Plot Options

6.3.4 Auto-Advance

The quickest way to score traits is to use the **Auto-Advance Mode**. Auto-advance also allows the user to concentrate on only those traits for which a measurement has not been provided.

When the user provides a value for a trait, KDSmart moves the focus to the next un-scored trait, skipping over those traits (and sometimes entire plots) which have already been scored. This is useful when starting scoring as it quicker and when scoring has been finished if the user needs to find any un-scored plots or traits. The following video and instructions demonstrate how to use *Auto-Advance*:

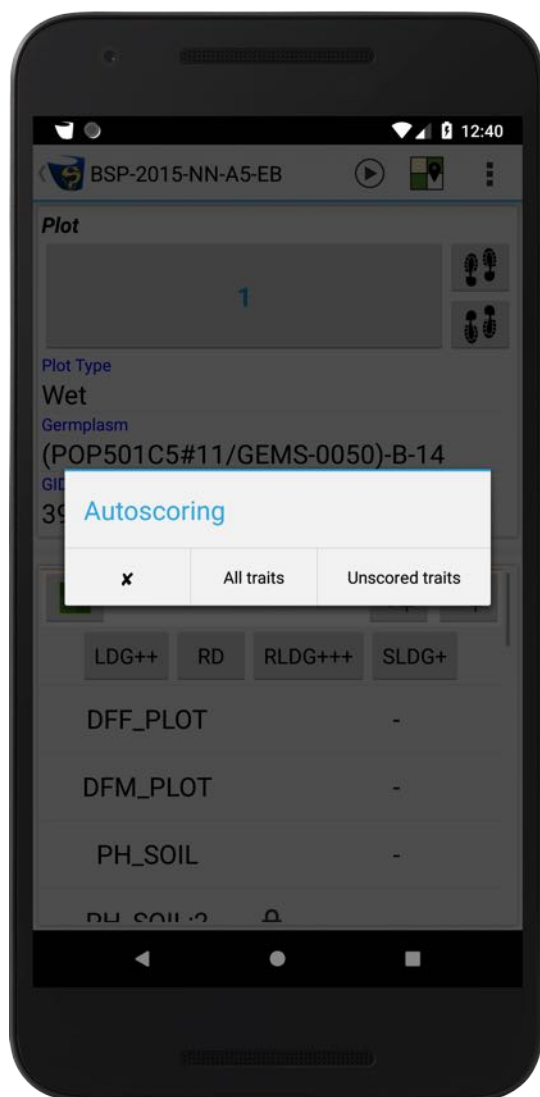






Fig. 13: Auto-Advance Options

Table 6: Using Auto-Advance

| Step | Action |
|------|---|
| 1. | Select the  Start Auto-Advance Button at the top menu of the Scoring Screen to turn on Auto-Advance Mode . This will provide auto-advance options as seen in the image above. |
| 2. | Choose either the <i>All Traits</i> option to score all traits within the dialogue box, or the <i>Un-scored Traits</i> option. |
| 3. | Begin scoring by selecting the blank area next to an un-scored trait. This displays a new screen with the data entry form for the trait on one side and the <i>Plot Information</i> on the other side (this is demonstrated in the image above). |

Continued on next page

Table 6 – continued from previous page

| Step | Action |
|------|---|
| 4. | <p>The  Advance/Retreat Buttons are no longer available, but there are  Backward/Reverse Buttons along the bottom that may be used if you want to skip to the next trait or revisit the previous one. If a plot is skipped, then KDSmart will let the user know this by:</p> <ul style="list-style-type: none"> • Vibrating the device; • Posting a system notification; and • Displaying a popup message for the user to confirm that they have reached the correct plot to continue scoring. |
| 5. | <p>Return to the Scoring Screen and select the  Stop Auto-Advance Button then the Cancel Button to stop auto-advancing between traits.</p> |

The video available at <https://www.youtube.com/embed/vsnCG3Ef40c> is a demonstration and instructions on the use of *Auto-Advance*.

Note: The Auto Advance feature is only available in **Path Scoring Mode**.

6.4 Assigning Tags

Tags are short text descriptions that are designed to be like reusable notes that can be applied to plots or sub-plots. Along with scoring traits, assigning tags is a part of the scoring process. One or more tags may be assigned to a plot (or sub-plot) or reassigned if required. More information about tags and their management can be found in the *Tags* page at <http://www.kddart.org/help/kdsmart/html/tags.html>

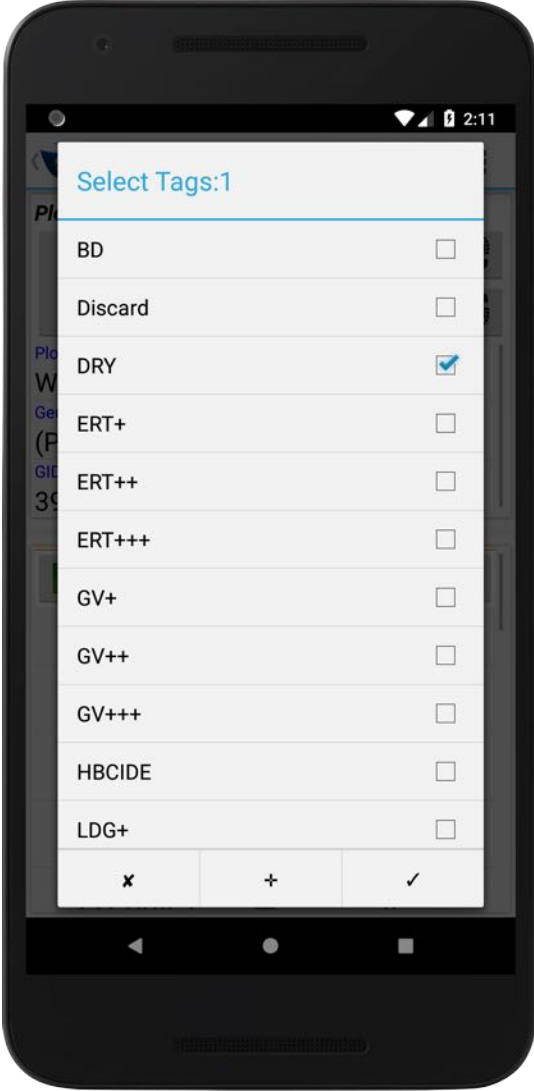
To assign a tag in **Path Scoring Mode**, follow these steps:

Table 7: Assigning Tags

| Step | Action |
|------|--|
| 1. | <p>Locate a plot or sub-plot to tag in the Scoring Screen.</p>  <p>Fig. 14: Tags on the Scoring Screen</p> |
| 2. | <p>Select the  Assign Tag Button.</p> |

Continued on next page

Table 7 – continued from previous page

| Step | Action |
|------|--|
| 3. | <p>Select one or more tags to assign them to a plot.</p>  <p>Fig. 15: Assigning Tags</p> |
| 4. | <p>Select the Confirm Button (tick) to save changes and return to the Scoring Screen. This displays the tag short name above the traits for the selected plot.</p> |

6.5 Adding Notes

Notes can be added on each plot or sub-plot in a trial. In any scoring mode, this can be done by selecting the



/ **Plot/Sub-plot Button** which will display some options such as an **Edit Note Button**. This can be seen in the image below (Path Scoring Mode).



Fig. 16: Adding Notes

Note: The **Sub-plot Button** in this example is of maize but it may be different depending on your settings e.g. a leaf or DNA icon. You can see that you can also deactivate plots and sub-plots in this menu and add sub-plots if needed.

6.6 Adding Attachments

Both images and audio files can be attached to each plot and sub-plot in KDSmart and can be used instead of notes or





tags. The  **Attachment Button** can be found on each plot and sub-plot (next to the  **Tag Button**) and will open the **Attachment Screen** as seen below:



Fig. 17: Attachments Screen

There are two attachments currently saved in the example above; one is an image and one is an audio file. This can be seen by the .jpg and .3gp file extensions. There are two tables below with instructions on attaching images and audio files.

Table 8: Attaching and Viewing Image Files

| Step | Action |
|------|--|
| 1. | Image files can be attached by taking a picture with the device camera. Select the  Camera Button to open the device's camera application. |
| 2. | Take a picture and select the Confirm Button . This will look different depending on what device you are using. |
| 3. | The new attachment should appear in the list of attachments as seen in the image above. Select the  View Button to open the image. |

Continued on next page

Table 8 – continued from previous page









| Step | Action |
|------|--|
| 4. | Select the  Delete Button to delete the image. Please note that there is no way to reverse a deletion. |

Table 9: Attaching and Listening to Audio Files

| Step | Action |
|------|---|
| 1. | Audio files can be attached by making an audio recording with the device microphone. Select the  Record Button to start recording. The button will turn red to indicate that recording has started. |
| 2. | The  Pause Button will now be available if you want to pause the recording of the audio file. If you pause the audio recording, the button will turn red to indicate that recording is currently paused. Press the  Pause Button again to resume recording. |
| 3. | Select the  Record Button again (when it is red) to stop the recording. |
| 4. | The new attachment should appear in the list of attachments as seen in the image above. Select the  Play Button to listen to the recording and the  Stop Button to stop the recording. |
| 5. | Select the  Delete Button to delete the recording. Please note that there is no way to reverse a deletion. |

DATA IMPORT, EXPORT & BACKUP

KDSmart contains three types of data that can be used in experiments: trials, traits, and tags. KDSmart manages its own database located on your Android device which contains this data but they can also be imported, exported, and backed up.

Any trial that is imported or exported will also contain any traits or tags that is used in it. However, traits and tags can also be imported or exported in separate files if required.

To commence using KDSmart with your own trials, that trial data must first be imported into KDSmart.

Note: There is a separate *Data Transfer* page at <http://www.kddart.org/help/kdsmart/html/exchangedata.html#data-exchange-kdxchange-method> which provides examples for transferring data between KDXplore and KDSmart using the Google Drive and KDXchange methods. It is a separate page because it provides instructions on using both KDXplore and KDSmart. The objective of this page is to provide more information on the various options available for KDSmart.

7.1 Importing Data

KDSmart can be used as a standalone application or as a part of the integrated KDDart platform. This means that there is a need for several different methods for importing files and data depending on how KDSmart is used. There are also options for both offline and online imports which can be helpful depending on the user's location and access to the internet.

Since Android version 4.4, the Storage Access Framework (SAF) has been used for browsing and opening files. This has been implemented in KDSmart and makes it possible to import (and export) files from document providers such as Google Drive or Dropbox, or files that are stored internally on the device. This means that there are many options for importing files whether your device is offline/online and what file hosting services you use.

If you have exported a *scoring set* from KDXplore, it will be importable as a *trial* in KDSmart. There is only a distinction between the terms in KDXplore. KDSmart views scoring sets and trials as the same thing.

Depending on whether you are importing trials, traits, or tags, there will be different options available. These will be outlined in the following sections.

7.1.1 CSV Import



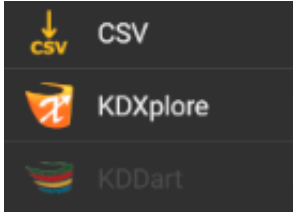
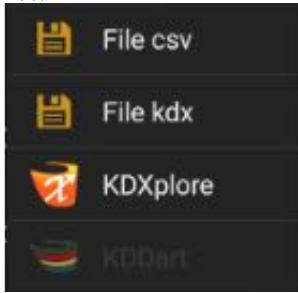
Comma Separated Value (CSV) files are a common file format that many users collect data with prior to using KDDart. Some users also use CSV files if they use KDSmart as a standalone application. More information about formatting CSV files can be found on the *CSV Formats* page at <http://www.kddart.org/help/kdsmart/html/kdsmart-app-b.html>

After selecting a file to import, each column in the CSV must be assigned an attribute type. This determines how the data in the column will be interpreted. Columns can be selected as **Don't Import** as well as whether the data is related to the trial, a plot, or a trait name to be scored.

TO successfully import a CSV trial, the file must contain at least a Plot ID **OR** both Plot Column and Plot Row **OR** all three columns.

See the steps below on how to import CSV files:

Table 1: CSV Import (SAF)



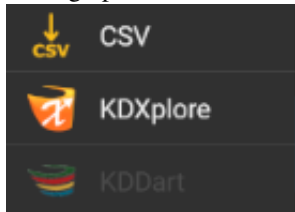
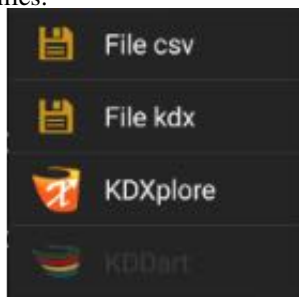
| Step | Action |
|------|--|
| 1. | Open the Trial Screen , Trait Screen , or Tag Screen on KDSmart and select the  Import Button or the <i>Import As</i> option in the  Menu Options . |
| 2. | <p>The Import Options will open. If you are importing traits or tags, there will be the following options:</p>  <ul style="list-style-type: none"> • <p>Importing from the Trials Screen will result in an additional option to import KDX files:</p>  <ul style="list-style-type: none"> • |
| 3. | Choose the File CSV Button . This will open the SAF as pictured below: |
| 4. | Select the CSV file you want to import and then select the Open Button . |
| 5. | Ensure that all headings are present and the <i>Import As</i> options are correct such as plot attributes and traits for plots. |
| 6. | Select the Import Button to finalise the trial import. |

Note: All types of CSV files (trials, traits, and tags) can be imported into KDSmart.

7.1.2 KDX Import

KDX files contain all experiment information including a trial, traits, and tags. It is similar to a zipped folder and is much easier to transfer than a CSV because there is no import mapping. It is recommended to use KDX files when using KDXplore and KDSmart together as it reduces complexity of importing and the chance of errors. See the instructions below for how to import a KDX file:

Table 2: KDX Import (SAF)

| Step | Action |
|------|---|
| 1. | Open the Trial Screen , Trait Screen , or Tag Screen on KDSmart and select the  Import Button or the <i>Import As</i> option in the  Menu Options . |
| 2. | <p>The Import Options will open. If you are importing traits or tags, there will be the following options:</p>  <ul style="list-style-type: none"> • <p>Importing from the Trials Screen will result in an additional option to import KDX files:</p>  <ul style="list-style-type: none"> • |
| 3. | Select the File KDX Button . This will open the Storage Access Framework for choosing files on the device internal storage or an application such as Google Drive. |

Continued on next page

Table 2 – continued from previous page

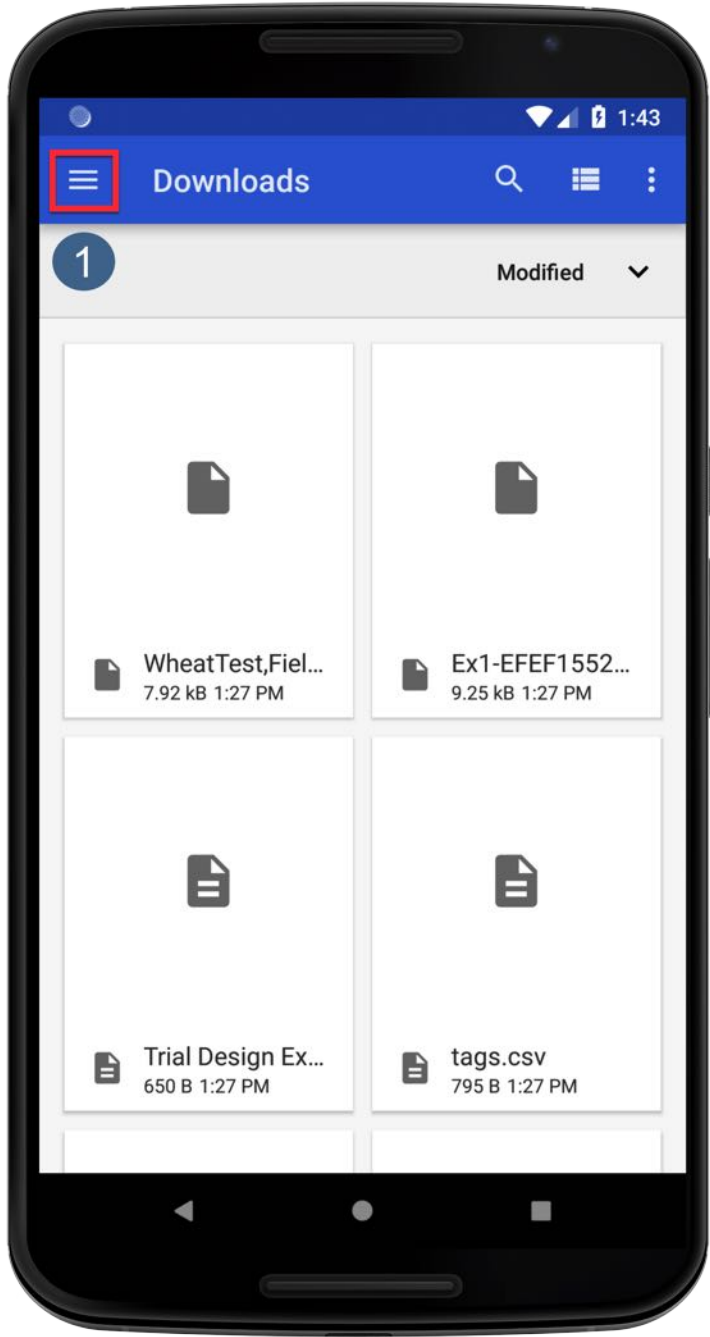
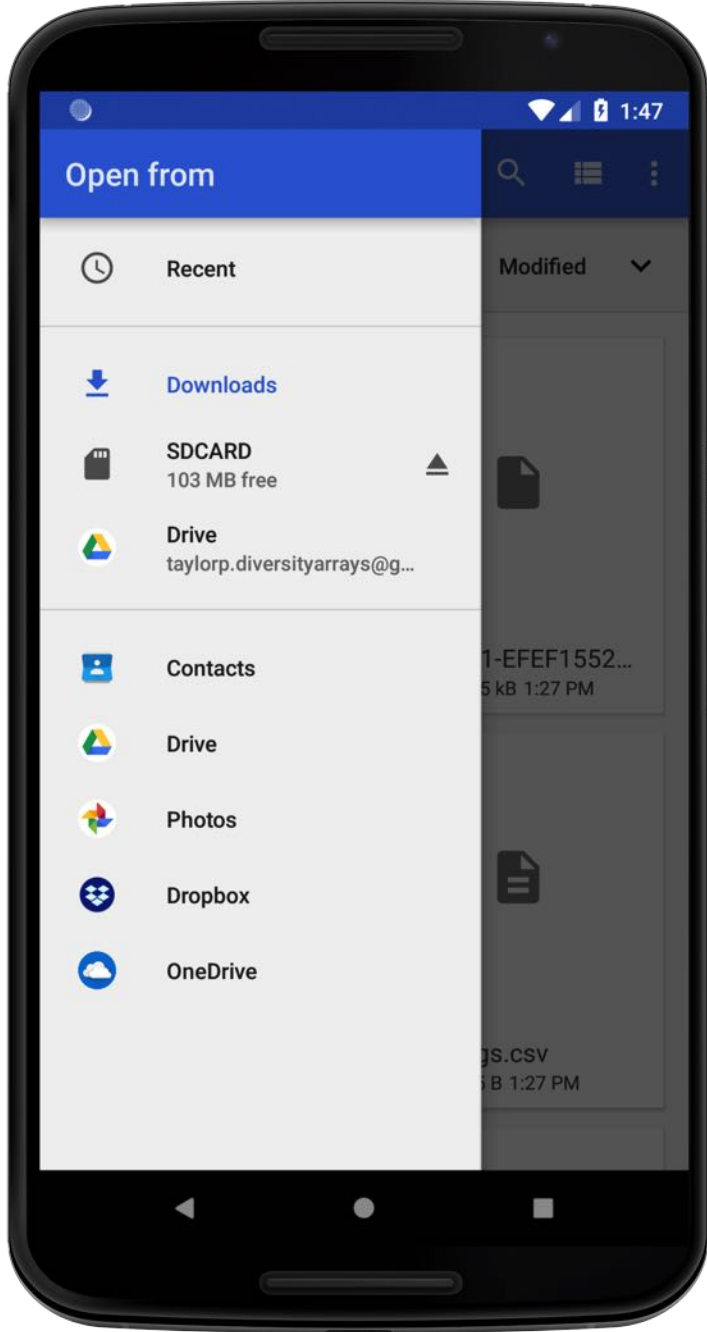
| Step | Action |
|------|---|
| 4. | <p>If the file you need is in the folder that has been opened then select it. If you need to search for the file then select the SAF Menu Button at 1 (as outlined in the image below):</p>  |

Fig. 1: SAF (Select to zoom)

Continued on next page

Table 2 – continued from previous page

| Step | Action |
|------|--|
| 5. | <p>The SAF Menu will be opened and you will be able to select either folders on the device, or any application that is installed.</p>  <p>Fig. 2: SAF Menu (Select to zoom)</p> |
| 6. | <p>Select an internal location or application (such as Google Drive or Dropbox) and locate then choose the KDX file that you are importing. Once selected, an Open Button will appear at the top of the screen. Select the Open Button and the KDX file will be imported with no additional configuration.</p> |

The video referenced below is a part of our KDTutorial series which demonstrates how to import a scoring set (KDS-

mart views scoring sets as trials) from Google Drive to KDSmart.

Note: KDX files can contain all types of data (trials, traits, and tags) however, you will only be able to find the option to import a KDX file in the **Trial Import Options**.

7.1.3 KDXplore Import (KDXchange)

The KDXplore option will open KDXchange which is used for transferring data from KDXplore to KDSmart (and vice versa) over a Wi-fi connection when there is no cellular connection available. You will need access to a router or a mobile device that can host a Wi-fi hotspot.

Connecting to KDXchange requires both KDXplore and KDSmart to be configured. There is a separate *Data Transfer* page at <http://www.kddart.org/help/kdsmart/html/exchangedata.html#data-exchange-kdxchange-method> which gives specific instructions for how to use both Google Drive, and KDXchange for transferring data between KDXplore and KDSmart. See that page for more information on using KDXchange.

7.2 Exporting & Sharing Data

Exporting and sharing data files in KDSmart are similar but distinct actions that allow users to send trials, traits, and tags to the device internal memory or other applications. These differences will be outlined in the sections below.

Both of these methods have the same *Export Options* listed below:

- Full Data for KDXplore;
- Full Data in Zip;
- Only Scores: Plots (CSV); and
- Only Scores: Plots & Sub-Plots (CSV).

7.2.1 Exporting Data

Exporting allows the user to export a trial, trait, or tag to either the device internal memory (Tablet) or to KDXplore through KDXchange.

Tablet (Internal Memory)

The *Export to Tablet* option will export data to the internal storage of the KDSmart device.

The video available at <https://www.youtube.com/embed/WJsHN0tApWo> provides a guide and instructions to exporting data:

Note: The video provides an example of exporting trials but the same process can also be used for traits and tags.

Table 3: Exporting Data

| Step | Action |
|------|--|
| 1. | Depending on what sort of data you would like to export, navigate to the Trial Screen , Trait Screen , or Tag Screen . Choose a trial to export. |
| 2. | Select the Export To Button . You will be presented with the Export To Options . |
| 3. | Select the Tablet Button to export a data file directly to the device that you are using. The Choose Export Option Window will appear with the options that are listed above these instructions. |
| 4. | Choose an export option. The Storage Access Framework (SAF) File Chooser will open. |
| 5. | Select a file location on your device to save the exported file to. |
| 6. | Select the Select Button to finalise the export. There will be a notification on your device when the exported file has saved to that location. |

KDXplore Export (KDXchange)

The KDXplore option will open KDXchange which is used for transferring data from KDXplore to KDSmart (and vice versa) over a Wi-fi connection when there is no cellular connection available. You will need access to a router or a mobile device that can host a Wi-fi hotspot.

Connecting to KDXchange requires both KDXplore and KDSmart to be configured. There is a separate *Data Transfer* page at <http://www.kddart.org/help/kdsmart/html/exchangedata.html#data-exchange-kdxchange-method> which gives specific instructions for how to use both Google Drive, and KDXchange for transferring data between KDXplore and KDSmart. See that page for more information on using KDXchange.

7.2.2 Sharing Data

Sharing allows the user to send a trial, trait, or tag through a 3rd party application such as Google Drive, Gmail, Drop Box, etc.

The video available at <https://www.youtube.com/embed/VQPYOaGw8hY> provides a guide and instructions on how to share data:

Note: The video provides an example of exporting trials but the same process can also be used for traits and tags.

Table 4: Sharing Data

| Step | Action |
|------|--|
| 1. | Depending on what sort of data you would like to export, navigate to the Trial Screen , Trait Screen , or Tag Screen . |
| 2. | Select the Share Button . The Choose Export Option Window will appear with the options that are listed above these instructions. |
| 3. | Choose an export option. A list of applications compatible with the Storage Access Framework (SAF) will open. These applications may include Google Drive, Gmail, Drop Box, etc. |
| 4. | Choose an application that you want to share the file with. After making a choice, the application that you chose will open. What you do next will depend on what application you are using to share the file. See the video referenced above for an example of saving a file to Google Drive. |

7.3 Data Backup



Any saved data on KDSmart including trials, traits, and tags, can be backed up improve data security and management.

There are various options for backing up KDSmart data:

- Trials as Zip - best for saving files as CSVs;
- Trials as KDX - best for using with KDXplore; and
- Database Files - for backing up all data.

The video available at https://www.youtube.com/embed/3w8OAh_amao provides a guide and instructions for backing up data with the *Trials as KDX* option:

Table 5: Data Backup

| Step | Action |
|------|--|
| 1. | Navigate to the Manage Screen . On the Database Tab , there are options for backing up data and database fixes. |
| 2. | Select the  Output to Folder Button . This will open the device SAF. |
| 3. | Choose a folder to save your backups to by navigating to the folder and then selecting the Select Button . You will be directed back to the Database Tab . |
| 4. | Use the radio buttons to select a backup option such as <i>Trials as KDX</i> . |
| 5. | Select the  Save Button to confirm the backup. The files will now be available in the chosen location. |

DATA TRANSFER

Note: This is a common help topic for both KDXplore and KDSmart.

8.1 Introduction

There are several methods of moving data in to and out of KDSmart which can be found on the *Data - Import, Export, Backup* page at: <http://www.kddart.org/help/kdsmart/html/data-import-export-backup.html#data-import-export-backup>

This topic focuses on using KDXplore with KDSmart, which provides more time saving and productivity benefits for the user. Previously, inbuilt software called KDXchange was used to transfer data between KDXplore and KDSmart. Both applications have recently been updated to include integration with Google Drive which requires much less effort in setup. Whilst an internet connection is required, both devices do not need to be on the same Wi-Fi network. Google Drive is now the recommended method, however, there may still be a need to use KDXchange so both methods are outlined here. The following sections outline the steps required for exchanging data between KDSmart and KDXplore:

- Setup - Connecting KDXplore to KDSmart Devices; and
- Transfer - Moving data (Trials, Traits and Tags) between KDSmart and KDXplore.

For more information on why you would need to transfer data, see the *KDSmart Home Page* at <http://www.kddart.org/help/kdsmart/html/index.html> See the *KDXplore Home Page* at <http://www.kddart.org/help/kdxplore/html/index.html> to learn about how you can use KDXplore for data management and curation.

8.1.1 Data Transfer - Google Drive Method

Google Drive is a quick and easy way of exchanging data between devices and requires little setup time. The example provided will take you from exporting a Scoring Set from KDXplore to Google Drive, importing it into KDSmart, exporting the Scored Data file to Google Drive, and then importing that file into KDXplore for curation.

The process of exchanging data will be described in the following steps:

1. Connect to the Internet
2. Google Drive Setup
3. Transferring Files from KDXplore to Google Drive
4. Transferring Files into KDSmart from Google Drive
5. Transferring Files from KDSmart to Google Drive
6. Transferring Files into KDXplore from Google Drive

Step 1 - Connect to the Internet

Google Drive transfers will only work when devices are connected to the internet but they do not have to be connected at the same time. For example, a user on KDXplore may export a Scoring Set to Google Drive which is uploaded to their personal folder, turn off their computer, and then go out into the field and import that Scoring Set into to KDSmart. For users who do not have mobile data on their KDSmart device or are in an area that does not have signal, it will still be necessary to connect to WiFi.

For further information on setting up WiFi please see the [Step 1 - Using WiFi](#) section below.

Step 2 - Google Drive Setup

As well as having an internet connection, you will need to have a Google account which gives you access to Google Drive. A free account will provide 15gb of space which is more than enough for using with KDXplore and KDSmart. To sign up or access *Google Drive* see the following page: <https://www.google.com/drive/>.

This link will be usable on KDXplore, Android devices should have a Google Drive application that would usually be already installed by default but can also be found in the Google Play Store.

Step 3 - Transferring Files from KDXplore to Google Drive

Once a Trial, Trait or Tag has been created, it needs to be transferred to a KDSmart device for use in the field. The following instructions demonstrate how to transfer Trials (or other data) from KDXplore to Google Drive so that they can be used in KDSmart.

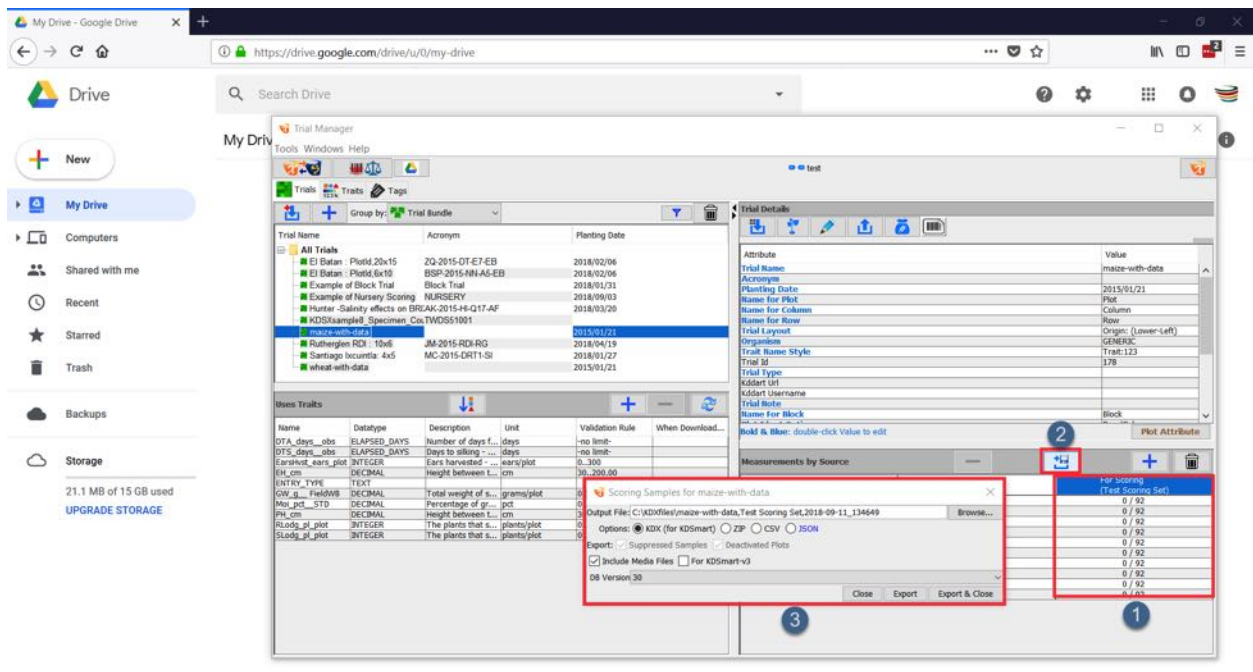


Fig. 1: Exporting a Scoring Set

Table 1: Transferring a Trial from KDX to Google Drive

| Step | Action |
|------|---|
| 1. | Ensure that Google Drive is opened in an internet browser and have KDXplore open to prepare for the transfer. |
| 2. | Choose a Scoring Set such as the one at 1 and then select the Export button at 2 . |
| 3. | The Export window displays (as at 3) which provides export options. Select the <i>Browse</i> button to choose a location on the computer to save the Scoring Set to. Ensure that the radio button for <i>KDX file</i> is selected so that it is ready to be used in KDSmart. |
| 4. | Select either the <i>Export</i> or the <i>Export & Close</i> options within the Export window and the KDX file will be exported to your chosen location. A dialogue opens and asks whether you want to open the containing directory - do this if you want to transfer the file to Google Drive immediately. |
| 5. | <i>Click+drag</i> the file into the web browser with Google Drive opened and drop it to complete the upload. The file should now appear in Google Drive and there is a message which confirms that the upload has been completed. |

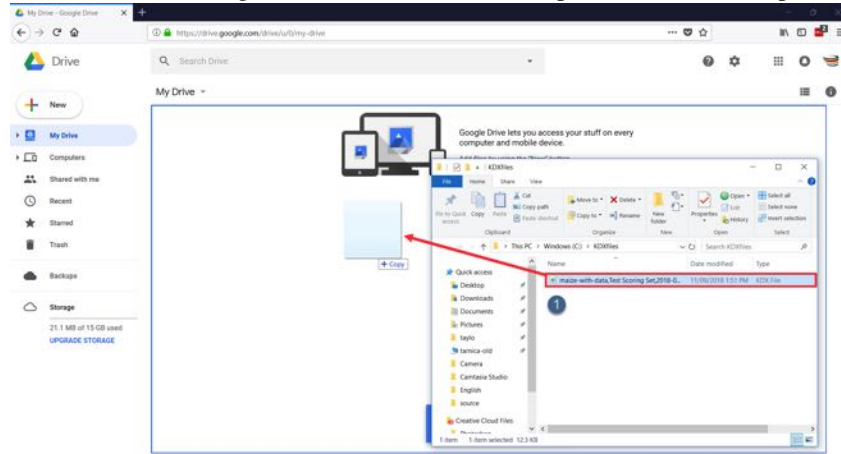


Fig. 2: Uploading Files to Google Drive

Step 4 - Transferring Files into KDSmart from Google Drive

Files that are uploaded to Google Drive from KDXplore need to be imported into KDSmart. The following steps will demonstrate how to open Google Drive on your device and choose files to be imported into KDSmart.



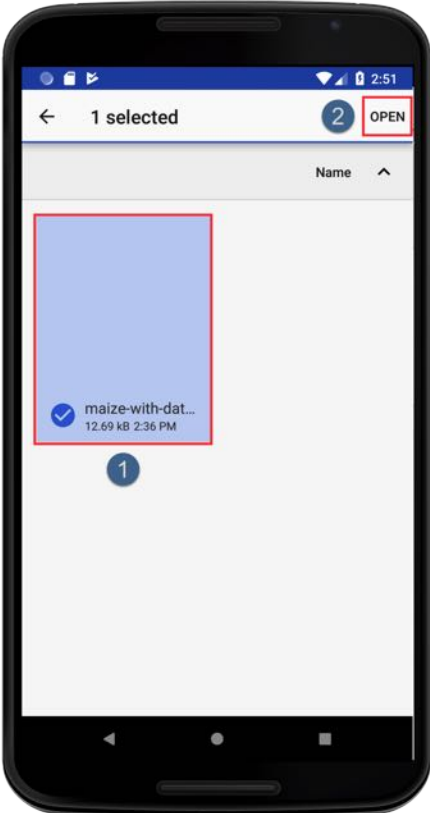
Fig. 3: Importing a Trial 1/3

Table 2: Importing a Trial

| Step | Action |
|------|--|
| 1. | Navigate to the Trials screen and select the Import button at 1 . |
| 2. | Select an import option - for this tutorial choose the File KDX option at 2 . This opens Google Drive. |

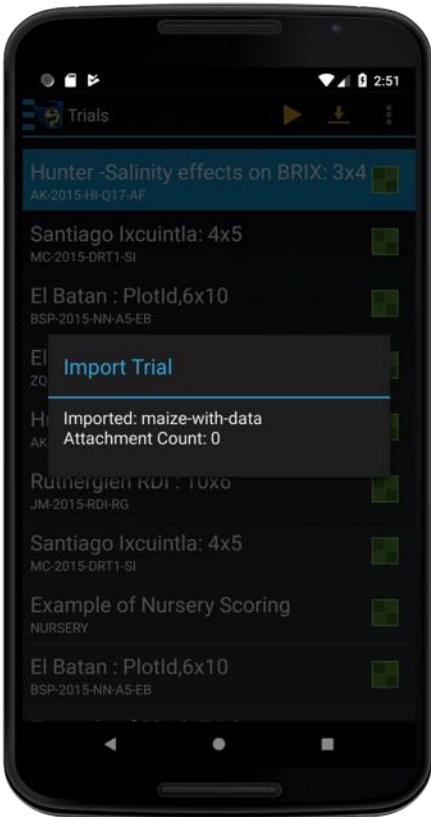
Continued on next page

Table 2 – continued from previous page

| Step | Action |
|------|--|
| 3. | <p>Select the KDX file to be imported such as the one at 2 in the below image. Then select the <i>Open</i> button at 2 and the import will begin.</p>  <p>Fig. 4: Importing a Trial 2/3</p> |

Continued on next page

Table 2 – continued from previous page

| Step | Action |
|------|---|
| 4. | <p>A successful import results in the following screen. The attachment message indicates that there are no attachments to the Trial.</p>  <p>Fig. 5: Importing a Trial 3/3</p> |

Step 5 - Transferring Files from KDSmart to Google Drive

Once data is collected by scoring with KDSmart, the data needs to be transferred to KDXplore for curation. Step 5 will demonstrate how to transfer scored data for KDXplore using Google Drive.

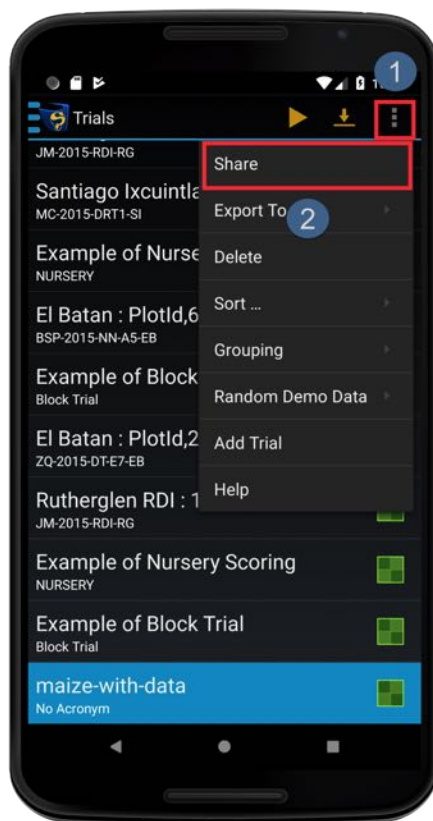


Fig. 6: Transferring a Trial 1/5

Table 3: Transferring a Trial

| Step | Action |
|------|---|
| 1. | On the Trials screen in the above image, ensure that the Scored Trial that you want to transfer is selected and then choose the Options button at 1 and then the <i>Share</i> option at 2 . |

Continued on next page

Table 3 – continued from previous page

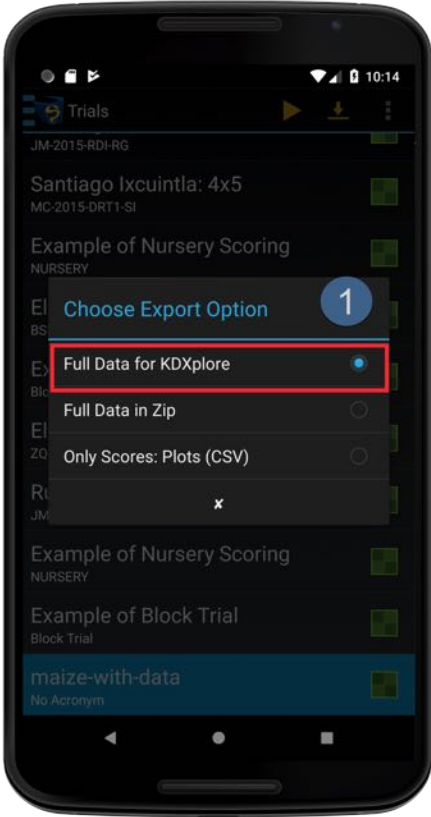
| Step | Action |
|------|--|
| 2. | <p>The Choose Export Option window is then displayed as seen in the image below. Select the <i>Full Data for KDXplore</i> option at 1.</p>  |

Fig. 7: Transferring a Trial 2/5

Continued on next page

Table 3 – continued from previous page

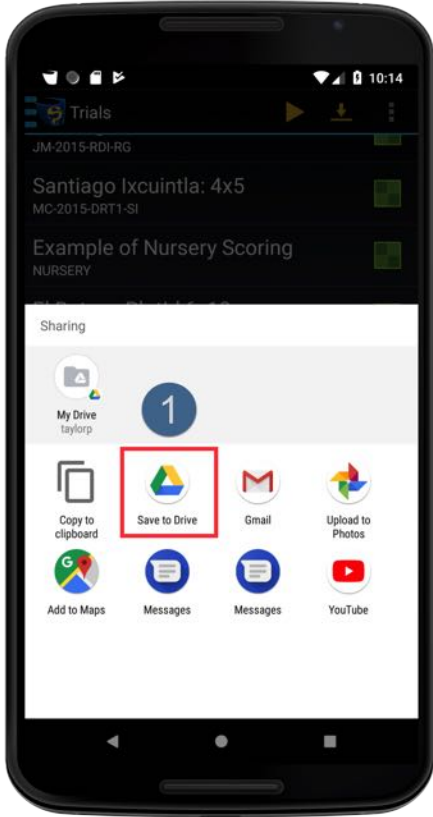
| Step | Action |
|------|---|
| 3. | <p>You will be presented with options for sharing the KDX file. Select the Save to Drive option at 1 in the below image.</p>  <p>The image shows a smartphone screen with a sharing menu. The menu is titled 'Sharing' and lists several options: 'My Drive' (with a blue circle containing the number 1), 'Copy to clipboard', 'Add to Maps', 'Messages', 'Gmail', 'Upload to Photos', and 'YouTube'. The 'Save to Drive' option is highlighted with a red box. The background of the phone screen shows a list of trials, including 'JM-2015-RDI-RG', 'Santiago Ixcuintla: 4x5', 'MC-2015-DRT1-SI', and 'Example of Nursery Scoring'.</p> |

Fig. 8: Transferring a Trial 3/5

Continued on next page

Table 3 – continued from previous page

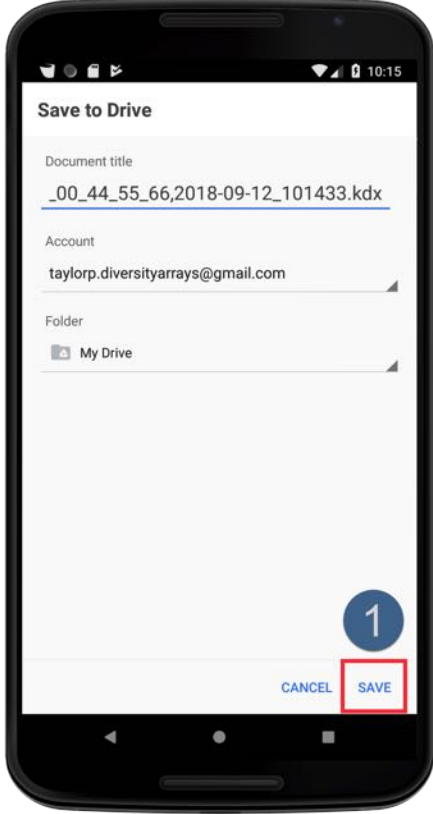
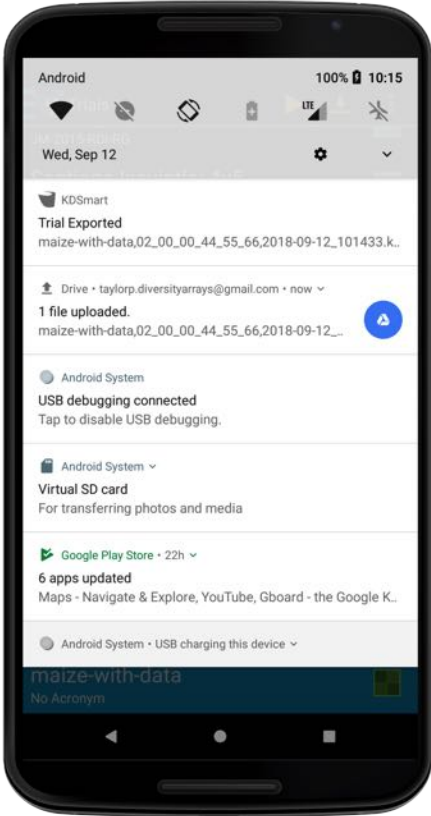
| Step | Action |
|------|--|
| 4. | <p>Choose the Save to Drive to display options for saving the file as seen in the below image. Select the Save option at 1 when you are ready to save the file to Google Drive.</p>  |

Fig. 9: Transferring a Trial 4/5

Continued on next page

Table 3 – continued from previous page

| Step | Action |
|------|--|
| 5. | <p>Once the file has been saved, confirmation notifications are displayed on the device as seen in the below image. This indicates that the Scored Trials are now stored in Google Drive.</p>  <p>Fig. 10: Transferring a Trial 5/5</p> |

Step 6 - Transferring Files into KDXplore from Google Drive

The final step is to load the Scored Trial from Google Drive into KDXplore. This allows the user to curate and analysing the scored data.

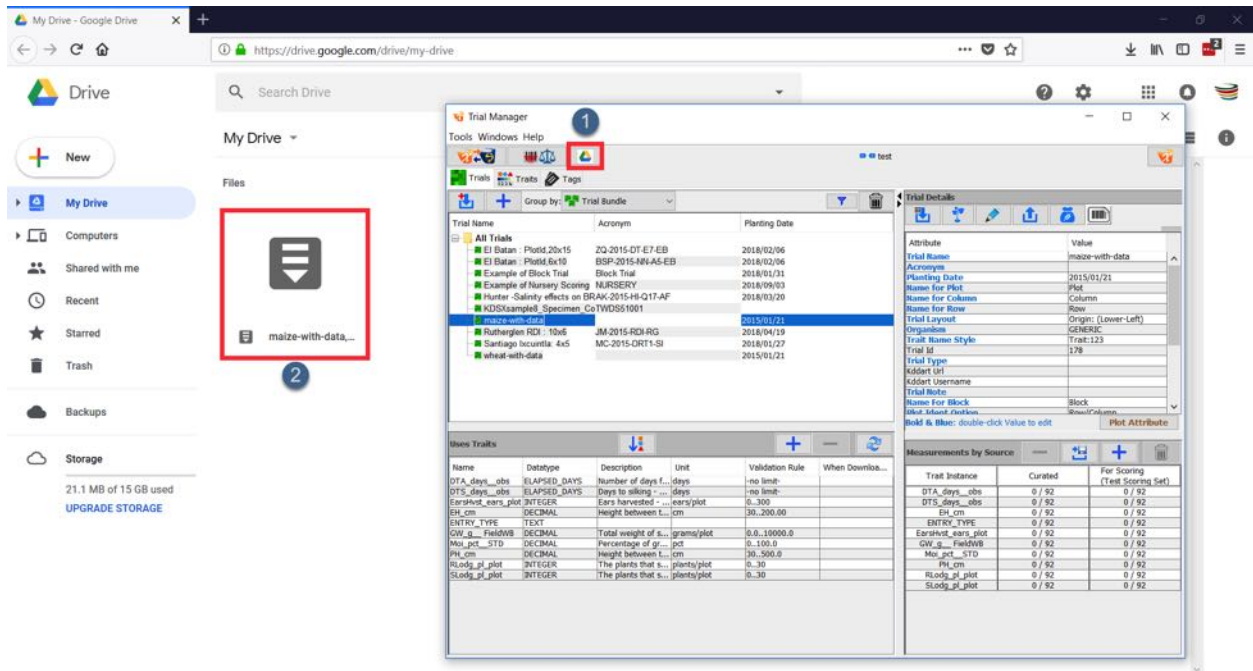


Fig. 11: Downloading a Trial from Google Drive

Table 4: Loading a Trial from Google Drive

| Step | Action |
|------|--|
| 1. | Ensure that Google Drive is opened. If it is not, then there is a Google Drive button in KDXplore which opens it in a browser. This button is located at 1 in the above image. |
| 2. | Choose any file such as the one located at 2 . <i>Right-click</i> this file and then choose the <i>Download</i> option. This downloads the file to the default location for your browser (e.g. The Downloads folder). |

Continued on next page

Table 4 – continued from previous page

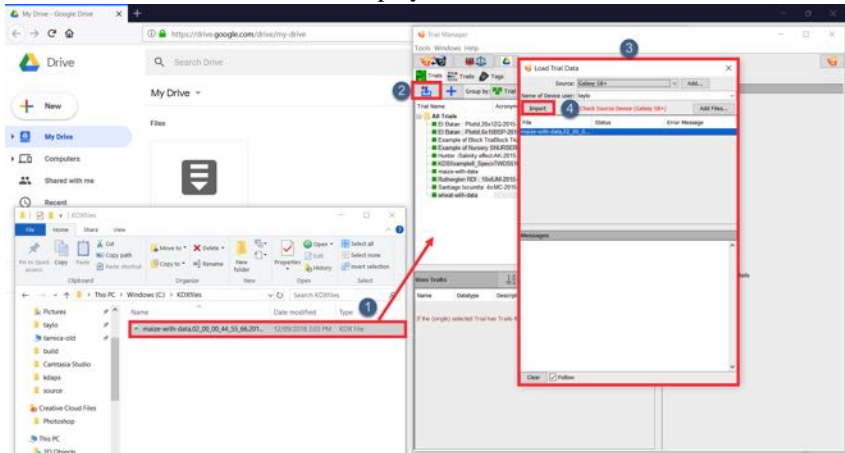
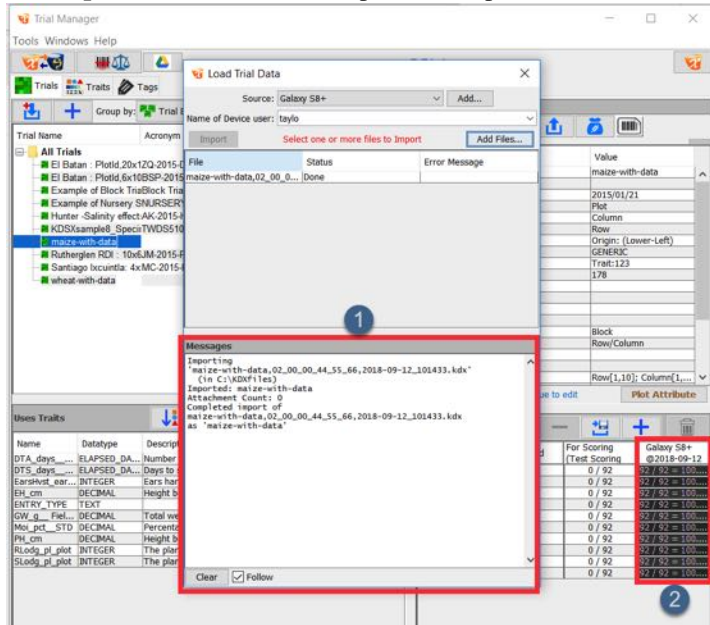
| Step | Action |
|------|---|
| 3. | <p>Click+drag the downloaded file (such as the one ¹ in the below image) to the Trials panel in KDXplore. This displays the Load Trial Data window at ³. The Download button can also be selected to display the Load Trial Data window.</p>  |
| 4. | <p>Select/highlight the file you want to import, select a <i>Source</i> device, and then enter the <i>Name of the Device User</i>.</p> |
| 5. | <p>Select the Import button at ⁴ to complete the import.</p>  |

Fig. 13: Import Trial Data

8.1.2 Data Transfer - KDXchange Method

Whilst the Google Drive method is now the recommended method for exchanging data between KDXplore and KDSmart, KDXchange is still provided as a backup method for exchanging data.

8.1.3 Setup - Connecting KDXplore to KDSmart Devices

Connecting Devices has three steps.

Step 1 - Using WiFi

KDXplore and KDSmart devices connect and synchronise data using a WiFi network.

The KDSmart device(s) and the KDXplore laptop/PC **must** be connected and visible to each other on the **same network** (i.e. same wifi connection). This is a networking requirement and not a limitation of KDSmart/KDXchange.

Note: Depending on the network configuration, there may be times when your PC/Laptop is connected to a wired network (not on WiFi) yet will be able to connect to KDSmart devices on WiFi.

Tip: Many organisational IT policies lock computer settings preventing the setup or activation of your own WiFi Hotspot without needing Administrator user access on the computer. **Before** travelling to ‘the field’ we suggest you prepare, test and become familiarised with this means of connecting devices. Seek support in your organisation if needed.

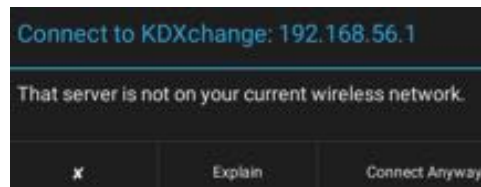


Fig. 14: KDSmart - WiFi Connection Warning Example

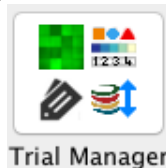
If the message above is displayed try the **Connect Anyway** button, however, this may result in mixed success. Only a couple of tries is needed!


In the Field - Your Own WiFi Hotspot

When a WiFi network is unavailable at your location, a portable WiFi hotspot can be created on your Laptop (if it has that capability). The connection can then be shared with your other KDSmart devices using KDXchange (see the above tip).

The KDXchange Window

The KDXchange window can be found by opening KDXplore on a PC and then opening the **Trial Manager** module



by selecting the **Trial Manager** icon. Once the module is open, select the **KDXchange Server**  icon.

The following image displays a section of the KDXchange screen highlighted to show the following areas:

- 1 **Connection** panel is where the options to connect devices are located. This includes the IP Address where the KDXchange server will be created.
- 2 **KDXplore** panel links KDXplore from the user's computer. This means that the list of Trials, Traits, and Tags that are on the user's version of KDXplore are displayed. The user will need to choose between either the Trials, Traits or Tags to be selected.
- 3 **KDSmart Devices** is a list of all the KDSmart devices that are connected to KDXchange or are available for connection. The image demonstrates that a device named 'Galaxy S8+' from the user named 'Tester' is currently connected.
- 4 **Device** is a panel which displays data from the currently connected KDSmart device.

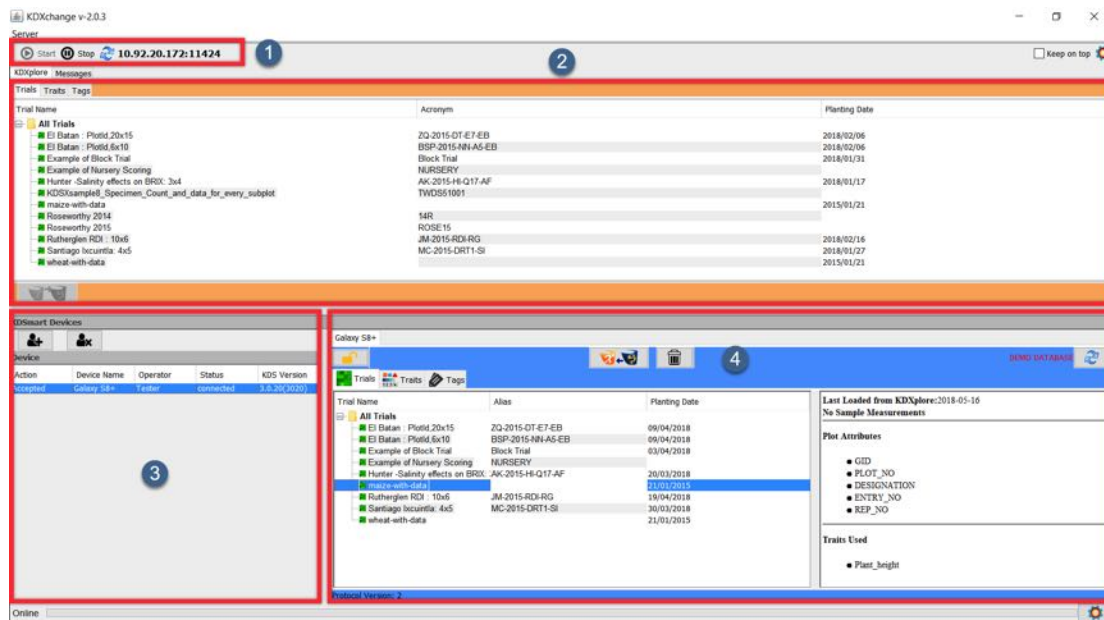


Fig. 15: KDXchange Main Window

Note: KDXchange server software in KDXplore and KDSmart enables them to communicate and needs to be kept running on the pc/laptop until any synchronisation tasks between the devices has completed. Also, the devices should be kept in close proximity whilst connected. Once tasks have completed the KDXchange server can be stopped.

Step 2 - Prepare KDXplore/KDXchange

Step 2 involves preparing KDXplore on the laptop/pc to communicate with KDSmart devices. The following steps must be performed on the laptop/pc:

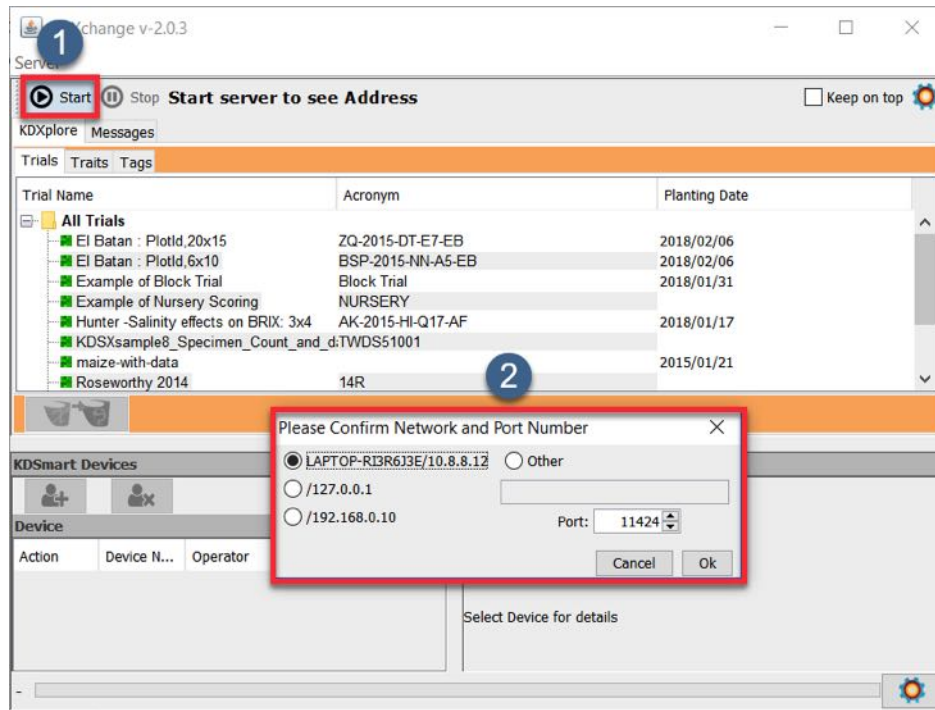




Fig. 16: Confirm Network/IP Address and Port number

Table 5: Step 2 - Starting the KDXchange server in KDXplore

| Step | Action |
|--------------|--|
| 2.1 (KDX) | On the Laptop/PC start KDXplore and select the Trial Manager  icon. |
| 2.2 (KDX) | Select the KDXchange Server  icon at top of the Trial Manager window to open KDX-change. |
| 2.3 (KDX) | Select the Start button (or Shift Start to enter address and/or port number) which is located at 1 on the above image. |

Continued on next page

Table 5 – continued from previous page

| Step | Action |
|--------------|--|
| 2.4 (KDX) | The Network/IP Address and the Port number need to be confirmed. The selected Network/IP Address in this example is different to that of another computer. The IP address of the computer running KDXplore (suggested by default), is usually fine but can be changed if required. Select the OK button in the window at ② to confirm this IP Address. The Port Number usually should be left at the default setting, however, if it is changed, both KDSmart and KDXplore must have the same port number. Once OK has been selected, the window will disappear and the program will start <i>listening</i> for devices which means that it is scanning for available devices on the Wi-Fi network. |
| 2.5 (KDX) | Once KDXplore is <i>listening</i> for devices, there will be a message displaying the IP address and port number at ① in the following image. By selecting the Stop button at ②, the user can stop KDXplore listening for devices. <div> <p>The screenshot shows a 'Messages' window from KDXplore. It displays the following text: 'Addressing KDXchange...', 'address set to: LAPTOP-8238633E/192.168.0.10', 'IP Address Available: 127.0.0.1', '192.168.0.10', and 'Server listening on 192.168.0.10:11424'. A red box labeled '1' highlights the IP address and port number. Another red box labeled '2' highlights the 'Stop' button in the top left corner of the window.</p> </div> |

Fig. 17: KDXchange connection to KDSmart devices

Step 3 - Preparing KDSmart Devices For Upload/Download




Step 3 involves connecting one or more KDSmart devices via WiFi with KDXplore on the laptop/pc. These 'connection' steps are common to both **Upload** to KDXplore or **Download** from KDXplore and for Trials, Traits or Tags.

Table 6: Step 3 - Connecting KDSmart devices to KDXplore's KDXchange server

| Step | Action |
|--------------|---|
| 3.1 (KDX) | Ensure that the KDXchange server is <i>listening</i> for any KDSmart device(s) from the previous <i>Part 2</i> steps (as demonstrated above). |


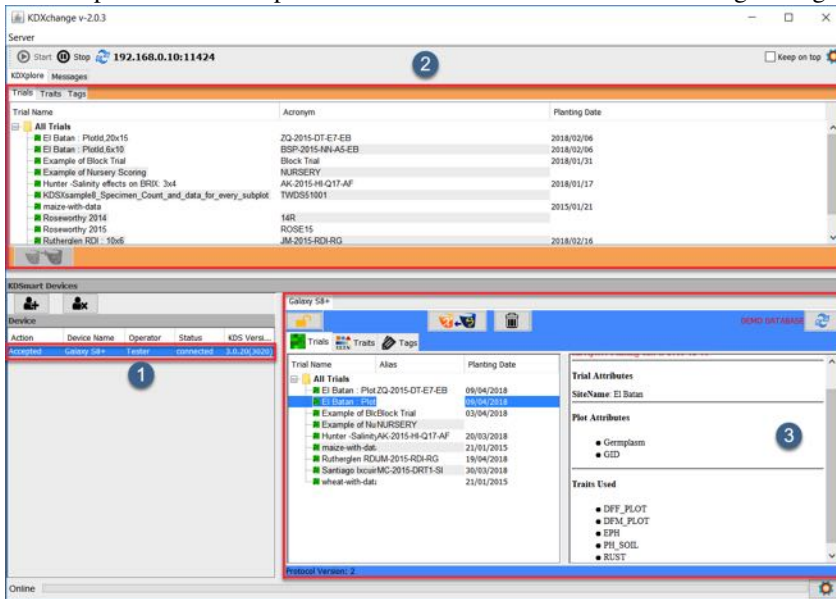
Continued on next page

Table 6 – continued from previous page

| Step | Action |
|--------------|---|
| 3.2 (KDS) | <p>From the home screen on each KDSmart device, select the appropriate Trials, Traits or Tags panel then select the Connect button as seen in 1 then choose the KDXplore icon at 2.</p>  <p>Fig. 18: Starting a Connection</p> |
| 3.3 (KDS) | <p>A dialogue box asking whether to continue will appear. Choose the <i>tick</i> at 1 to continue.</p>  <p>Fig. 19: Accept a Connection</p> |
| 3.4 (KDX) | <p>Return to KDXplore on the PC/Laptop and at 1, the KDSmart device should appear as <i>Pending</i> which means it is ready to connect. To connect the device, select the Allow button shown at 2.</p>  <p>Fig. 20: Allowing KDSmart devices</p> <p>If multiple KDSmart devices were to be connected and the same process was performed on them, the Device panel at 1 would also list those devices.</p> |

Continued on next page

Table 6 – continued from previous page

| Step | Action |
|--------------|--|
| 3.5 (KDX) | <p>A dialogue box then opens which asks for information about the device as seen in the following image:</p>  <p>Fig. 21: Allowing KDSmart devices</p> <p>Enter the name of the user in 1 and then select the OK at 2.</p> |
| 3.6 (KDX) | <p>Once user information has been entered, the device connection is complete. KDXplore should look like the following image:</p>  <p>Fig. 22: Allowing KDSmart devices</p> |

The **Device** panel displays the device as *Accepted* and the data from both the connected computer and KDSmart device will appear in panels 2 and 3.

8.1.4 Transfer - Moving data (Trials, Traits and Tags) between KDSmart and KDXplore

Transferring KDSmart data to/from KDXplore requires KDXplore and the KDSmart device(s) to be connected and waiting to transfer files.

The steps in the previous section, *Setup - Connecting KDXplore to KDSmart Devices* **must** be performed first before proceeding here.

Battery - Power Saving

When a WiFi connection between KDSmart device(s) and KDXplore is established the power saving options on the device(s) may be overridden and the devices could remain **on**. If needing to conserve battery power on the phone/tablet/laptop, it may be advisable to stop the connection once data transfers have been completed.

From KDXplore to KDSmart

The following image and table show the steps required to perform a KDXplore to KDSmart File transfer.

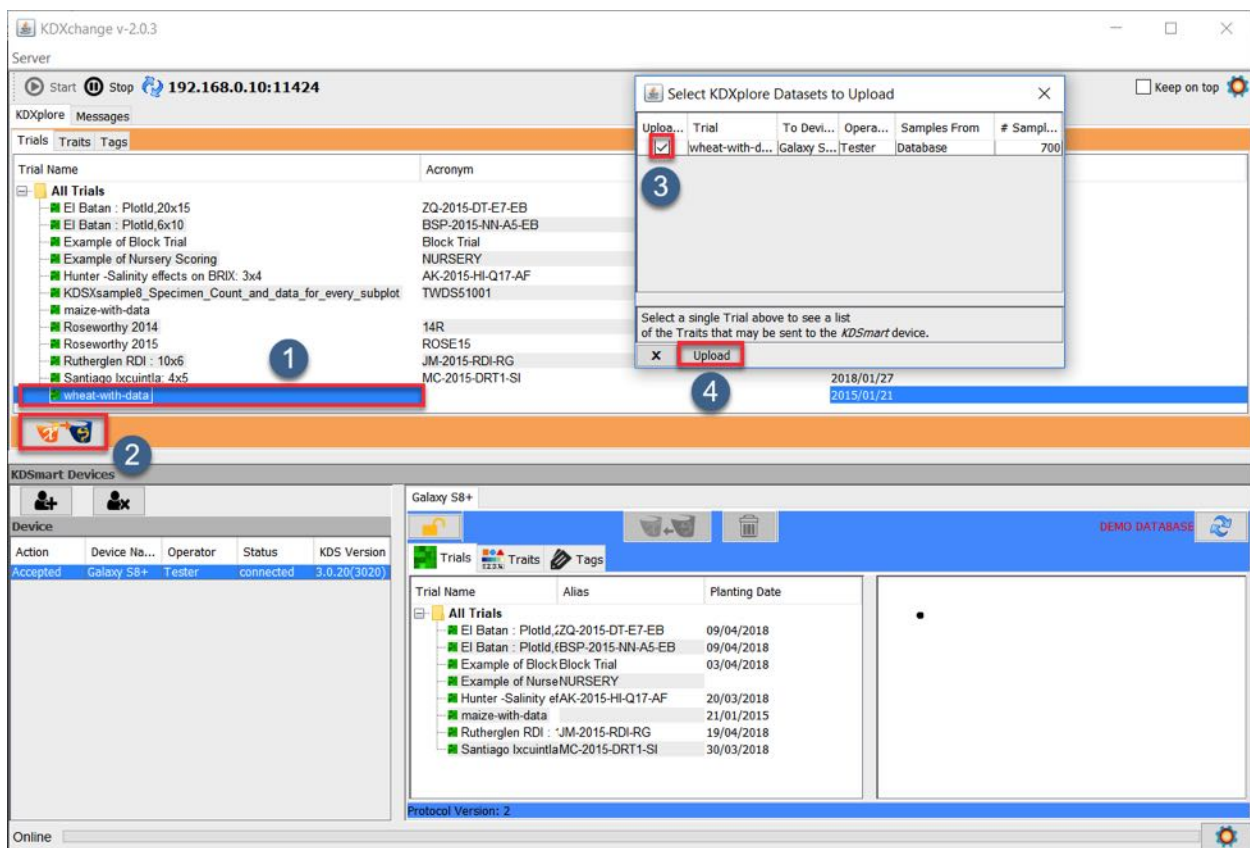







Fig. 23: Transfer Steps - KDXplore to KDSmart

Table 7: Transferring data from KDXplore to KDSmart

| Step | Action |
|------|---|
| 1. | Select an item e.g. the Trial named ‘wheat-with-data’ that is shown at  in the above image. |
| 2. | Once the item is highlighted, select the KDXchange Server  icon at  to start the transfer of data. Another method of choosing files to transfer is to <i>click+drag</i> an item such as a Trial to the KDSmart device. This method of transfer can work for single files, or for bundles of Trials, Traits, or Tags. |
| 3. | The Dataset Upload window opens and files that have been selected will appear in it. The purpose of this window is to confirm the upload of datasets. Select the checkbox as seen at  and then select the OK button at  to finalise the upload. |

From KDSmart to KDXplore

The steps outlined in the following image and table describe how to transfer Trials, Traits, or Tags from KDSmart to KDXplore when they are connected using KDXchange.

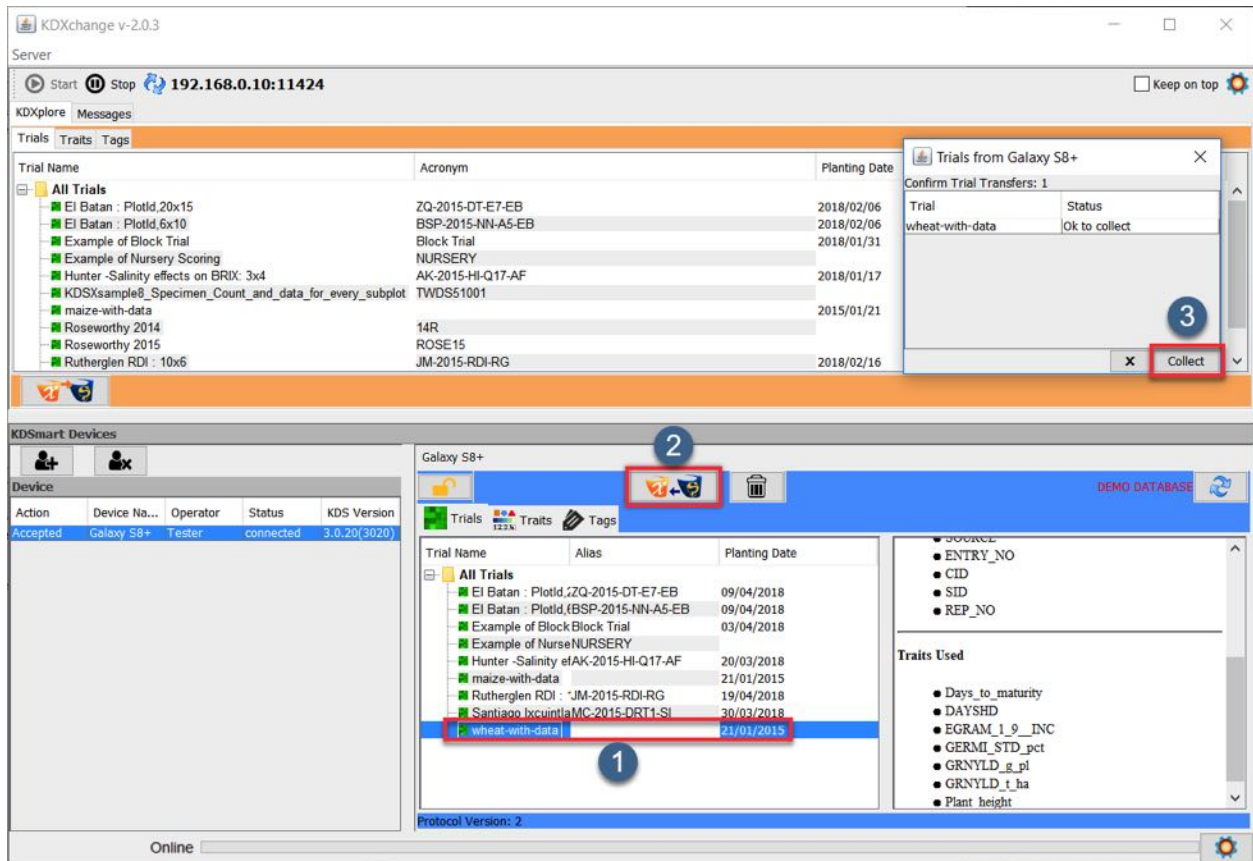



Fig. 24: Transfer Steps - KDSmart to KDXplore

Table 8: Transferring data from KDSmart to KDXplore

| Step | Action |
|------|--|
| 1. | Select an item e.g. the Trial named 'wheat-with-data' that is shown at 1 in the above image. |
| 2. | Once the item is highlighted, select the KDXchange Server  icon at 2 to start the transfer of data. As with the KDXplore to KDSmart transfer, files can be transferred by <i>click+drag</i> . |
| 3. | A Confirmation window should appear. Select the Collect button at 3 which will confirm the transfer and the Trial is then be copied into KDXplore. |

Finished - Disconnecting Devices

When a KDSmart device is connected any touches to the KDSmart window, accidental or otherwise, may cause the following warning to display:

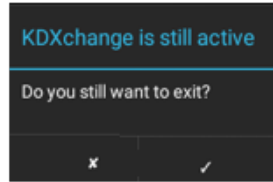


Fig. 25: Disconnection Warning

If disconnection is unintended, select the **X** button to dismiss the message and continue, otherwise, select the tick to confirm.

Disconnection can also be achieved using the **Stop** button adjacent to the Run button in the below image. Either method will return KDSmart to normal operation and close the connection.



Fig. 26: Disconnection Warning

Tip:

- After disconnection of KDSmart device(s) the KDXchange server will still be running on the PC/Laptop. Whilst this is still running reconnection of a device can be quickly achieved.
 - The KDXchange server can be stopped when data transfers is finished.
-

CSV FILE FORMATS

These pages provide information and formatting assistance for the construction of valid CSV Trial/Nursery files for import into KDSmart and KDXplore.

KDSmart and KDXplore share the same import code base, designed to make the task easier. This introduction will help with understanding what needs to be prepared for a CSV import using either application.

Note: Other data import methods exist, instead of CSV files, for loading Trial/Nursery/Trait/Tag data into KDSmart/KDXplore which can offer better and longer term advantages.

9.1 KDSmart/KDXplore Import Mapping

Importing a Trial using CSV format in KDSmart/KDXplore commences with an attribute mapping table, similar to the examples in the following illustration. This is an important step which helps you setup how your Trial or Nursery information is loaded and defined in each application.

Note: This method of attribute selection is employed to make the import task easier, rather than keep editing and adjusting the CSV file format.

Before the import proceeds, CSV Column Headings in the file need to be assigned an *Attribute Type* using the “Import As” column.

Table 1: Trait Name Style Import Trial from CSV Column Mapping Example

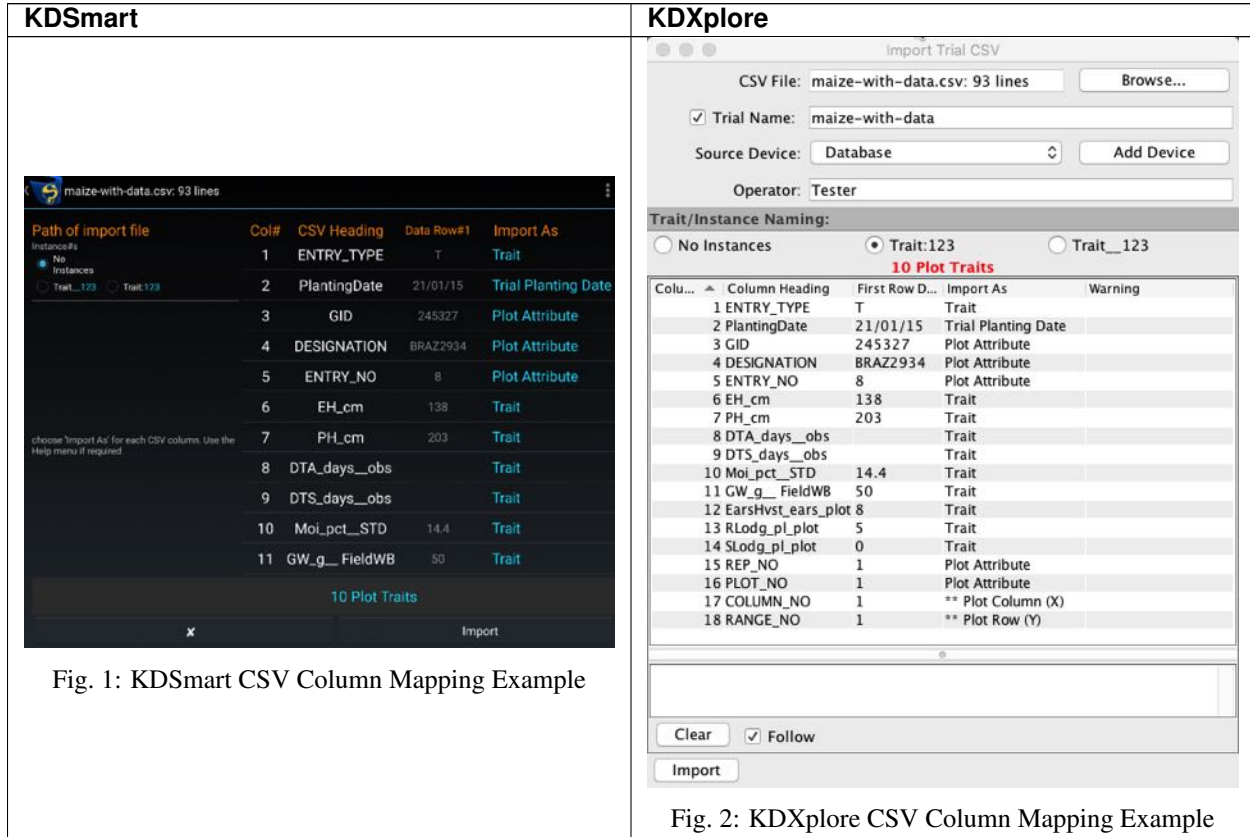


Fig. 1: KDSmart CSV Column Mapping Example

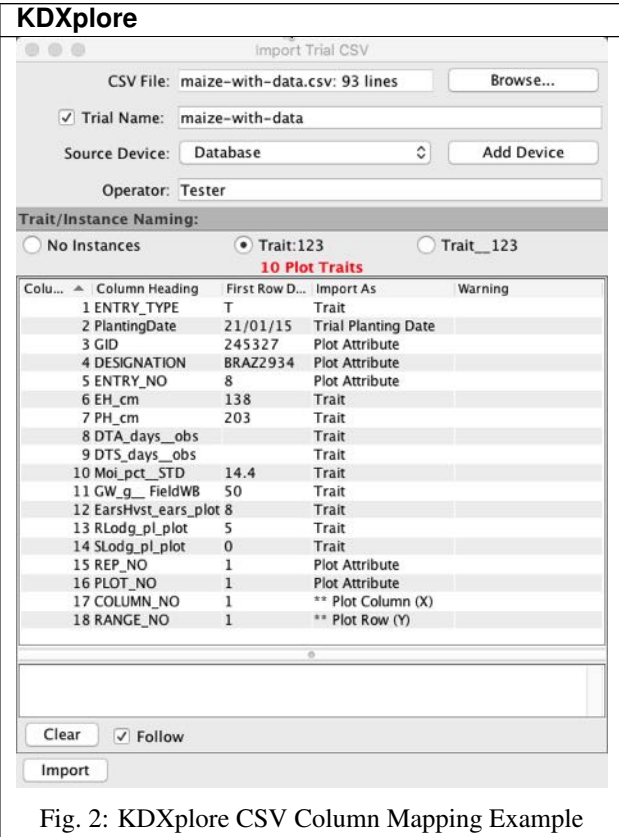


Fig. 2: KDXplore CSV Column Mapping Example

The interface examples above illustrate the:

- File chosen to import is “maize-with-data.csv”;
- Name of the CSV’s column Headings;
- First data row; and
- Blue (KDSmart) ‘Import As’ column.

Selecting the ‘Import As’ entry, for each row as necessary, reveals a drop down list of attributes that can be assigned to the column. KDSmart/KDXplore makes a ‘best guess’ of the attribute type where possible based upon the first row of data.

9.2 Trials and Plots

The following tables list each Attribute Type. Pay particular attention to the ones marked as blue text:

Table 2: Trait Name Style Attribute Type Usage

| Attribute Type | Usage |
|--|---|
| <ul style="list-style-type: none"> • Trial Attribute or • Plot Attribute | Indicates KDSmart must retain the value as an attribute, either for the Trial or for each Plot respectively. |
| <ul style="list-style-type: none"> • Trait or • Trait for Sub-Plot | Applying either of these Attributes to a column causes a <i>Trait</i> of that name to be added to the list of Traits for the Trial. |
| Ignore | Use this Attribute to ignore columns in the CSV file. |

The *Attribute Types* listed above may be applied to **ANY** heading in the CSV file.

Any columns with a name starting with “Link:”, “Date:”, “Date_”, “Sub-Plot#:”, or “Sub-Plot#_” will be automatically assigned as *Ignore* (but you can always change that if you wish).

9.3 Trial & Plot Import Options

When importing a heading classified as Trait or Trait for Sub-Plot KDSmart/KDXplore uses hints in the heading to determine whether it is only a Trait Name or if the heading also identifies a Trait Instance.

This is designated as the Trait Name Style.

You may choose one of the following options:

Table 3: Trait Name Style options:

| Option | Base Instance Number | Format | Example / Description |
|-------------------------------------|----------------------|---------------------------------|---|
| No Trait Instance detection | | | All Trait headings will have a single Trait Instance created. Headings of: AMT1, AMT:1, AMT__1 will correspond to three different Traits with exactly the names provided. |
| Ends in colon followed by digits | 1 | <traitName> : <instanceNumber> | AMT, AMT:2 results in Trait Instance numbers of 1 and 2. |
| Ends in two underscores then digits | 1 | <traitName> __ <instanceNumber> | AMT, AMT__2 results in Trait Instance numbers of 1 and 2. Note: Don’t include spaces - only depicted here for display purposes. |

The other options you need to select are how KDSmart/KDXplore determines Sub-Plots from the CSV headings. This is described in the [Sub-Plot Count and Trait Instances](#) section below.

To specify that a column is for a particular Sub-Plot, add the following suffix #nn (i.e. # followed by digits, which must be an integer greater than zero) where the number identifies the individual.

You may specify whether or not “sub-plot” data is to be collected here or while scoring by touching the Plot icon:



The following three tables list, in turn, the headings that are used for different parts of a Trial Import. Abbreviations used: ID - Required for Identification OPT - Optional ATTR - Attribute.

9.4 Trial Specific Data

The first table lists the headings that pertain to Trial-specific data.

Table 4: Headings For **Trial** Specific Data

| Attribute Type | Headings Automatically Recognised | Description |
|-------------------------|---|--|
| Trial Planting Date OPT | <ul style="list-style-type: none"> PlantingDate TrialPlantingDate DatePlanted Planted DateSown Sown SownDate | The base value used for computing ELAPSED_DAYS values for Traits, e.g. Days to Flowering. (Can be changed manually after import) |
| Trial Name OPT | Trial Name | If present, this is used as the name of the Trialin. If not present, the name of the CSV file will be used. |
| Trial Alias OPT | <ul style="list-style-type: none"> Abbreviation TrialAbbreviation TrialAcronym Acronym | A short name for the Trial that will be used on screens where there is limited space. |
| Trial Column Name OPT | <ul style="list-style-type: none"> ColumnName NameForColumn | This is the word used for the X coordinate (see the attribute type X-Column in the Plot headings table below). Example: for “Range/Row” the value here would be “Range”. |
| Trial Row Name OPT | <ul style="list-style-type: none"> RowName NameForRow | This is the word used for the Y coordinate (see the attribute type Y-Row in the Plot headings table). Example: for “Range/Row” the value here would be “Range”. |
| Trial Plot Name OPT | <ul style="list-style-type: none"> CellName NameForCell PlotName NameForPlot | This is the word used to describe each “cell”. For many plant-related field trials this is likely to be “Plot”. For other trials/experiments it may be “Panel”, “Pond”, “Test-tube” etc. |
| Trial Bundle OPT | <ul style="list-style-type: none"> TrialBundle TrialGroup TB TG | Assigns the name of a Trial Bundle for the Trial |

Continued on next page

Table 4 – continued from previous page

| Attribute Type | Headings Automatically Recognised | Description |
|-----------------------|---|--|
| Trial Database Id OPT | <ul style="list-style-type: none"> DatabaseTrialId TrialId TrialNumber | May be provided to cross-reference to the originating database. |
| Trial Attribute ATTR | May apply to any heading in the file. See <i>Trial Attribute Headings</i> below. | Retain the value as an attribute of the Trial. If you apply this type to a column then every row must have the same value. |

9.5 Plot Specific Data

Table 5: Headings For **Plot** Specific Data

| Attribute Type | Headings Automatically Recognised | Description |
|----------------------------|--|---|
| Plot Id ID Integer | <ul style="list-style-type: none"> CellId PlotId EntryId Plot | If present, uniquely identifies the Plot in the Trial. Must be unique. |
| PlotBlock ID Integer | <ul style="list-style-type: none"> PlotBlock BlockNo | If present uniquely identifies the Block in the Trial. |
| Plot Column (X) ID Integer | <ul style="list-style-type: none"> PlotColumn X Column Col ColumnX X-Column Column_No BlockX | The X–coordinate of the Plot within the Trial. If present, the (X,Y) pair must uniquely identify the Plot in the Trial, OR If PlotBlock is selected the (X,Y) pair must be unique within the Block. |
| Plot Row (Y) ID Integer | <ul style="list-style-type: none"> PlotRow Y Row RowY Y-Row Range_No Range BlockY | The Y–coordinate of the Plot within the Trial. If present, the (X,Y) pair must uniquely identify the Plot in the Trial, OR If PlotBlock is selected the (X,Y) pair must be unique within the Block. |

Continued on next page

Table 5 – continued from previous page

| Attribute Type | Headings Automatically Recognised | Description |
|----------------------------------|--|--|
| Plot Note OPT | <ul style="list-style-type: none"> • PlotNote • Note • TrialUnitComment | A description or information for the imported plot. |
| Plot Type OPT | PlotType | If present, this specifies the type of plot (e.g. Control, Check, etc.). |
| Plot Barcode OPT | <ul style="list-style-type: none"> • PlotBarcode • Barcode • TrialUnitBarcode | If Plot Barcode column provided it must not be blank. See the User Guide section on Barcode Scanning for further details of how the data in this column is used. |
| Plot Tags OPT | <ul style="list-style-type: none"> • Tags, • PlotComments, • Comments | Additional comments for the imported plot. A list of pipe-separated () Tag labels. |
| Plot Database Id OPT | <ul style="list-style-type: none"> • DatabasePlotId, • TrialUnitId, • TrialUnitNumber | May be provided to cross-reference to the originating database. |
| Sub-Plot Count OPT Integer | <ul style="list-style-type: none"> • SpecimenCount, • IndividualCount, • Plant Count | Number of Sub-Plots or plants present within the plot to be imported. Please read the section below <i>Sub-Plot Count and Trait Instances</i> . |
| Plot Attribute ATTR | May be applied to any heading in CSV. See <i>Plot Attribute Headings</i> below. | Retain the value as an attribute of the Plot. Each row may have a different value (including blanks). Choose any subset to display as Plot Info while scoring. |

9.6 Sub-Plot Specific Data

Table 6: Headings For **Sub-Plot** Specific Data

| Attribute Type | Headings Automatically Recognised | Description |
|------------------------|---|--|
| Sub-Plot Id ID Integer | <ul style="list-style-type: none"> • SpecimenDatabaseId • Sub-PlotDatabaseId • Sub-PlotDbId • PlantDatabaseId • IndividualDatabaseId | If present, uniquely identifies the Sub-Plot in the Trial. Must be unique. |

Continued on next page

Table 6 – continued from previous page

| Attribute Type | Headings Automatically Recognised | Description |
|---------------------|---|--|
| Sub-Plot Tags OPT | <ul style="list-style-type: none"> • Sub-PlotTags • SPTags • PlantTags • IndividualTags • SpecimenTags | Additional comments for the imported Sub-Plot. A list of pipe-separated () Tag labels. |
| Sub-Plot Traits OPT | | Any heading with # that is not matched to one of the above Sub-Plot specific headings will default to a Sub-Plot Trait. E.g Plant_Height#6 will default to Sub-Plot Trait. |

9.7 Attribute Types for Trait Variations

This table continues from the two above but lists the Attribute Types for Trait variations and for *excluding* a column from import.

Table 7: Attribute Types For Trait Variations

| Attribute Type | Section | Headings Automatically Recognised | Description |
|------------------------|---------|--|---|
| Trait OPT | Trait | May be applied to any heading in the CSV file. | Marks this column as representing a Trait that is scored only for Plots . The <i>Trait Name Style</i> governs if a <i>Trait Instance</i> is being referenced or not. |
| Trait for Sub-Plot OPT | Trait | May be applied to any heading in the CSV file. | Marks this column as representing a Trait that is scored only for Sub-Plots . The <i>Trait Name Style</i> governs if a <i>Trait Instance</i> is being referenced or not. |
| Ignore | | May be applied to any heading in the CSV file. | Indicates that this column should not be imported. |

For an example see the following [A Simple Example](#) topic.

9.8 Sub-Plot Count and Trait Instances

Multiple instances for a Trait can be imported by including the instance number in the heading. For example, importing the second instance of the Trait 'Plant_Height' can be achieved by including a colon Plant_Height:2.

Alternatively using the Sub-Plot Count column instructs KDSmart/KDXplore to create the specified number of Sub-Plots in each plot.

When Sub-Plot Count is present and non-blank, the integer value in this column will cause creation of the given number of Sub-Plots in the Plot.

This will apply to all of the columns that have an *Attribute Type* of Trait or Trait for Sub-Plot.

If a column is **NOT** marked as Sub-Plot Count, no Sub-Plots will be created during the import of the data file; in this



case, if you wish to add a Sub-Plot to a plot, use the popup menu that appears when you touch the Plot icon: (during the scoring activity) and choose the Add Sub-Plot option. This presents a list of all the Traits that are defined as Trait for Sub-Plot and one of these may be selected to score for the new *Sub-Plot*.

9.8.1 Notes For Importing Subplot Data

The TRAIT FOR SUB-PLOT column heading requires a suffix of # with the Sub-Plot number the value is referring to.

For example, importing a Plant_Height value for Sub-Plot three have a heading Plant_Height#3. To import for all of the Sub-Plots available (Number seen in Sub-Plot count column) use #*. If the trait is a specific instance, the instance number can be imported as you would typically just with the Sub-Plot number appended e.g. Plant_Height:2#3.

9.8.2 Conditions For Importing Subplot Data

The Sub-Plot Count column import will create the provided number of empty Sub-Plots for the specified plots.

- Trait for Sub-Plot will create the required number of Sub-Plots for the value ('#Number').
- Trait Sub-Plot numbers ('#Number') cannot be higher than the Sub-Plot Count if both are being imported.
- Sub-Plot Count column is required if #* (for all Sub-Plots) is used.
- There cannot be two identical column names with Trait for Sub-Plot (e.g. Plant_Heigh#1, Plant_Height#1).
- If #* is used for the same Trait as #Number (e.g. Plant_Height#*, Plant_Height#1) the numbered column (Plant_Height#1) takes priority for the specified Sub-Plot.

9.9 Plot Attribute Headings

The items below identify headings that are automatically classified as *Plot Attributes* by KDSmart.

- Treatment
- SelectionHistory, Selection_History
- ReplicateNumber, Replicate, Rep, Repeticion, REP_NO
- GenotypeName, Genotype, GID
- Origin, Origin (that's a "zero")

- Designation
- Type
- CID, SID, CROSS, SOURCE, ENTRY_NO, SUB_BLOCK, PLOT_NO
- PedigreeName, Pedigree, BreedersPedigree
- Type

Note: This list will be replaced by the *CSV Import Profile* functionality at a later release. Also the spelling of ‘Repeticion’ is required as it is within the ‘code’.

9.10 Trial Attribute Headings

The following are automatically classified as Plot Attributes by KDSmart:

- SiteName, Site, Location
- SiteYear, Year
- TrialType, TrialTypeName
- TrialStartDate, StartDate

9.11 Values in CSV files

CSV files may contain data in the various data “columns”.

For columns marked to be imported as *Traits*, the following rules apply:

1. Blank values will be treated as un-scored Traits as will the word UNSCORED (the latter is not required unless you want to make un-scored trait values very obvious in a CSV file).
2. The word MISSING will be imported as a special token denoting a missing value.
3. The word NA will be imported as a special token denoting “not-applicable” or “not-available” (whatever you take it to mean).

Note: All other values will be checked using the **validation rule for the trait**. Any failure to pass the validation check will cause the entire import to fail.

If you select a column to be used as the *Trial Name*, the value in the first data line may not be the same as any existing *Trial* in the database.

Similarly, if you have not chosen a column as the *Trial Name*, the name of the file (excluding anything from the last “.” onwards) will be used to check for a pre-existing trial in the database.

Note: *Trial Name* checks are **not** case sensitive.

9.12 A Simple Example

9.12.1 Example File Construction

For this simple example (line no.s shown for clarity) the CSV file with three lines consists of:

```
1 date sown,Row,Range,MZC,MZP,#Sub-Plots,LLEN
2 2014-12-15,23,4,,,2,
3 2014-12-15,21,5,,,0,
```

Using the “After Sub-Plot Count”, described in [Sub-Plot Count and Trait Instances](#), the following definition could be used in KDSmart:

Note: In the following table, the top heading row is *NOT* part of the data file.

Table 8: Simple Example: Three Row CSV File (Header Row and Two Data Rows)

| Attribute Type | Plating Date | X-Column | Y-Row | Trait | Trait | Sub-Plot Count | Trait for Sub-Plot |
|----------------|--------------|----------|-------|-------|-------|----------------|--------------------|
| CSV Line 1 | date sown | Row | Range | MZC | MZP | #Sub-Plots | LLEN |
| CSV Line 2 | 2014-12-15 | 23 | 4 | | | 2 | |
| CSV Line 3 | 2014-12-15 | 21 | 5 | | | 0 | |

9.12.2 Example Result

The result of importing this diminutive Trial will be:

- Only two plots at positions (23,4) and (21,5);
- Two Traits, MZC and MZP, are being scored for each Plot;
- The first Plot (CSV Line 2) has two Sub-Plots for which the trait LLEN (leaf length) will be scored;
- The second Plot (CSV Line 3) has no Sub-Plots requiring scoring. However, if while Scoring a Sub-Plot was added to the latter Plot, you will then be asked to score the LLEN Trait for the new Sub-Plot.

Additionally, as no columns in this example were designated as X-Column-Name or Y-Row-Name, the default names of “Column” and “Row” is used to describe the Plot coordinates. Following import, the Trial Details can be edited in KDSmart and the row/column names changed to your choice e.g. “Row” and “Range” respectively, if required to make the nomenclature align more closely to your usual vocabulary. Best practice however, is to name them in the CSV file rather than change them in KDSmart.

9.13 Spaces, Case Sensitivity and Blank Lines

When reading and parsing the headers, KDSmart removes all spaces and performs a case-insensitive comparison to match CSV headings with the automatically recognised built-in headings.

It also skips over any blank lines and takes the first non-blank line as the headings line.

9.14 Traits

The following table describes the required and optional Trait headings for a CSV file that contains details of Traits that will be used by *Trials*.

Table 9: Required and Optional Trait CSV File Headings

| Heading | Alternatives | Notes |
|-------------------------|---|--|
| TraitName | Name | This column heading must be present. All others are optional. The value should be kept short and, if you wish to use the name in KDXplore with CALC <i>Traits</i> no spaces are permitted and the name must begin with a letter. We recommend using the underscore (_) character or CamelCase to improve readability. See also the description of the import option regarding <i>Trait Name Style</i> . |
| TraitAlias OPT | Alias | If provided, should be a shorter form of the <i>TraitName</i> to use during scoring. |
| TraitLevel OPT | Level | Default: Plot. Versions before (KDSmart V3.0.3, KDXplore Beta1.1.4 or Prod 2.1.4) TraitLevel could specify only <i>Plot</i> or <i>Sub-Plot</i> . For versions equal to or above, TraitLevel can specify the trait is either for the: <i>Plot Level</i> by using “Plot” or “TrialUnit”; or the <i>Sub-Plot</i> level by using “Sub-Plot”, “Sub-Plot”, “Individual” or “Plant”. |
| TraitBarcode OPT | Barcode | Used to identify the Trait when using a barcode scanner for scoring. |
| TraitUnit | Unit, Unit-Name, TraitUnit-Name | You can provide anything you like that will assist you in remembering what to enter while Scoring. |
| TraitDescription | Description, Desc | A longer description of the Trait. |
| TraitDatatype | Datatype | One of CATEGORICAL, DATE, ELAPSED_DAYS, INTEGER, DECIMAL or TEXT. See <i>Traits</i> for further details. |
| TraitValidation | TraitValRule, Validation, Validation-Rule | See <i>Traits</i> for further details. |
| DatabaseTraitId | TraitId | If you provide this column, KDSmart will record the value and export it on request (a reference to the originating database). See Protected Traits below. |

Note: A new Trait can be created directly in KDSmart. If you do this and are also uploading or synchronising your data to KDXplore or KDDart you may have to reconcile the differences if there is already a Trait of the same name (compared in a case-insensitive manner).

9.14.1 Overwriting Existing Traits

Entries for existing Traits can be specified in a CSV file. The Traits are matched by Trait Name (ignoring case) and incoming Traits with the same name as one already in the database will be checked for compatibility:

Table 10: Trait Import Overwriting Behaviours

| Trait in Database | Trait in CSV File | Action Taken |
|---------------------|-----------------------|--|
| Data Type is TEXT | Any Data Type | The Trait Data Type in the CSV file will replace the data type in the database. |
| Any other data type | Data Type is TEXT | A warning is issued identifying the line and the import continues excluding the line from the CSV file. |
| Any other data type | Data Type is not TEXT | A warning is issued if the data types are not the same (and the import continues) |
| Description | Description | <p>Descriptions are truncated to the current database limit then compared for equality.</p> <p>If they are the same (ignoring case), a warning will be issued but the new Trait's description will replace the current one in the database. Otherwise:</p> <ul style="list-style-type: none"> • CHOICE: must have the choices or the old choices must be a subset of the new choices • INTEGER and DECIMAL: the limit "exclusions" must be identical, however the new Trait's limits may be "wider" than the current Trait in the database <p>If any of incompatibilities above are identified, a warning is issued and the import continues without altering the current Trait in the database.</p> |

9.14.2 Protected Traits

If a Trait has been imported with a DatabaseTraitId, it is deemed to be "protected".

In this case you may only edit the Trait Alias and changes to the validation rule are not permitted except for INTEGER and DECIMAL Traits where you may change the range of acceptable values but only to make the range smaller.

For example, if an INTEGER Trait has been defined to have values from 0 to 100 you may only change the lower limit to be 1 or more and the upper limit to be 99 or less.

9.14.3 Calculated Traits

These have the Trait Data Type of CALC. No measurements are collected by KDSmart for these Traits.

The value may only be viewed in KDXplore during data curation. KDXplore is able to calculate Trait values from other Traits via entering a formula (similar to Excel).

Note: New Traits cannot be derived from Trait names containing spaces. Recommendation that underscores are used in place of spaces for Trait names, especially if they are intended for use in calculations.

See: *Calculated or Derived Traits*

9.15 Tags

The following details the required and optional headings in a CSV file that contains details of Tags that will be used to annotate Plots and Sub-Plots when Scoring a Trial.

| Heading | Alternatives | Mandatory | Description |
|------------------------|--|-----------|--|
| Label | TagLabel, Comment | Yes | Name of the Tag e.g. BD for bird damage |
| Description | TagDescription, Desc, CommentDescription | Yes | Tag description |
| DatabaseLabelId | LabelId, Id | No | Useful for cross-reference to the originating database |

9.16 Sub-Plot Level Trait Import Examples

The following six cases illustrate part of the input CSV file and how the Trait will be represented in KDSmart. The last example, case 7, shows what not to do!

Case 1 - Two Specimen Level Traits CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|---------|---------|
| Header - 1 | X | Y | SpecimenCount | PHght#* | PWdth#* |
| 2 | 1 | 1 | 5 | 15.0 | 2 |
| 3 | 1 | 2 | 3 | 13.0 | 3 |

In this example at the second CSV row, five specimens are defined for a plot at (1,1) which will set the initial value to 15.0 for the specimen level trait PHght.

When performing the Import in KDSmart Traits such as these two traits must be set to **Trait for Specimen** when performing the CSV import mapping.

Import Result in KDSmart

| | | |
|-----------|-------|-------|
| Plot: | 1,1 | |
| Specimen: | PHght | PWdth |
| 1 | 15.00 | 2 |
| 2 | 15.00 | 2 |
| 3 | 15.00 | 2 |
| 4 | 15.00 | 2 |
| 5 | 15.00 | 2 |

Case 2 - Two Specimen Level Traits

CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|---------|---------|
| Header - 1 | X | Y | SpecimenCount | PHght#2 | PWdth#3 |
| 2 | 1 | 1 | 5 | 15.0 | 3 |
| 3 | 1 | 2 | 3 | 13.0 | 3 |

Import Result in KDSmart

| | | |
|-----------|-------|-------|
| Plot: | 1,1 | |
| Specimen: | PHght | PWdth |
| 1 | - | - |
| 2 | 15.00 | - |
| 3 | - | 3 |
| 4 | - | - |
| 5 | - | - |

Rule Note: SpecimenCount Value Must be >= Trait Instance Numbers

Case 3 - One Specimen Level Trait

CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|-----------|-----------|
| Header - 1 | X | Y | SpecimenCount | PHght:1#* | PHght:1#2 |
| 2 | 1 | 1 | 5 | 15.0 | 17.0 |
| 3 | 1 | 2 | 3 | 14.0 | 16.0 |

Import Result in KDSmart

| | | |
|-----------|-------|--|
| Plot: | 1,1 | |
| Specimen: | PHght | |
| 1 | 15.0 | |
| 2 | 17.0 | |
| 3 | 15.0 | |
| 4 | 15.0 | |
| 5 | 15.0 | |

Case 4 - One Specimen Level Trait

CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|-----------|-----------|
| Header - 1 | X | Y | SpecimenCount | PHght:1#* | PHght:2#* |
| 2 | 1 | 1 | 5 | 10.0 | 20.0 |
| 3 | 1 | 2 | 3 | 9.0 | 19.0 |

Two Instances of Trait PHght

Import Result in KDSmart

| | | |
|-----------|-------|---------|
| Plot: | 1,1 | |
| Specimen: | PHght | PHght:2 |
| 1 | 10.0 | 20.0 |
| 2 | 10.0 | 20.0 |
| 3 | 10.0 | 20.0 |
| 4 | 10.0 | 20.0 |
| 5 | 10.0 | 20.0 |

Case 5 - Specific Specimen Level Trait CSV Example

| CSV Row | CSV Row Contents..... | | | | | |
|------------|-----------------------|---|---------------|-----------|-----------|-----------|
| Header - 1 | X | Y | SpecimenCount | PHght:1#* | PHght:1#2 | PHght:2#* |
| 2 | 1 | 1 | 5 | 12.0 | 13.0 | 16.0 |
| 3 | 1 | 2 | 3 | 11.0 | 12.0 | 15.0 |

Two Instances of Trait PHght

Import Result in KDSmart

| | | |
|-----------|-------|---------|
| Plot: | 1,1 | |
| Specimen: | PHght | PHght:2 |
| 1 | 12.0 | 16.0 |
| 2 | 13.0 | 16.0 |
| 3 | 12.0 | 16.0 |
| 4 | 12.0 | 16.0 |
| 5 | 12.0 | 16.0 |

Case 6 - No Specimen Count Used CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|-----------|-----------|
| Header - 1 | X | Y | SpecimenCount | PHght:1#1 | PHght:1#2 |
| 2 | 1 | 1 | 5 | 12.0 | 13.0 |
| 3 | 1 | 2 | 3 | 10.0 | 11.0 |

Import Result in KDSmart

| | | |
|-----------|-------|--|
| Plot: | 1,1 | |
| Specimen: | PHght | |
| 1 | 12.0 | |
| 2 | 13.0 | |
| 3 | - | |
| 4 | - | |
| 5 | - | |

Case 7 - Error in CSV

This portion of a CSV has an error. It will not import into KDSmart or KDXplore.

CSV Example

| CSV Row | CSV Row Contents..... | | | | |
|------------|-----------------------|---|---------------|-----------|-----------|
| Header - 1 | X | Y | SpecimenCount | PHght:1#* | PHght:1#4 |
| 2 | 1 | 1 | 20 | | 2.0 |
| 3 | 1 | 2 | 2 | | 2.0 |
| 4 | 1 | 3 | 2 | | 2.0 |
| 5 | 1 | 4 | 2 | | 2.0 |
| 6 | 1 | 5 | 20 | | 2.0 |

This fails because of the formula:

SpecimenCount Value Must be \geq Trait Instance Numbers.

CSV Rows 3, 4 and 5 show a SpecimenCount of 2. This value is less than the value '4' indicated in the last column header.

9.17 Excel Formula for Converting ISO-8601 Timestamp to Excel Date

When KDXplore or KDSmart use a timestamp for a scored trait value the timestamp is recorded in .

Using this format means that you can correctly compare data collected in different time zones.

Unfortunately Microsoft Excel does not automatically recognise this format. However, using the formula below, you can easily convert the date/time string in ISO-8601 format into an Excel date/time value and render this in a more useful form by using an appropriate cell format (e.g. yyyy-mm-dd hh:mm:ss).

The formula is:

```
=DATEVALUE (LEFT (A1 , 10) )
+ TIMEVALUE (MID (A1 , 12 , 8) )
+ IF ("Z"=MID (A1 , 20 , LEN (A1) -19) , 0 , (INT (MID (A1 , 20 , LEN (A1) -19) /100) *60+MOD (MID (A1 , 20 ,
↪LEN (A1) -19) , 100) ) /1440)
```

If you wish to know what the formula is doing, the explanation is below. The formula above is split across three lines to facilitate the following explanation.

Excel's internal date time format is a *real* number where the part before the decimal point is the *number* of days and the portion after the decimal point is the *fraction* of a day.

The first line of the formula extracts the year/month/day portion and converts it into the full days portion of the result

The second part of the formula extracts the hours/minutes/seconds portion and converts it into the day fraction portion.

The third and final part obtains the time zone portion of the ISO-8601 timestamp and converts it into another day fraction part. It checks for the special *Z time zone* that indicates a zero offset. If it is not Z, the time zone is in \pm HHMM format so the formula extracts the HH portion separate from the MM portion, computes the total as a number of minutes and divides by 1440 (the number of minutes in a day) to arrive at a final day fraction component that is added to the amount determined by the first two parts of the formula. Any leading plus or minus sign is used to correctly perform this computation.

TIPS & TROUBLESHOOTING

This page contains a few general usage tips for KDSmart.



Select any heading to expand/display  or contract  the section.

10.1 Tips

10.1.1 Determining The Android Version

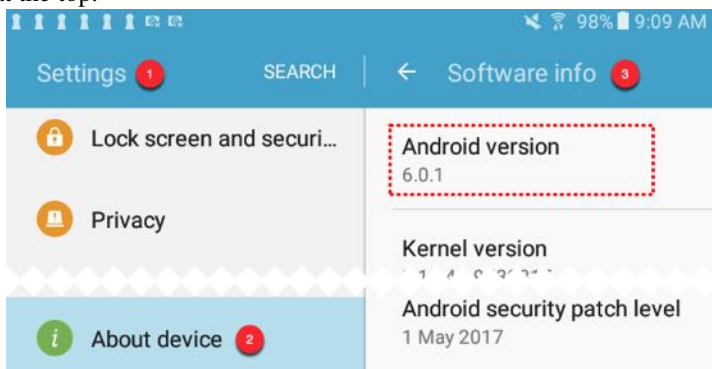
For support purposes, you may be asked to provide the version number of Android you are using. This is a simple check to perform on your phone or tablet by performing the following:

Table 1: Determining Android Version

| Step | Action |
|------|---|
| 1. | From the phone's Home Screen (not in KDSmart) select  Settings . |
| 2. | Scroll down to the bottom and select either About Phone or About Device . |
| 3. | Earlier versions the Android Version will appear in this list.  <p>Fig. 1: About Phone (Select to zoom)</p> |

Continued on next page

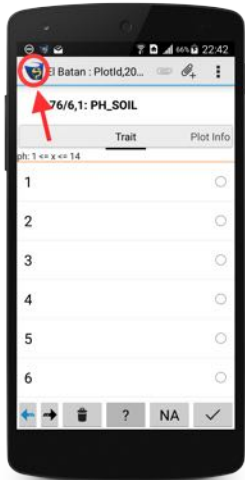
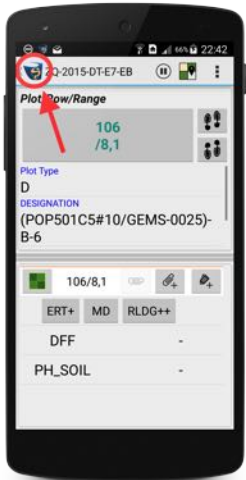

Table 1 – continued from previous page

| Step | Action |
|------|--|
| 4. | <p>Later versions select the Software Info item and Android Version should appear at the top.</p>  <p>Fig. 2: Android Version (Select to zoom)</p> |

10.1.2 Continue Scoring The Previous Trial

The name of the trial being scored is displayed on the KDSmart **Home Screen**. Just touch the **Start Scoring Button** or the trial name to continue from where you were previously scoring. KDSmart remembers the position or plot when you last exited the scoring activity for the trial (see the next section) and will present that plot to you.

10.1.3 Quick Stop for a Break

| | | |
|---|---|---|
| <p>1. If in Auto-advance Mode, exit using the Home Button in the top left corner:</p>  | <p>2. In the Scoring Screen, exit using the Home Button in the top left corner:</p>  | <p>3. Confirm the exit by selecting the Confirm Button in the popup:</p>  |
|---|---|---|

10.1.4 Android Permissions

Android has introduced more stringent application security which affects KDSmart and any other Android application. Permission is required at the initial application installation, and may be requested again following installing any application updates.

Without allowing permissions an application will not work, or be unable to use all its functionality.

Upon initial KDSmart installation, a message similar to the following example will be displayed. Selecting **Allow** will enable KDSmart to work.

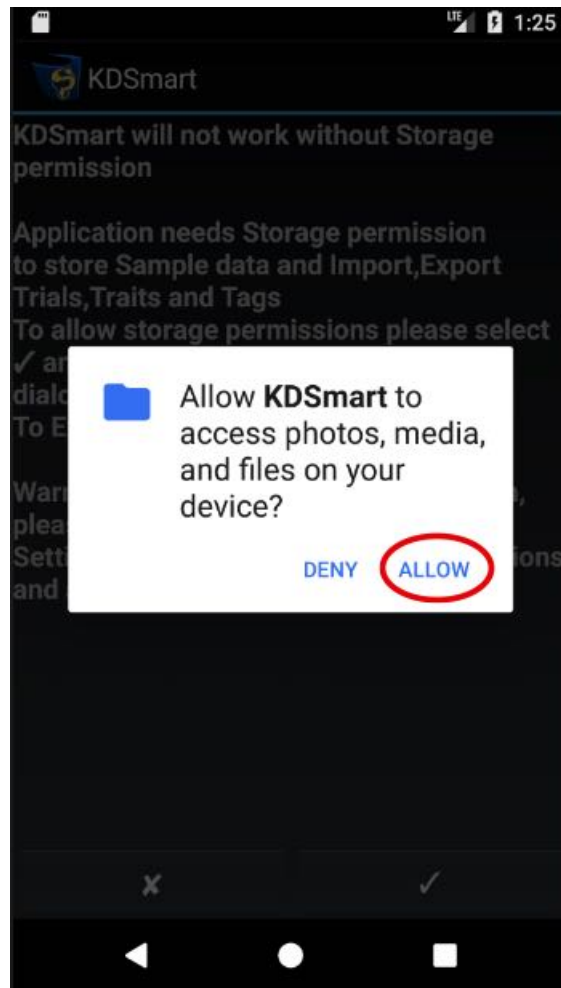


Fig. 3: Android Permission Request (Select to zoom)

If *Deny* is selected, KDSmart will display an advisory message (appearing in background of above image) with a **Cancel Button** and an **Accept Button**. Selecting:

- **Cancel** will stop KDSmart; and
- **Accept** will cause Android to redisplay the approval request message again.

Selecting *Don't ask again*, if it is displayed, and *Deny* will require a visit to Android settings to restart the request process. See [Restoring/Changing Permissions](#) below for instructions.

The next example shows the permission request following an update to KDSmart, which must be accepted before the application will open.

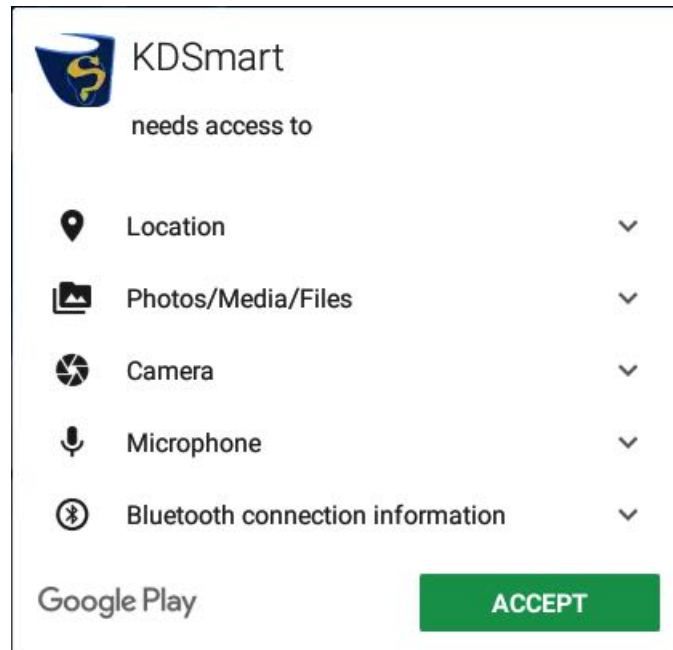


Fig. 4: Android Access Permissions Request (Select to zoom)

10.1.5 Why Must I Grant Access?

Applications, including KDSmart, need to access the storage/memory on the device be able to:

- Load your trial/nursery data;
- To add to or make changes to that data; and
- To save your data.

Quite simply, without allowing any permission, KDSmart **Will Not Work**.

Other features KDSmart can use on the device, such as the camera, microphone, etc. are also affected. The following table shows KDSmart permission requirements for the application or specific features to work:


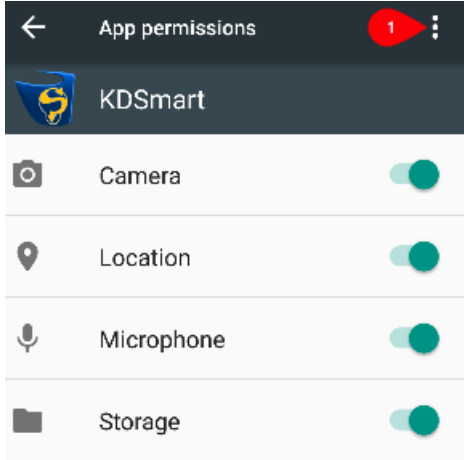
Table 3: KDSmart Permission Requirements

| Permission Required | Description |
|---------------------|---|
| Camera | Required if the camera is to be used by KDSmart. |
| Location | Required if the location option has been enabled. |
| Microphone | Required to record any audio notes using the microphone in KDSmart. |
| Storage | KDSmart will not work without being given storage permission. This is required to store <i>any data</i> on the device e.g. sample data, trial import or export, traits, tags, etc. |
| Bluetooth | Required if Bluetooth barcode scanners or scales are to be used. |

10.1.6 Restoring/Changing Permissions

At some stage you may have denied KDSmart access, e.g. to the camera, or *Never ask again* has been selected. These settings can be changed by using the following procedure.

Table 4: Procedure to change KDSmart Permissions

| Step | Action |
|------|--|
| 1 | On the Android device, select the system Settings Button  |
| 2 | Select Applications |
| 3 | Select KDSmart |
| 4 | Select Permissions |
| 5 | <p>Enable the required permission. Remember Storage is mandatory to use KDSmart and the other settings are needed if that functionality is required.</p>  <p>Fig. 5: Permission Settings (Select to zoom)</p> <p>Note: Selecting More or the highlighted menu button illustrated at (1) displays All permissions. These additional settings will also affect KDSmart behaviours for certain features.</p> |

10.1.7 Database Integrity Check

This database check and repair is mainly relevant in a situation where the following error occurs:

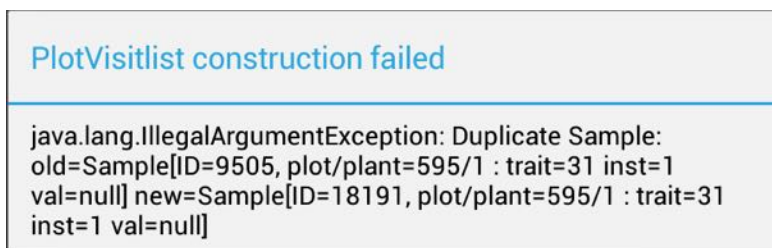



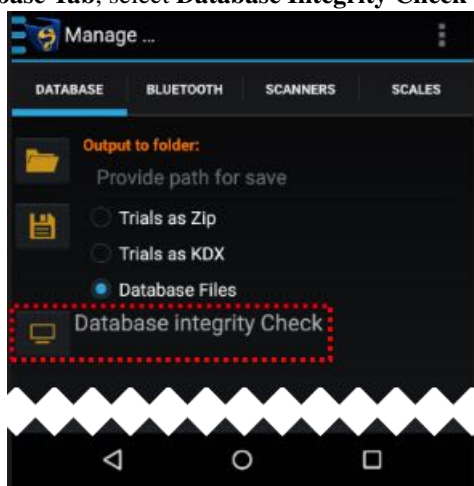
Fig. 6: Example Error Requiring DB Integrity Check/Repair

This function checks the KDSmart database for the existence of duplicate samples for a trait instance, plot, sub-plot in each trial and removes the sample *if the Trait Value is null*.

If any duplicate samples are found containing a value, the following error message will appear: “*Duplicate Samples with a value Please contact Diversity Arrays and send them your Database*” will be displayed and the check/repair processing will stop.

Should repair display this message and is unable to proceed, please export the database and report the issue separately attaching the database in the email, or use an alternative file transfer method if the file is too large for email. The option to export the database is located just above the **Database Integrity Check Button**.






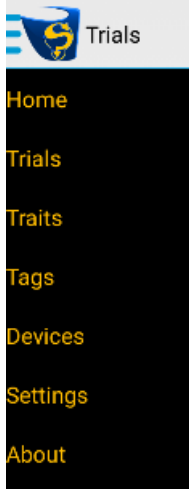
Table 5: Steps to execute the Database Integrity Check

| Step | Action |
|------|--|
| 1 | At the Home Screen or menu by selecting the Devices Button .  Manage |
| 2 | Within the Database Tab , select Database Integrity Check  <p>Fig. 7: Database Integrity Check/Repair</p> |

Note: Depending upon the size of trials within the KDSmart database, this check could take more than 10-15 minutes. The check can be cancelled, however, any errors present may not be repaired.

10.1.8 Navigation Within KDSmart

Standard Android application navigation is used in KDSmart. The table below outlines some of the UI elements related to navigation.

| Button | Description |
|---|---|
|  or  or  | Back Buttons to return to the previous screen. |
|  | Selecting the Back area (highlighted) surrounds the top left corner containing the logo and trial name or similar region on one of the edit screens (e.g. edit trait, tag etc.). |
|  | <p>Side Menu Screens with three blue menu bars have a slide out a menu at the top left as illustrated. Select the menu bars to display or hide the menu.</p>  <p>Fig. 8: Slide Out Menu (select to zoom)</p> |

10.1.9 Screen Orientation/Rotation



Android is able to lock or prevent the screen from rotating for all apps on the device. KDSmart behaves in accordance with this Android device setting.

| If Android Screen Rotation Is ... | Then KDSmart will ... |
|-----------------------------------|---|
| Enabled | Respond to changes in the screen orientation. |
| Disabled | Not detect or respond to changes in the screen orientation. |

Note: Automatic rotation is intentionally disabled within the **Scoring Screen** to prevent undesirable screen changes. Various movements of the user and device in the field, such as bending down to inspect a sub-plot would cause frequent and unnecessary screen changes.

Table 8: Steps to rotate the scoring screen (Landscape to Portrait, Portrait to Landscape)

| Step | Action |
|------|--|
| 1 | Ensure <i>Android Screen Rotation</i> is enabled. |
| 2 | In KDSmart, exit from the scoring screen to another screen. |
| 3 | Turn the device to the required position (portrait or landscape). |
| 4 | Return to the Scoring Screen which should now display with the desired orientation. |

10.1.10 Lists and Select Mode for Multiple Selection

This is a generic tip for KDSmart trials, traits and tag selection lists. The example shown is the trial list.




Fig. 9: Multiple Selection Example (Select to zoom)

When a list of items is displayed, as the trial list in the left-hand image **1** above, a *long press* on any Trial item will invoke **Select Mode**.

Once in **Select Mode**, multiple items may be selected, by touching them as illustrated in the right hand **2** image above where three trials have been selected. The number of items selected is indicated at the top right, in this example

Selected:3 appears.

Selecting the  **Action Button** in the **Action Bar** (not shown), will perform the chosen action for the selected item(s).

Caution: Please be take care when using the delete function which will remove the selected trials. Backup your data regularly to prevent any loss as delete is final.

10.1.11 What Data Transfer Method is Best?










This is dependent upon several factors influenced by your organisation's implementation of KDDart platform components either fully, partially or not at all. For example, if KDSmart is being used 'standalone' without any other KDDart software, CSV files are required to load your data.

The following table outlines

| Best When ... | Description |
|---|--|
| KDSmart is to be used on its own | Using KDSmart <i>standalone</i> , without any other KDDart software, means CSV files must be used to import and export all your trial, traits and tag data. Also useful if you want to try KDSmart with some of your trial data just to see how it works in the field. |
| Several KDSmart devices used to score the same trial and KDXplore is being used | Using KDXplore with KDSmart when a direct connection can be established for data transfer, or if a connection is not possible either CSV or KDX files can be used. |
| Your Trials are stored in KDDart's data layer and a direct connection is available | This functionality is returning to KDSmart to directly connect with the KDDart database layer for trial selection and download or upload. |




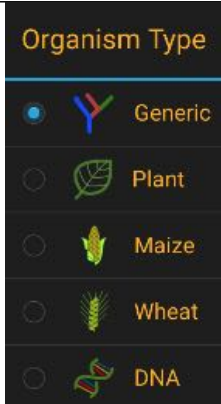
10.1.12 Symbols and Buttons

The button symbols used in KDSmart are shown in the following table:

| Button | Term | Description |
|---|----------------------------|---|
|  | Trials | Trials or nurseries refer to the experiments or research being conducted. Select <i>Trials</i> on the Home Screen to display the list of trials that have been loaded into KDSmart. <i>Demonstration Trials</i> are preloaded for familiarisation of KDSmart and training. |
|  | Tags | Manage the tags used in the trials. |
|  | Traits | Manage the traits used in the trials. |
|  | Devices | Manage devices (scanners, scales, etc.), Bluetooth, and database. |
|  | Settings | Manage the device settings and those that apply to all trials. |
|  | Information | Contextual help for KDSmart, information about KDSmart, and licensing. |
|  | Start | Start or Run button. |
|  | Run (Demo DB) | Start the active trial. A white border indicates the current setting is for a <i>Demonstration</i> database trial (<i>Demo DB</i>). |
|  | Run (Production DB) | Start the active trial. A yellow border indicates the current setting is for a <i>Production</i> database trial (sometimes referred to as <i>Prod DB</i>). |

Continued on next page

Table 10 – continued from previous page

| Button | Term | Description |
|--|-----------------------|---|
|  | Advance | Step forward and advance to the next plot. |
|  | Retreat | Step backward and retreat to the previous plot. |
|  | Plot | Either a plot ID or a column and row pair that uniquely identifies an area (i.e. plot) within a trial. Within a trial, each combination or column/row must be unique. |
|  | Organism Types | Within settings, the type of organism being measured can be specified. This appears in the Scoring Screen . Each setting has a different image representation for the organism type. |

10.2 Troubleshooting

10.2.1 Block Trial Issues

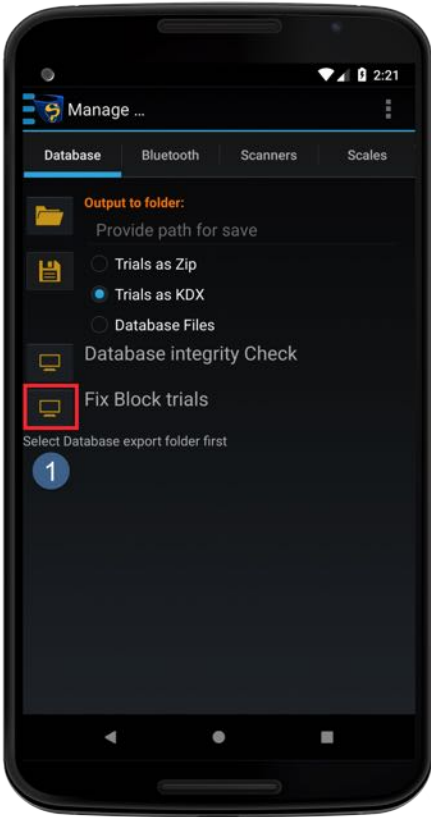
The 3.0.28 update has resolved some database issues with block trials. However, some users may find that after updating KDSmart, their block trials do not work anymore. This is due to the trials not being compatible with the new database version. The following instructions outline a quick fix for this issue:

Table 11: Fixing Block Trials

| Step | Action |
|------|--|
| 1. | <p>Navigate to the Devices Screen. The image below shows how to get there from the Home Screen. Select the Devices Button at 1.</p>  <p>Fig. 10: Devices Screen</p> |

Continued on next page

Table 11 – continued from previous page

| Step | Action |
|------|--|
| 2. | <p>A Fix Block Trials Button has been added and can be seen in the below image at 1.</p>  <p>Fig. 11: Fixing Block Trials</p> |
| 3. | <p>A list of block trials will be displayed. Select the trial that you want to fix and it should be converted to be compatible with the newest version of KDSmart.</p> |

10.2.2 Plot Attribute Alias Issues

The 3.0.28 update to KDSmart has involved a change in the way that block trials are handled. Some users may experience issues with the plot attribute alias of a block trial if they try to import a block trial to KDSmart 3.0.28 if it was exported from an earlier version of KDSmart.

If you have this issue, KDSmart will present options for setting the correct plot attribute alias which can be seen in the below image. Choose the field that should match up with the plot attribute alias and the file will be converted for you.

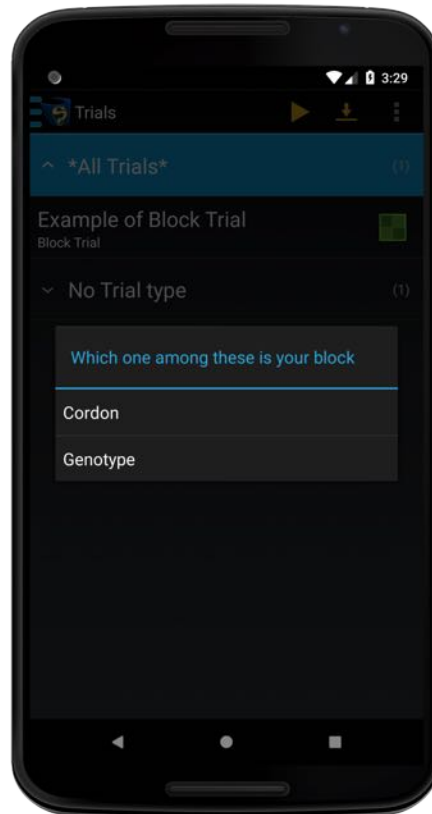


Fig. 12: Fixing Plot Attribute Alias

BLUETOOTH SCANNING

Important: It is advisable before taking KDSmart and a Bluetooth scanner or scales to the field to test:

1. The scanner is configured correctly;
 2. The tablet/phone with KDSmart can operate successfully with it; and
 3. Your barcodes work as expected.
-

Barcode scanning in KDSmart can assist with quick, easy and accurate scoring. Barcode scanning can be used for plot or sub-plot location labels and for traits.

This page contains information for enabling Bluetooth scanner devices in Android, making it available for KDSmart. An introduction to scoring using barcodes with a Bluetooth barcode scanner is also provided.

KDSmart is designed to take advantage of a Bluetooth scanner when:

- Bluetooth is available on the tablet or phone; and
- The tablet/phone can successfully connect with the Bluetooth device; and
- Trial(s) or traits have been prepared for barcode use **before importing** into KDSmart.

Barcode values must be present in the trial before it is imported into KDSmart from KDXplore or CSV file. KDXplore can generate barcodes for the trial and traits. For trials with KDXplore generated barcodes, the option *Use KDXplore Barcodes* found in KDSmart settings needs to be enabled.

Non KDXplore barcodes can be used with a trial. These need to be:

- Included with a Trial CSV file for plot/sub-plots;
- Must be unique - A *not unique* error for plot barcodes would result upon import;
- Trait import CSV file with barcodes would need to be imported first; and
- The option *Use KDXplore Barcodes* in KDSmart Settings needs to be disabled.

The following sections describe how to connect a Bluetooth device, provide information about the barcode types, examples of how to score and some tips.

11.1 Connecting the Tablet/Phone

Note: Bluetooth scanners generally have two modes: HID and SPP. (More details on this page:) Your scanner **must** be set to **SPP mode before connecting** it with KDSmart. Instructions should be available in your Scanner's Manual.

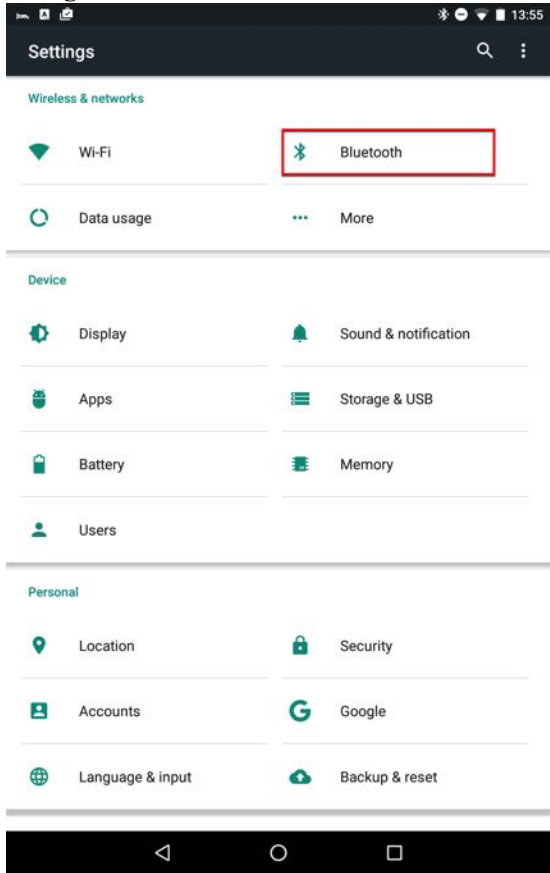
Before connecting to and using a Bluetooth device, the tablet/phone with KDSmart installed, must first be introduced to the device, referred to as *pairing*. Sometimes the device may have a pin number associated to enable pairing to occur.

The first connection and subsequent connections will require the devices to be *paired*. Pairing may need to be repeated when disconnection occurs which can be:

- After a period of time has elapsed;
- After devices ‘go to sleep’ (they enter sleep mode to extend their battery life);
- If the device is too far apart from the tablet/phone;
- Signal is interrupted due to obstacles (e.g. walls, etc.); or
- A combination of all of the above.

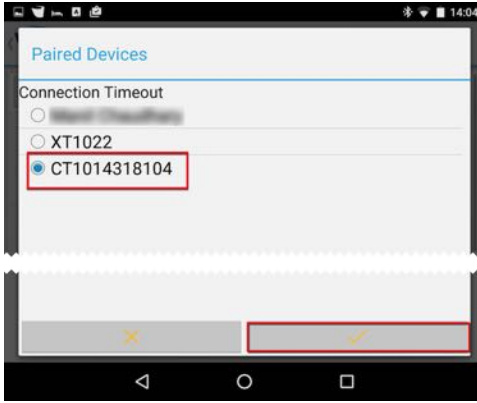
The following instructions show how to enable Bluetooth on the tablet/phone and pair with a scanner.

Table 1: Steps to Enabling Bluetooth on the Tablet/Phone

| Step | Action |
|------|---|
| 1. | <p>On the Android tablet/phone go to Android Settings then Select Bluetooth.</p>  <p>The screenshot shows the Android Settings application. The 'Wireless & networks' section is visible, with 'Wi-Fi' and 'Bluetooth' options. The 'Bluetooth' option is highlighted with a red rectangular box. Below this, the 'Device' section lists various settings like Display, Sound & notification, Apps, Storage & USB, Battery, and Memory. The 'Personal' section at the bottom includes Location, Security, Accounts, Google, Language & input, and Backup & reset. The status bar at the top shows the time as 13:55 and various icons. The navigation bar at the bottom shows the back, home, and recent apps buttons.</p> <p>Fig. 1: Android Settings</p> <p>Note: The version in this image was Android MarshMallow v 6.0.1, which may have a different appearance to the settings in your Android version.</p> |

Continued on next page

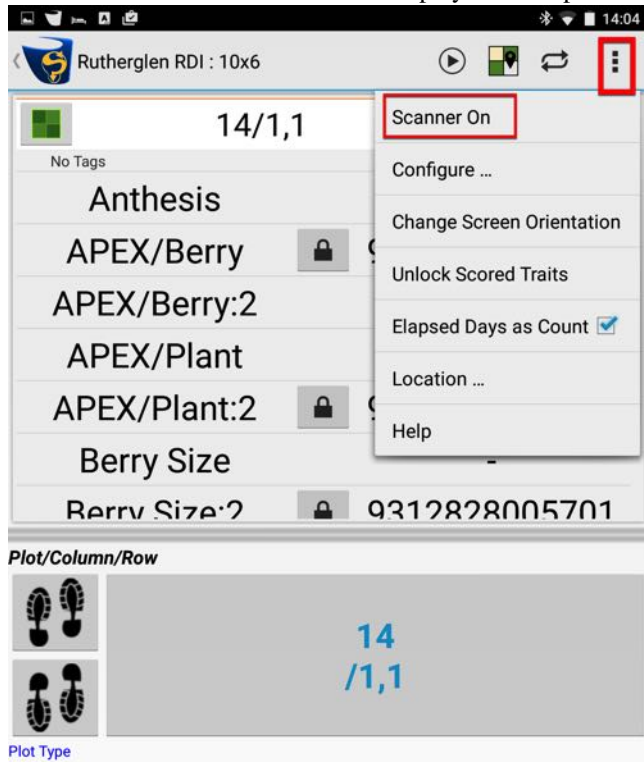
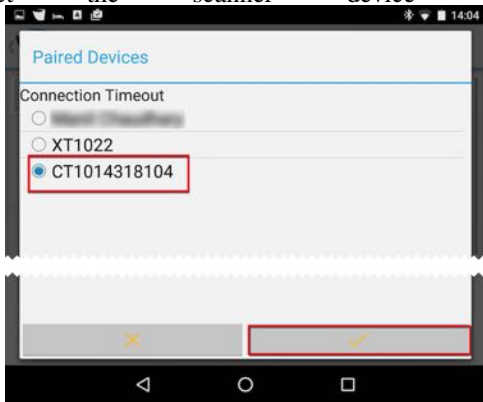

Table 1 – continued from previous page

| Step | Action |
|------|--|
| 2. | <p>If not already powered on:</p> <ol style="list-style-type: none"> Turn on Bluetooth on the tablet/phone; Ensure the scanner/scales to be connected is also switched on and in accordance with the device instructions is <i>discoverable</i> (it may need switching off and on again if it is not detected). When the tablet/phone successfully <i>discovers</i> the Bluetooth device, it should appear in the list of Available Devices on the tablet/phone. Once it has appeared it is ready for pairing. If not repeat the process. |
| 3. | <p>Select the required device in the list of Available Devices and enter the pin number of the device if requested to complete the pairing. Once successfully paired, the device will appear in the list of Paired Devices as illustrated:</p>  <p style="text-align: center;">Fig. 2: Paired Devices</p> |
| 4. | <p>With the device paired and connected, it is ready for use by any Android applications, such as KDSmart. As noted previously, the distance or proximity required to successfully maintain a Bluetooth connection between the device and the KDSmart tablet can and will vary. If disconnection occurs, reconnecting could be necessary.</p> |

11.2 KDSmart - Scanner On

Once the Android tablet/phone has been connected KDSmart can be connected to the scanner as outlined in the following steps.

Table 2: Steps to Set Scanner On In KDSmart

| Step | Action |
|------|--|
| 1. | <p>Return to Path View for the trial in KDSmart to be scored and from the top right menu (highlighted in the example) select Scanner On. This will display the paired devices.</p>  <p style="text-align: center;">Fig. 3: Scanner On</p> |
| 2. | <p>From the list of available Bluetooth paired devices select the scanner device to connect</p>  <p style="text-align: center;">Fig. 4: Paired Device Selection</p> |
| 3. | Select the confirmation  Tick Button . |
| 4. | Scoring now may commence using the barcode scanner. |

Tip: To verify the scanner is working correctly use some prepared trait barcodes, if they are available. Try the following:

1. Within Path View for your trial select **Scanner On** from the menu
2. Go to **Manage Traits** and select the required trait;
3. Select the **Test Validation Button**;
4. Try entering values using the scanner. They should appear as if manually entered.

11.3 Using Barcodes in KDSmart



Note: *Current Plot* refers to the specific location (i.e. plot, sub-plot, etc.) selected and displayed in KDSmart **Path View** ready for scoring.

KDSmart can use barcode input to assist with streamlining scoring. Barcodes can be used for the following:

- **Location barcodes** - used to position and display the current plot for the trial associated with the scanned barcode location
 - Plot; or
 - Sub Plot;
- **Trait barcodes** - used for the current plot to set either the:
 - Trait with value; or
 - A value for the selected trait.




This different functionality/behaviour is outlined in the following table (**Note:** The barcodes displayed and human readable text are for illustration only):

Table 3: Barcode Types in KDSmart/KDXplore

| Prefix | Barcode Type | Example | Result When Scanned... |
|--------|--------------|--|--|
| PL/ | Plot |  PL/nnnnnnnn | KDsmart will position the scoring window to the <i>plot</i> at the barcode location. |
| SP/ | Sub Plot |  SP/nnnnnnnn | KDsmart will position the scoring window to the <i>sub plot</i> at the barcode location. |

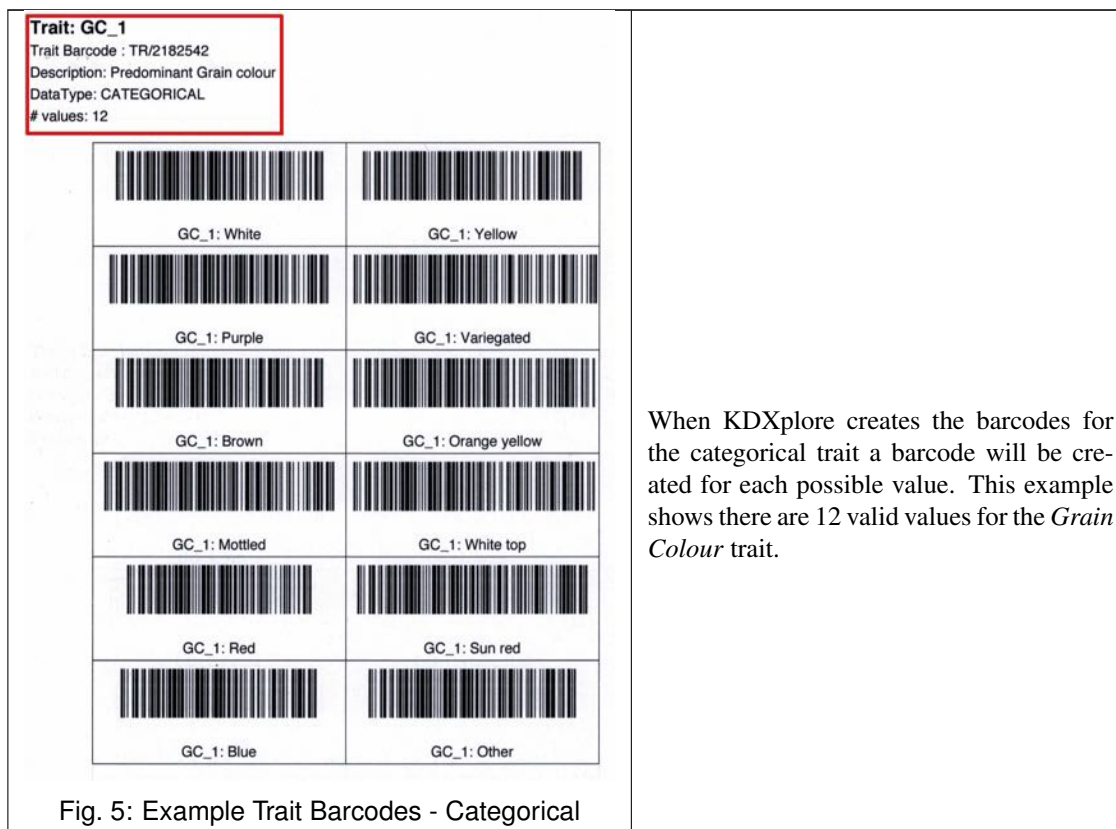
Continued on next page

Table 3 – continued from previous page

| Prefix | Barcode Type | Example | Result When Scanned... |
|--------|-------------------|--|--|
| TR/ | Trait Name |  TR/nnnnnnnn | <p>For the current plot KDSmart:</p> <ul style="list-style-type: none"> • Selects the trait (<i>SEM</i> in the example) ready for a value to be entered. • A value may be manually entered or in some cases entered using a barcoded value (see value below). |
| TR/ | Trait Name: Value |  GC_1: Brown | <p>For the current plot KDSmart:</p> <ol style="list-style-type: none"> 1. Selects the specified trait (<i>GC_1</i> in the example); and 2. Sets the value to the barcode value (brown). <p>These are possible for traits with a categorical data type or those with a specific and possibly short range. (See below <i>Example - Trait and Value Barcodes</i>).</p> |
| | Value |  7 | <p>For the current plot and selected trait <i>waiting for a value to be entered</i>, KDSmart will enter the value of the barcode(s). In this example the value '7' would be entered as if entering the digit '7' from the keyboard.</p> <p>Note: When using value barcodes an <i>end-input</i> barcode may be required to signify the end of input (See illustration in <i>Example - Trait and Value Barcodes</i>).</p> |

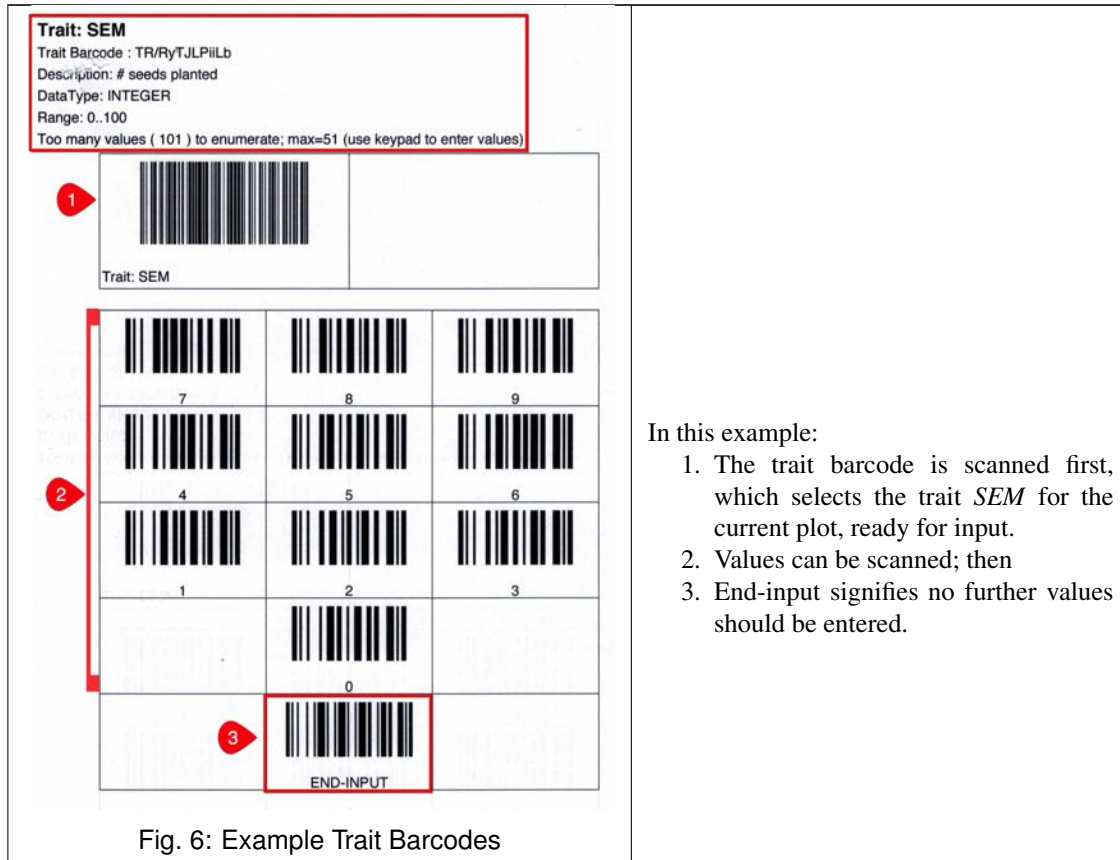
11.3.1 Example - Categorical Trait Barcodes

The following example shows a categorical trait barcode for the trait instance *GC_1*.



11.3.2 Example - Trait and Value Barcodes

The following example shows a trait barcode for the trait *SEM*.



11.4 Using a Scanner – Examples

In KDSmart trials containing barcodes can utilise scoring using a barcode scanner. To facilitate barcode scoring in KDSmart preparation is required, such as generating barcodes in KDXplore.

For a description of barcode types that can be used in KDSmart, refer to the table *Barcode Types in KDSmart/KDXplore* in the previous topic [Using Barcodes in KDSmart](#).

The following scenarios illustrate barcode assisted scoring.






11.4.1 Navigating To A Specific Plot Or Sub-Plot

Scanning a plot barcode (prefixed PL/), or sub-plot barcode (prefixed SP/), will directly reference or display the location in KDSmart (i.e. the current plot).

For example if a barcode was located at the plot, it could be scanned and KDSmart will position the current plot at this location for the record to be viewed, trait(s) scored, tagged, etc.

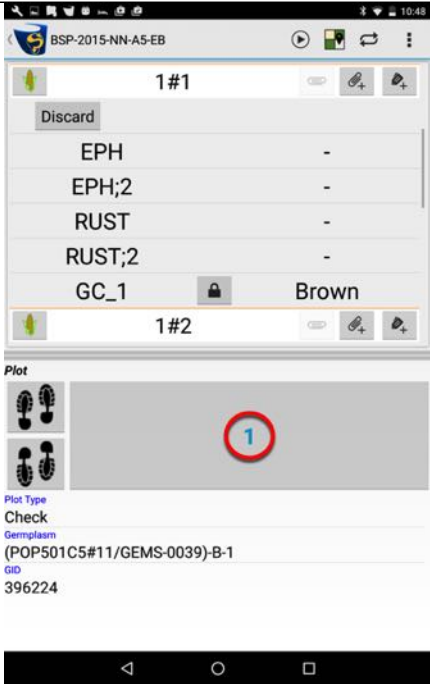
The following table outlines the steps required:

Table 6: Navigating by Scanning a Plot or Sub-Plot Barcode

| Step | Action | Description |
|------|--|--|
| 1. |  | A scanner, connected and ready, with the trial open in KDSmart in Path View . |
| 2. |  | Then |
| 3. | <div>  </div> <div>  </div> | or Scan either the plot or sub-plot barcode for the required plot/sub-plot |
| 4. |  | Which results in: |

Continued on next page

Table 6 – continued from previous page


| Step | Action | Description |
|------|---|---|
| 5. |  <p>Fig. 7: Example Trait Barcodes</p> | The current plot in KDSmart is positioned at the matching plot or sub-plot record ready for scoring or viewing. |

11.4.2 Scanning a Trait Barcode with Value – Categorical Data Type

For the currently displayed plot location, scanning a trait barcode with value (prefixed TR/) will set the value of the trait to the value represented by the barcode.




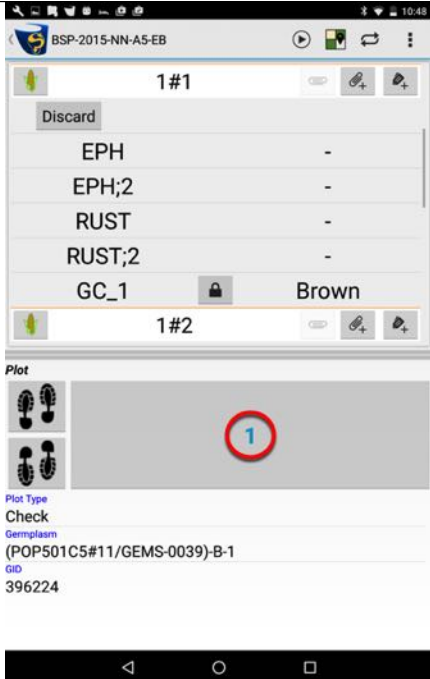
The example shown next will set the Trait *GC_1* to *Brown* at the current location (i.e. plot 1):

Table 7: Scanning Trait Values - Categorical

| Step | Action | Description |
|------|---|--|
| 1. |  | A scanner, connected and ready, with the trial open in KDSmart, in Path View , positioned with the current plot at the required plot/sub-plot. Also have a trait barcode ready to scan. This maybe a printed sheet of trait barcodes (see example above Example - Categorical Trait Barcodes). |

Continued on next page

Table 7 – continued from previous page




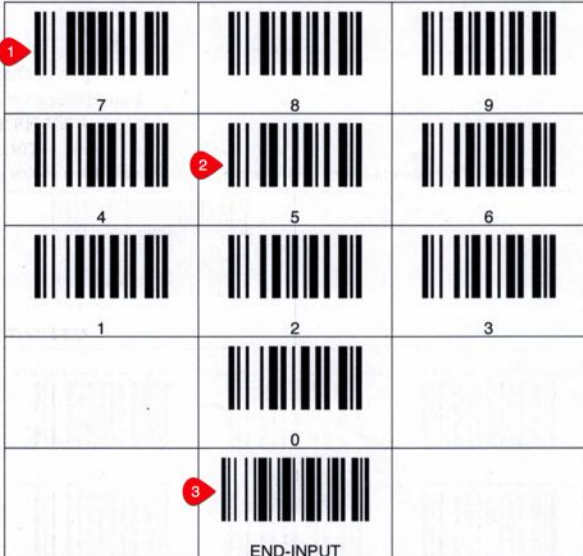
| Step | Action | Description |
|------|--|--|
| 2. |  | Then |
| 3. |  | Scan the trait Name:Value Barcode for the required trait and value. Trait <i>GC_1</i> value = <i>Brown</i> in the example. |
| 4. |  | Which results in: |
| 5. |  | Value now set for the GC_1 Trait instance to Brown.. |

11.4.3 Scanning a Trait Name Barcode – Numeric Data Type

The difference here is a value is not associated with the trait barcode. When the trait scoring window is presented (as if you manually touched the trait for the current plot), it can either be entered either via the numeric key pad or by scanning value barcodes. (see example above [Example - Trait and Value Barcodes](#))

Depending upon the data type, your barcodes and what value needs to be entered, several barcodes may need to be scanned to perform the data entry.

Table 8: Scanning Trait Values - Numeric Data Type

| Step | Action | Description |
|------|---|---|
| 1. |  | A scanner, connected and ready, with the trial open in KDSmart, in Path View , positioned at the required plot or sub-plot. Have the required trait barcodes (see example above <i>Example - Trait and Value Barcodes</i>) ready for scanning. |
| 2. |  TR/nnnnnnn | Scan the trait barcode for the required trait. |
| 4. |  | The trait numeric entry window will display. Either manually enter the value using the numeric keypad or scan the appropriate value barcodes. |
| 5. |  | <p>If scanning the input, to enter a value of 75</p> <ol style="list-style-type: none"> 1. Scan the first digit – 7; 2. Scan the second digit – 5; Then 3. Scan the end-input barcode which instructs KDSmart the input is complete. |

11.5 Suggestions

A few suggestions follow for practical usage and also how trait datatypes and their validation could improve data collection, both manually or with barcodes.

11.5.1 Trait Value Barcodes

Using barcodes for traits requires the operator to carry those codes in some manner, possibly in laminated form to the field. In many situations using a barcode will be much quicker to record a trait, however in some instances it maybe slower or less convenient. The suggestions are to inspire some thought as to how best define and manage traits to ensure efficient and accurate data collection.

Traits can be represented with a barcode (TR/ trait barcodes) to streamline data recording. For these one of the most applicable datatypes is canonical. Barcodes for these traits can also be associated with a value, so scanning with a trait value barcode is a single operation.

The simple canonical example described earlier, repeated below, is for a trait grain colour *GC* with values of: white, purple, red, etc. (12 bar codes). At the current plot in KDSmart, just scanning one of these barcodes records the specific value for the trait.

Trait: GC_1
 Trait Barcode : TR/2182542
 Description: Predominant Grain colour
 DataType: CATEGORICAL
 # values: 12

| | |
|---|--|
|  |  |
| GC_1: White | GC_1: Yellow |
|  |  |
| GC_1: Purple | GC_1: Variegated |
|  |  |
| GC_1: Brown | GC_1: Orange yellow |
|  |  |
| GC_1: Mottled | GC_1: White top |
|  |  |
| GC_1: Red | GC_1: Sun red |
|  |  |
| GC_1: Blue | GC_1: Other |

Fig. 8: Example Trait Barcodes - Categorical

An integer example could be for a trait *Soil_PH* with 14 values would have 14 bar codes: PH1, PH2, PH3,, PH14. Scanning one of these barcodes would set that trait to the value scanned for the current plot.

For some situations traits may have too many barcodes to make them worthwhile e.g. an integer trait with a valid range of 50 which would involve carrying a sheet of 50 trait barcodes. Locating and scanning the correct one could be more cumbersome and impractical, so either scanning value barcodes or manual entry could be more convenient.

Alternatively for this scenario, the most frequent trait values could be carried and entered using trait value barcodes and the less frequent values recorded manually.

11.5.2 Trait Preparation

When preparing traits consider alternative datatypes. Data collection could be made easier, with or without barcodes as selection of a value from a list can be easier than always needing to enter values.

PRIVACY POLICY

12.1 What information is collected?

KDSmart can potentially collect:

- The location of your device;
- Pictures or audio that you take to record more information about your scoring activity; and
- The device identifier to help you separate the source of data when performing data curation from multiple devices.

12.2 Is it used by Diversity Arrays Technology?

The information that KDSmart collects is not used by Diversity Arrays Technology except if and when you decide to upload the data you have scored to a database that is, by formal agreement, managed and located on Diversity Arrays Technology servers.

12.3 When is the information collected?

KDSmart will only capture Location information if you have decided to turn on that facility. In this case, each value scored for a trait is recorded along with the date-time stamp and the Location.

Audio and pictorial information is only captured when you, the user, decide to make use of that functionality. The media data is saved in relation to the plot (or sub-plot) item and will only be exported, uploaded or transferred as and when you request that to happen and to the destination you decide.

The device identifier is available to you to identify the device used to capture the phenotypic data when you export it. However, this is only used to initialise the data item and you are able to change that to whatever value you decide if you do not wish to make public the device identifier.

When KDSmart connects to KDXchange, the device identifier is used to ensure that devices are uniquely identified but this information is not permanently recorded by the KDXchange server.

12.4 When/where is the information shared?

The data collected is shared only to a location that you decide and only when you decide to perform this operation.

Share destinations are either:

- a CSV, ZIP or KDX file on your tablet;
- a KDXchange server (running on a desktop or laptop system); or
- a KDDart server, when enabled and only to the server destination that you choose.

KDSmart provides a Lockdown facility to further protect the integrity and privacy of your data. However, if you choose to use a data sharing application, your data is subject to the data security and privacy provisions of that application.

VERSION 3.0 CHANGES

This topic describes the major changes in KDSmart Version 3.0 which reached production status on 28th April 2018.

13.1 What's New In Release 3.0

KDSmart Version 3.0 introduces a number of new features aimed to further assist in making scoring in the field easier. We are grateful to all the feedback and suggestions from our users. Some of the following improvements are as a direct response to user suggestions.

This topic provides an overview of some of the main new features, namely:

- A new **Home Screen** - more information at hand;
- The **Spreadsheet View** – underlying functionality is still the same as for trial scoring;
- Addition of trait instances - easy to add or remove trait instances to a trial;
- New trait and tag bundles - for easier management; and
- Progress tracking for all trials - (samples scored / total number of samples).

13.2 The Home Screen

The Main or Home window has undergone changes to include more trial information for the selected trial without a need to first visit the trials window.

Features of the updated **Home Screen** include:

- Scroll through the trials in KDSmart by swiping left or right in the **Home Screen**.
- Page indicator bars, above the trial name, indicate current position in the list of trials and whether scrolling left or right will reveal more trial.
- Restarting KDSmart or returning to the main window will display the name of the last *Trial* displayed (possibly the last being scored).


- The  **Start Scoring Button** now has dual functions:

Long Press

- Displays the **Scoring Configuration Screen**.

Single Tap

- Recommence interrupted scoring for a trial; or

- Displays the **Scoring Configuration Screen** if the trial is yet to be scored.
- For the displayed trial, using the top  **Start Scoring Button** recommences scoring from the last plot or position where the scoring stopped.
- The **Trial Progress Bar** provides a quick visual guide for the displayed trial.
- The new **Trial Details Button** is a fast path to the details of the displayed trial.
- When screen space is limited (e.g. with a phone) the **Lower Menu Bar** now has left/right scrolling to reveal any additional function buttons.

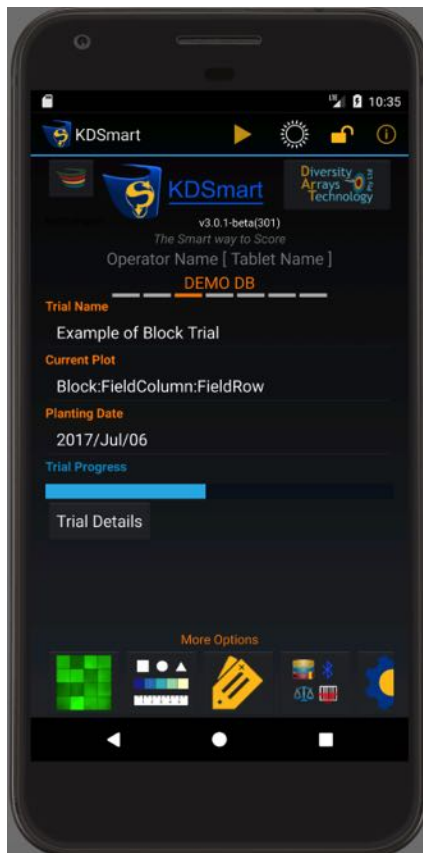


Fig. 1: New Home Screen

13.3 The Spreadsheet View


Spreadsheet View is a new option in Version 3.0 for scoring providing a ‘spreadsheet style’ view of a trial. Some scoring situations will benefit from this alternative to the original and default **Path View**. It is easy to alternate between the two as views as your needs dictate in the field.

The following illustration shows the **Spreadsheet View Scoring Screen** (no scored traits visible):



Fig. 2: The Spreadsheet View Menu

Note: When first selecting **Spreadsheet View**, the first column is partially collapsed, designed to accommodate small phone screens. It can easily be adjusted by:

1. Selecting the  **Menu Button** at top right.
2. Select **Adjust First Column Width Checkbox** to display a sizing slider at the bottom of the screen.
3. Adjust the width as required then switch off the resizer by deselecting the **Adjust First Column Width Checkbox**.

13.3.1 How to Select Spreadsheet View

Spreadsheet View can be selected in the **Scoring Configuration Screen** for a trial as illustrated next.

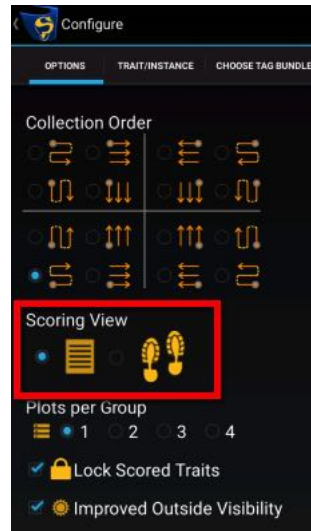


Fig. 3: Scoring View Selection

The default view can also be chosen in the **Settings Menu**.




13.3.2 Spreadsheet View Window Elements

The following image shows a cropped and annotated version of the previous example **Spreadsheet View**. A description of the window elements is provided in the following table.



Fig. 4: Annotated Spreadsheet View

Table 1: Annotations for the illustration above

| Item | Description |
|------|--|
| 1. | Select the  Location Button to return to the last scored sample. |
| 2. | Active Trait Columns , scrollable left to right. Note: Traits that are inactive for the scoring session are not displayed. |
| 3. | The Plot Column i.e. plot ID/ column, row. Also shows indicators for tags, notes, photos and menu selector. |
| 4. | Symbolises the plot. Downward pointing  indicates the plot is expanded displaying the contained sub-plots. Sideways pointing  indicates the sub-plots for the plot are hidden from view. |
| 5. | A sub-plot belonging to the plot above. |
| 6. | The dash ‘-’ symbolises an un-scored trait. Touch the cell to score the trait for this plot. |
| 7. | The dot ‘.’ symbolises a value cannot be entered e.g. this is a plot level trait. In this example, it is a plot level trait and it is at the sub-plot row, hence not scorable. |
| 8. | The green arrow indicates plots are vertically scrollable. |
| 9. | The yellow arrow indicates the traits are horizontally scrollable. |
| 10. | Blue arrow indicates this area can be expanded or contracted by selecting Adjust First Column Width Checkbox from the Settings Menu (at circle 11) then using the resizing bar. |
| 11. | The Settings Menu . There are significantly different menu items in Spreadsheet View compared to Path View . See the Settings Menu topic below. |

To enter or replace a score for a sub-plot touch the required row and column position for the trait. The displayed dialogue is dependent upon the trait’s data type e.g. the following example is for a date data type.

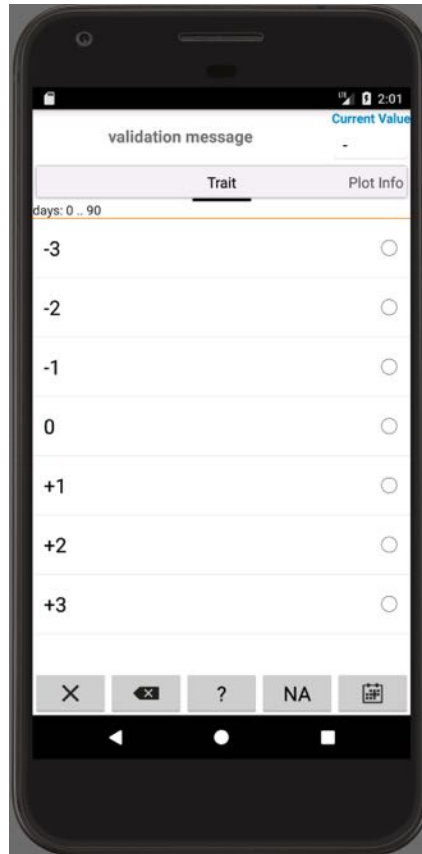


Fig. 5: Date Data Type Trait Entry

Note: If the *Lock Scored Traits* option is enabled, subsequent attempts to edit the existing value will display a warning with an option to continue or stop to prevent accidental changes as illustrated next.

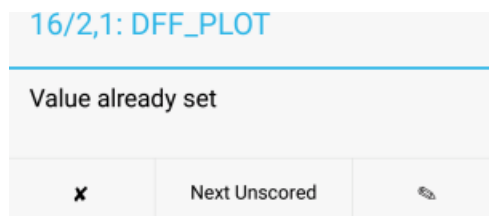


Fig. 6: Trait Already Set

Note: Entry of Trait values is the same for both Spreadsheet and Path views.


13.4 Trait Levels

Previously, trait levels could only be specified as either plot or sub-plot. With KDSmart version 3.0.3, trait level can be set to:

Plot Level by using *plot* or *trial unit*; or

Sub-Plot Level by using *sub-plot*, *individual* or *plant*.

13.5 Trait Instances

Trait instances can be added to a trial when viewing the traits for a trial. In the following example the **Trait Instance Button** has been selected to reveal the highlighted menu.  **Add**

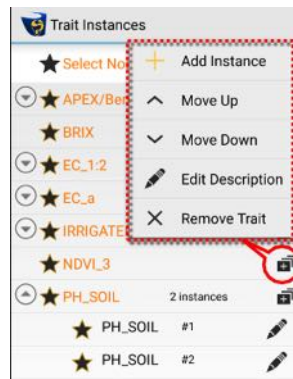




Fig. 7: Trait Instance Menu

The menu options for trait instances, as appearing in the above illustration, are:

Table 2: Menu options for trait instances

| Item | Description |
|------------------|--|
| Add Instance | A new instance can be added to a trait which is associated with the trial. Trait instances appear with naming of #1, #2, #3, etc. |
| Move Up/Down | A trait, always with its instances, can be moved up or down relative to other traits. By default, the traits appear in alphabetic order. |
| Edit Description | The description of the trait instance can be edited. The  Edit Button appears next to a trait instance to perform this. |
| Remove Trait | A trait or a trait instance can be removed from a trial only if it is <i>not scored</i> . Use the  Edit Button adjacent to the trait instance to remove the trait. |

Note: In a situation of multiple trait instances, e.g. #1, #2 and #3, the removal of #1 from a trial will leave instances #2 and #3. If an instance is added it will be instance #4 (i.e. #1 is not replaced). However, in this example, if #3 is removed then an instance is added, it will be #3. An instance cannot be removed if it contains any scored values.

13.6 Displaying Trait Attributes

Selecting the trait name at the top of the trait column displays the trait's attributes. These include trait:

- Alias;
- Description;
- Datatype;
- Validation rule;
- Units; and
- Level.

The following illustration from **Spreadsheet View** shows the trait DFF_PLOT (at '1') was touched to display the highlighted information:

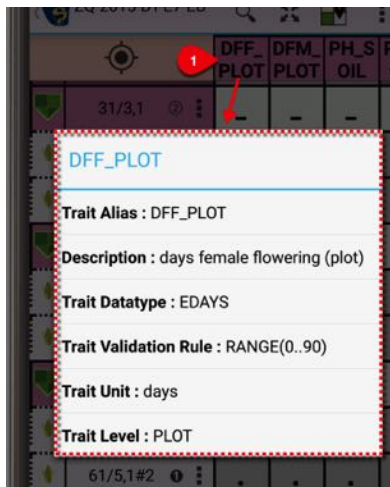


Fig. 8: Trait Attributes Display

13.7 Additional Plot or Sub-Plot Attributes and Actions

A *short press* on the plot or sub-plot identifier/coordinate displays the plot or sub-plot attributes.

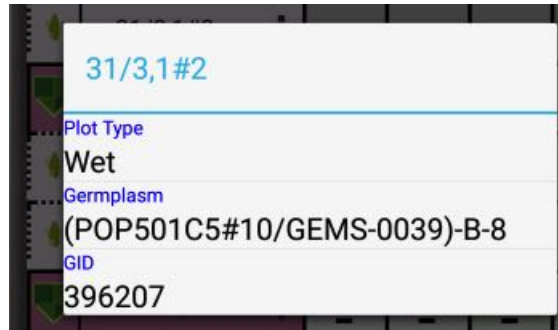


Fig. 9: Plot Attributes Display

A *long press* on the plot or sub-plot identifier/coordinate displays further attributes and functions. These are:

- Deactivate or activate the plot/sub-plot;
- View, add or remove tags;
- Add a note (typed entry) for the plot/sub-plot;
- Add photos;
- Add an audio note; and
- Add a sub-plot to the plot.

The following example shows the sub-plot has two tags assigned, *GV+++* and *MD* and no images are attached, as the **Attachment Icon** is disabled.



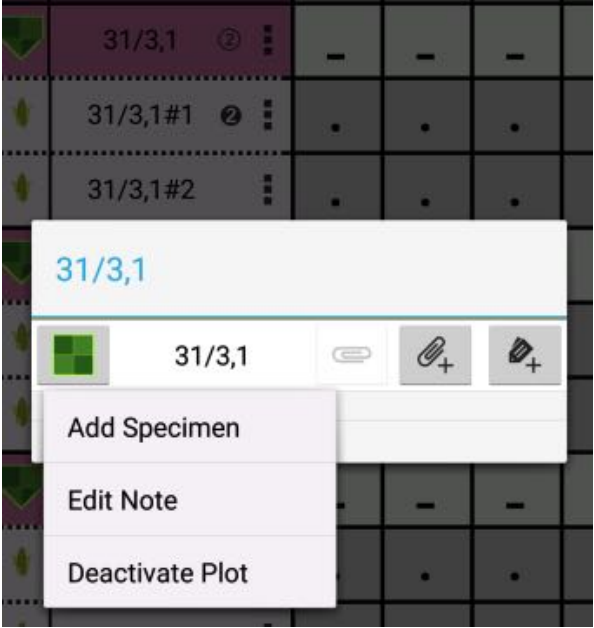
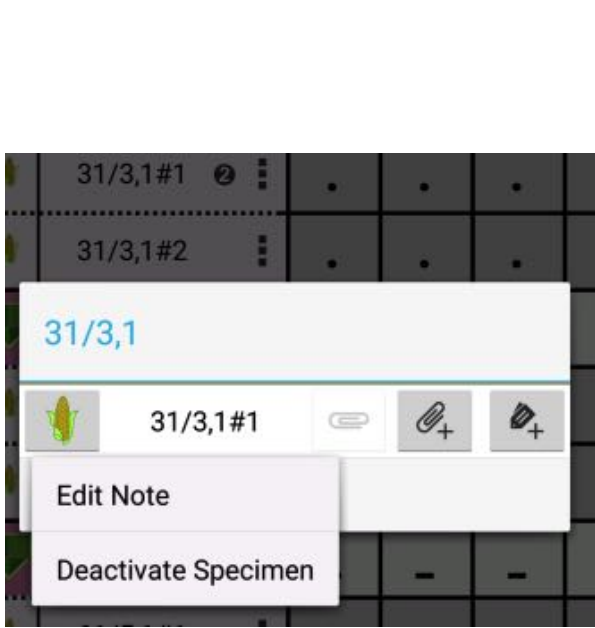
Fig. 10: Long Press

With attributes displayed as in the above example, a short press of either the plot/sub-plot icon or identifier/coordinate will display the menu which is both illustrated below.

| Plot Menu | Sub-Plot Menu |
|-----------|---------------|
|-----------|---------------|

Continued on next page

Table 3 – continued from previous page

| | |
|---|--|
|  |  |
|---|--|

13.8 Settings Menu

Selecting the top right  **Settings Menu Button** in **Spreadsheet View** displays a menu as illustrated. The menu items are different from those in **Path View**. See the following table for a brief description of these menu options:

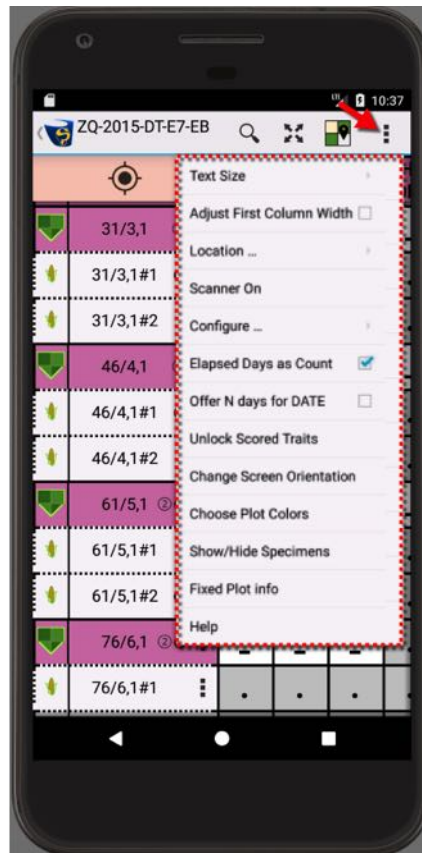


Fig. 11: The Spreadsheet View

| Item | Description |
|----------------------------------|--|
| Text Size | Adjust the text size of the sample values. |
| Adjust First Column Width | Displays a slider at the bottom of the screen allowing adjustment of the first column width which is helpful for small phone screens with limited space. |
| Location | Enable or disable location services. |
| Scanner On | Displays the Paired Devices Screen to allow connecting or reconnecting to a scanner. |
| Configure | Configure the information to appear in the plot attributes. |
| Elapsed Days Count | Checkbox to change the display of elapsed days from a date to the number of days since the trial planting date. |
| Unlock Scored Traits | Unlocks scored traits, enabling modification without warning step. |

Continued on next page

Table 4 – continued from previous page

| Item | Description |
|----------------------------------|--|
| Change Screen Orientation | Change the screen orientation, e.g. change from landscape to portrait. A three-second delay allows the tablet to be turned to the desired orientation before the rotation lock is reactivated. |
| Choose Plot Colours | Three colours are available for plots and traits and more can be added on request. |
| Show/Hide Sub-Plots | Hides or shows all the sub-plots, useful for scoring only plot traits. |
| Fixed Plot Info | Enables selection for column display of inactive traits and plot attributes. |
| Help | Displays the inbuilt KDSmart help. |

13.9 Trait and Tag Bundles

Bundles are a mechanism for sorting either traits or tags into logical, usable groups. This may assist with their use and management, e.g. it may be helpful to bundle traits for a type of crop, season or a specific experiment. They can also assist with distribution to multiple KDSmart devices for efficiency and to ensure consistency.

Some features of bundles are:

- A trait or tag can exist in multiple bundles;
- Every trait or tag is a member of the *All Traits* or *All Tags* bundles;
- Bundles make the selection of traits or tags easier for export or import;
- Traits or tags can be added or removed from bundles (except *All Traits* or *All Tags*);
- It is easy to select multiple traits/tags and create a new bundle; and
- Bundles can be deleted, except for the *All Trait* and *All Tag* bundles.

The example below shows a trait bundle named *Dates Bundle* expanded to show the contents. Note the circled number, at the right of the bundle name, indicating it contains ten traits. When expanded the traits in the bundle appear below the bundle name (dotted highlight).

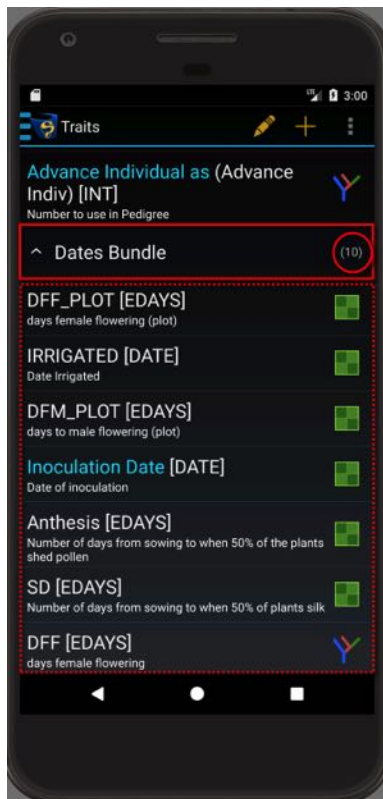


Fig. 12: Trait Bundle

Remember bundles are logical groupings, so there is only ever one instance of a trait defined in KDSmart.

Note: for Bundles, Tags work in the same manner as Traits.

13.9.1 Creating Bundles

Viewing traits or tags the procedure is the same. Traits are used here to illustrate.

To create a bundle, at least one trait or tag needs to be selected to invoke the menu, however, a bundle can exist without traits/tags.

A long press on a trait will reveal a different set of actions

Table 5: Example of Trait Menu Bar on different sized devices

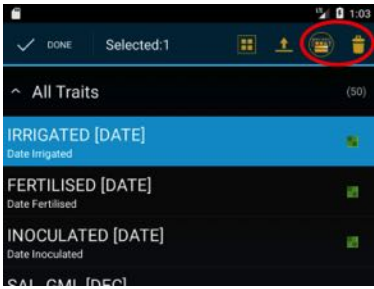
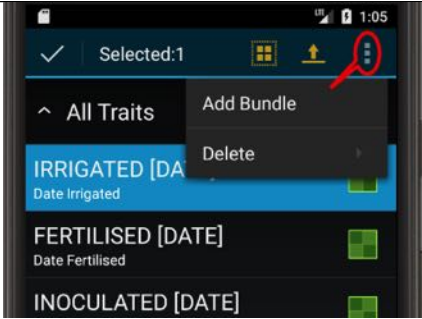
| Tablet | Phone |
|--|--|
|  <p>Fig. 13: Tablet Example</p> |  <p>Fig. 14: Phone Example</p> |

Table 6: Steps to Create, Add to or Delete from a Bundle


| Step | Action |
|------|--|
| 1. | In the Trait/Tag Screen , <i>long press</i> a trait/tag to be added to the bundle. |
| 2. | The top bar of the display will change to be similar to the previous trait window examples for phone and tablet. This also indicates the number of traits/tags selected. More traits/tags can be selected or deselected with a single press. |
| 3. | Select either the Setting Menu Button , the Trait Bundle Button , or Tag Bundle Button . |
| 4. | Enter a unique bundle name. The display will assist in providing a unique name. |
| 5. | Select the Create/Add Button to create the new bundle or if delete has been selected confirm by selecting the Delete Button . |

Note: Deleting a Bundle does *not* delete the Traits.

13.9.2 Export Bundles

Bundles can be exported as either a CSV file or to KDXplore which will require a connection.

Table 7: Steps to Export a Bundle

| Step | Action |
|------|---|
| 1. | In the Trait/Tag Screen , <i>long press</i> the bundle to be exported. |
| 2. | At the top bar of the display select the  Export Button . |
| 3. | Select the <i>Tablet</i> option to export a CSV file or KDXplore if you have a current connection to the KDXplore application. |
| 4. | Confirm and a message will indicate success and location of the CSV file. |

CHANGE HISTORY

See below for version change history of the KDSmart application. For more information on the features introduced in Version 3, see the [KDSmart Version 3 Changes](#) page.

Please note: Whilst this page is regularly maintained it may not always be aligned with the current Google Play Store version.

14.1 Version 3.0.33 : 2019/March/2

- We apologise for any issues that have been experienced in the last few weeks, especially in regards to failed file imports that some users have reported.
- It is very unfortunate that we only came to know about this major drawback a few days ago but it is resolved now.
- If you are experiencing similar issues, or anything else, please feel free to email us at kds-mart@diversityarrays.com. We promise that all feedback is taken seriously at DArT.

14.2 Version 3.0.33 : 2019/February/13

- This release gets rid of an important and hard to find bug of Block trials with attachment.
- Ever imported a trial which had -1 as Block on import? We did too and took it very seriously. We at DArT believe finding bugs and testing regularly is a good thing.
- Secret Announcement: there is a 3.1 beta coming.

14.3 Version 3.0.32 : 2019/January/18

- Block Selection bug fixes.
- Scoring configuration related bug fixes.

14.4 Version 3.0.31 : 2019/January/06

- Same fixes as 3.0.30 but fixed patch release.

14.5 Version 3.0.30 : 2019/January/06

- Google permissions compliance.

14.6 Version 3.0.29 : 2018/December/18

- Resolved issue with Plot IDs in Block Trials.
- Other small bug fixes.

14.7 Version 3.0.28 : 2018/December/05

- Improved stability of KDSmart.
- Resolved several issues with Block Trials.
- Some Block Trials will need to be converted to the new type. Please see <http://www.kddart.org/help/kdsmart/html/kdsmart-tips#troubleshooting.html> for more information.
- Language settings now update properly.

14.8 Version 3.0.27 : 2018/November/21

- KDSmart can now support Traits and Tags CSV import from Google Drive.
- We have also made some improvements related to Field View.
- Updated Translations for German and Spanish.
- Unfortunately we don't support Jellybean devices anymore.

14.9 Version 3.0.26 : 2018/October/29

- Same fixes a 3.0.25 but fixed patch release.

14.10 Version 3.0.25 : 2018/October/27

- KDSmart can scan barcodes with your phone camera in path view.
- Trait delete crash is fixed.
- Export and bundle related bug fixes.

14.11 Version 3.0.24 : 2018/September/26

- Google Drive support for .KDX files with images is now available.
- We have also made several bug fixes for better user experience.

14.12 Version 3.0.23 : 2018/September/03

- Audio Recording is now available in KDSmart to record and listen to your recordings.
- Bug fixes relating to non scrolling layouts.
- Trial Bundle bug fix.

14.13 Version 3.0.22 : 2018/August/01

- Bug fix on file name causing a crash, found very rare.

14.14 Version 3.0.20 : 2018/June/25

- Fixed issue with serpentine traversal in trials with missing plots.
- Fixed Off-By-One Number Picker in plot navigation dialog.
- Google Drive, Dropbox, OneDrive import implemented.
- Tags Crash fixed.

14.15 Version 3.0.19 : 2018/May/18

- Auto scoring skipping scored traits on “all-traits” bug fix.
- Auto scoring continuation bug fix.

14.16 Version 3.0.18 : 2018/May/03

- Fix database upgrader from version 2.0.73 or earlier to current version
- Fix incomplete database upgrades due to this issue.

14.17 Version 3.0.17 : 2018/April/28

- Bug fix for Android 7.1
- Fixes with help and Online playstore content.

14.18 Version 3.0.16 : 2018/April/28

- First Release of KDSmart 3.0 in production.

14.19 Version 2.0.78 : 2018/April/06

- Only Database upgrade, Upgrade to this version is highly recommended.
- There were few bugs in 2.0.74 and 2.0.75 with demo trials, which are now resolved, you might see a dialog asking you to reset demo database to get rid of those bugs.
- Moving from beta to production for earlier versions is deprecated. Which means 3.0.9 can be moved to 2.0.78 but cant be moved back. To move back to beta, 3.0.10 is needed.
- Plot Tags and Specimen Tags can be imported with Trial CSV.

14.20 Version 2.0.77 : 2018/March/19

- Crash with Tone Generator sorted.
- Maximum number of plots in a new trial is 1000 * 1000
- Crash associated with Auto scoring sorted
- New Trial creation will not block user interface

14.21 Version 2.0.76 : 2018/March/18

- Some new Translations.
- User interface to ask for resetting Database.

14.22 Version 2.0.75 : 2018/March/17

- RESET DEMO Database from Settings, to get rid of Demo Trials Problem.
- Crash associated with Demo Trials will instead show an error.

14.23 Version 2.0.74 : 2018/March/13

- Block Trials not available in KDS 2.0

14.24 Version 2.0.73 : 2018/January/21

- Only Database upgrade

14.25 Version 2.0.72 : 2017/August/01

- KDXchange bug fix for moving KDXplore Traits to KDSmart devices.
- KDXchange bug fix for moving KDXplore Tags to KDSMart devices.

14.26 Version 2.0.71 : 2017/July/28

- TagBundle and TraitBundle support for KDSmart 3.0 beta.
- Database upgrade to support coming release 3.0.

14.27 Version 2.0.70 : 2017/June/26

- Csv import functionality for specimens import can now use #N or #* for all specimens.
- Using SpecimenCount with #* or #N.
- Importing a trial checks for Specimen level trait of format #N.

14.28 Version 2.0.69 : 2017/June/17

- Auto Scoring can score all traits or un-scored traits.
- Block Traversal bug fixed.
- Improved Spanish and German translations.
- Help for selecting a Trial Layout is added in Trial screen page.

14.29 Version 2.0.68 : 2017/May/25

- Refresh KDSmart Demo Database to use a demo Block Trial
- Trials with Blocks can be used with KDSmart. Trials with blocks need unique X and Y pair for every block number.
- Bug with field traversal fixed.
- Bug with CsvImport fixed.
- Trial can belong to different Trial Types.

14.30 Version 2.0.67 : 2017/Mar/28

- KDX export files now use the preference value for databaseVersion
- The KDSmart process for KDXchange now uses the first address on the same network as KDXplore. This fixes an issue with some Android OS versions.

14.31 Version 2.0.65 : 2017/Mar/08

- Export to CSV now emits PlotAttributes.
- Fixed “GoTo Plot” for X,Y values beginning from N greater than 1.
- FieldView Search results for filtered values now works.

- More German and Spanish translations.
- If a Trait Alias exists, it is displayed instead of the Name (this helps in multi-lingual environments).
- Prepare database for Beta testers of KDSmart version 3.

14.32 Version 2.0.64 : 2017/Feb/20

- Fixes bluetooth device reconnect when Android puts the app to sleep.
- Provide a link to the Privacy Policy on the Information/Help page.
- Backup database files before upgrading to a new version.
- Provide an indicator of the DEMO database on the home screen.
- “Preparing...” dialog persists until ready for scoring.
- Online documents are now at

14.33 Version 2.0.63 : 2016/Nov/16

- Allow LockDown mode unlock in some edge cases
- Fix a bug relating to Attachment removal
- Support Sub-plot numbers in CSV headings for import/export (Trait#number)
- Prepare for improved Attachment support in KDXchange
- Improvements to Demo database examples
- Add timestamp to generated snapshots in Demo database

14.34 Version 2.0.62 : 2016/Nov/01

- Correct some phrases in German and Spanish-Mex localisation
- Fix Trait and Tag transfers from KDXchange
- Orientation change in Settings no longer changes back to the System Language

14.35 Version 2.0.61 : 2016/Oct/26

- Localisation for Spanish-Mexican
- Online documentation now links to www.kddart.org
- Allow Trait Description to be blank
- Normalise GPS Location serialisation

14.36 Version 2.0.60 : 2016/Oct/18

- Display Trait Alias in Auto-Advance mode
- Add Trial with just a TrialName and X,Y size
- Reinstate scrolling in FieldView
- Trial data export data uses trialname.csv and trialname_SubplotData.csv
- Provide battery usage logging via Settings

14.37 Version 2.0.59 : 2016/Oct/16

- Fix for Specimen Data output which is now available in a different file.

14.38 Version 2.0.58 : 2016/Oct/05

- Fix for Daylight saving in Elapsed days
- Fix for 4.3 inches keypad screen in Autoscoring.

14.39 Version 2.0.57 : 2016/Oct/03

- Crashes on coming back to KDSmart from another application resolved.
- Field View can be zoomed using fingers.
- Small screens up to 4.3' can install and score using KDSmart.
- Better user experience with Pane Layout to adjust Height allocated for Scoring and Plot information.

14.40 Version 2.0.56 : 2016/Aug/24

- KDSmart White background made consistent.
- Trait information color bug for Android Versions <= 20 solved.
- Trait Level information saving solved.

14.41 Version 2.0.55 : 2016/Aug/05

- A version released specifically for Tilapia build of Nexus 7 2012, the version failed to support the device.

14.42 Version 2.0.54 : 2016/Jul/24

- KDXchange support for KDDart Trials.
- Upload KDDart Trials support KDXplore -> KDSmart.
- Download KDDart Trials support KDSmart -> KDXplore.

14.43 Version 2.0.53 : 2016/Jul/08

- Fixed Autoscoring bug

14.44 Version 2.0.52 : 2016/Jun/27

- Add Example of how to do Nursery scoring
- Show TraitLevel prefix when changing sort order
- Correct and add more German l10n
- Show Heatmap colour/value assignments on long-click in FieldView cell
- “Tip” for the above
- Ensure “Clear Selection menu is visible when required
- Default display of EDAYS is now day count
- Fix crash in Settings when Language set to German

14.45 Version 2.0.51 : 2016/Jun/22

- Fix PlotInfo sync when skipping backwards in auto-advance
- Provide blue, orange and magenta shades for heatmap

14.46 Version 2.0.50 : 2016/Jun/20

- Fix intermittent loss of synchronisation of PlotInfo in auto-advance mode
- Use Flags for easier Language selection
- Acknowledgement for Partners/Collaborators

14.47 Version 2.0.49 : 2016/Jun/14

- **Add Settings option to choose Language**
 - System Setting
 - English

- German
- Fix text rendering in Help for non-English languages
- More translations.

14.48 Version 2.0.48 : 2016/Jun/13

- German localisation
- DeviceName and OperatorName visible on main screen
- If initially empty, an “Edit” pic appears - touch to enter values.
- If not initially empty, Long press to edit.
- Remember the last folder used for database save.
- FieldView Search: “Find Recent Scores” presents list of “n minutes ago”
- FieldView Search: HeatMap available (with Context Help)
- Attachments button now provides option to delete
- Keyboard Text size also applies to the “input” field
- Don’t use Keyboard Text LARGE setting for small/landscape screens
- Use correct INT/DEC format for stored sample values (e.g. 2.00 if 2. is entered)

14.49 Version 2.0.47 : 2016/May/21

- Show current Preference Setting for:
 - Device Name
 - Operator Name
 - Default Name for Plot, X-Coord, Y-Coord
- Display ElapsedDays “no-limit” when relevant
 - Fix a problem with ElapsedDays scoring.
 - Add preference to choose what to use on small screens for ElapsedDays calendar (Use Spinners, Use Calendar, Use Both)
- Ensure that “button” is visible when ElapsedDays value is greater than “+3d” option

14.50 Version 2.0.46 : 2016/May/19

- Fix intermittent problem saving KDX/ZIP/CSV
- GPS Location available in scoring
- Review Elapsed Days scoring
- Trial CSV Import
 - Don’t “check” blank values

- correct report of invalid TraitDataType
- Handle CALC Traits in KDX import
- Settings
 - Add OperatorName, DeviceName
 - Add Allow Inactive Trait Edit
- Confirm Edit of Inactive Trait
- More Date formats for PlantingDate import
- New icon for default Organism Type
- Fix creation of Unscored samples for SubPlot
- Miscellaneous bug fixes

14.51 Version 2.0.45 : 2016/May/06

- Traits must now be defined as Plot or SubPlot
- Adding Specimen to Plot only uses SubPlot Traits
- “Add Trait” now enabled
- Fixed Trial data Export for some ZIP and KDX situations
- Allow MISSING, NA and UNSCORED as CSV data input values
- Improve checking of first line data values for CSV import
- Ensure that current Trait Value is visible in auto-advance
- Increased size of Integer/Decimal input text field

14.52 Version 2.0.44 : 2016/Apr/15

- Menu “Add Tag” is immediately visible for Auto-Advance for Phone in Portrait mode
- KDXchange behaviour on current WiFi network:
 - Auto select if only one address
 - Auto-connect (with choice) if saved addresses found
- Improve explanation when on different WiFi network
- Planting Date entry on small screens can now change the Year
- Notify about non-adjacent Plots when skipping back during Auto-Advance
- Restore ability to skip forward in Auto-Advance
- Miscellaneous Bug fixes

14.53 Version 2.0.43 : 2016/Mar/17

- TEXT traits scored after DECIMAL or INTEGER now show the keyboard

14.54 Version 2.0.42 : 2016/Mar/16

- Auto-Advance scoring in the last Sample provides a message
- KDX files support for import from Tablet
- Improved KDXchange support
- Display folder path in FileChooser instead of just the folder name
- Accept “Trial Abbreviation” as preferred name for “Acronym” in CSV Import
- Database export folders use a DB_ prefix
- Internal: Prepare for internationalisation
- Internal? Remove “TRAILING_DIGITS” TraitNameStyle
- Internal: EDAYS as integer

14.55 Version 2.0.41 : 2016/Feb/10

- Enable “value:description” for CATEGORICAL traits
- Allow non-TEXT traits to replace TEXT when importing a WorkPackage
- KDXchange can now remove Trials from a Tablet
- Importing protected traits uses the original validation rule for checking
- Provide a “Cancel” button when scanning for KDXchange servers
- Provide sorting for lists of Trials, Traits and Tags
- Baseline support for alternate Locales for numeric Measurements

14.56 Version 2.0.40 : 2016/Jan/25

- Skip over de-activated Plots or Specimens when looking for next un-scored Samples.

14.57 Version 2.0.39 : 2016/Jan/24

- Fix Trial data transfer via KDXchange when the scoring sort order has not been previously set in KDXplore (apply usedForScoring and SSO from workPackage)

14.58 Version 2.0.38 : 2016/Jan/24

- Fix Trial data transfer via KDXchange when the scoring sort order has not been previously set in KDXplore.

14.59 Version 2.0.37 : 2016/Jan/20

- When exporting a Trial to the Tablet, the KDXplore option now appears first.
- Changing to high-visibility mode now applies to Trial, Trait and Tag management as well as Trait Instance selection and collection order.
- When auto-advance scoring skips a plot you now get a notification and must confirm that you are at the correct location to continue scoring.
- Improve cleanup of unused records during Trial deletion

14.60 Version 2.0.36 : 2015/Dec/14

- Fixes some issues when Trials are transferred from KDXplore
- Removes trailing YMD timestamp when constructing Trial Name from CSV import file

14.61 Version 2.0.35 : 2015/Dec/02

- Importing Traits and Tags into an empty database now shows details without having to exit/re-enter the Trait/Tag management page.
- Exporting Traits/Tags to Tablet displays destination in a dialog on completion.
- Export Folders are now timestamped.

14.62 Version 2.0.34 / 2015/Nov/18

- Negative INT/DEC range limits are now supported.
- Typing the decimal point for a DECIMAL trait value automatically inserts a leading zero.
- Changes to range limit inclusion for INT/DEC Traits are now persisted.
- Walk Section changes during Auto-Advance scoring now produce a notification.
- Simplified user interface for “Export to KDXplore” for Trials.
- KDXplore format option now available in “Export to Tablet”.

14.63 Version 2.0.33 : 2015/Nov/18

- Fixes a problem using skipBack/skipForward during Auto-Advance
- Clear the number of selected plots in FieldView subtitle (as well as the selections).

14.64 Version 2.0.32 : 2015/Nov/17

- Fixes a Race condition in FieldView initialisation
- Fix use of ZIP files with Storage Access Facility

14.65 Version 2.0.31 : 2015/Nov/17

- Decimal points are now re-enabled in the Keypad entry method.

14.66 Version 2.0.29 : 2015/Nov/16

- Sun/moon control on main screen to toggle hi-vis mode
- Screen orientation change during Scoring via menu option
- Resolved a database upgrade problem
- Resolve KDXchange server life-cycle issues

14.67 Version 2.0.28 : 2015/Nov/12

- Revert export menu invoking multi-select mode
- Barcode scanning not in Auto-advance mode
- Portrait Orientation:
 - Split Line removed from FieldView
 - Restore PlotInfo display in auto-advance
- Allow server restart in KDXchange
- Enable KDXchange Trial transfer from desktop
- Support white background for scoring setup and main screen
- Misc bug fixes

14.68 Version 2.0.27 : 2015/Nov/01

- Import works for NA,MISSING
- No duplicate trial imports
- Import warnings
- CSV: Column_No and Range_No
- Export/Import ELAPSED_DAYS as int
- Export Tags in CSV
- Plot Info displays Inactive Trait
- Field View TINY
- Plot Type in Plot Finder
- Resizable split views
- Delete button invokes select-mode
- Display Trial- and Plot- attributes

- Protected Trait support, Valid-for-CALC indicators
- Introduce Barcode support
- Show file modification time
- Icons in Scoring Setup
- Misc bug fixes

14.69 Version 2.0.26 : 2015/Oct/11

- User interface readability improvements
- Attachments and Tags available during auto-advance
- Create new Tag while selecting Tags
- Show Plot Type (i.e. “Checks”) in plot information
- Miscellaneous fixes

14.70 Version 2.0.25 : 2015/Oct/08

- Max 2 lines for Trait desc
- Don’t delete in-use Traits
- TrialName/Trait location swap
- Elapsed days display option
- Text size options for Plot Info
- Keypad for INT and DEC traits
- Suppress unnecessary export folders
- Improvements to ZIP export
- Change Plot Info Alias via long touch
- Larger buttons for Trait Scoring
- Buttons at top for Tablet/Portrait
- CALC validation rule support
- CSV Import improvements
- Fix Scoring Config Defaults
- Preference Icons for Default Visit Order
- Miscellaneous fixes

14.71 Version 2.0.24 : 2015/09/25

- Jump to Plot available from main scoring window
 - Touch on current Plot Button

- Long touch on other Plots (2- or 4-Plots Per Group)
- Fixed issue when exporting Trial as ZIP
- Improved barcode generation (Demo database reset)

14.72 Version 2.0.23 : 2015/Jul/24

KDXchange:

- Export To KDXchange supports file export (.kdx)
- Work Package Fixes
- Barcode data field support
- Settings to retain KDXchange addresses
- Refresh of Trial Details after edit
- Auto-Scoring issue fixed
- Fixed Changing Demo/Prod databases
- Barcodes and Trait Alias CSV import
- Attachments import to Pictures/KDSmart
- Home/Back navigation fixed for Scoring and Config
- Back button in File Chooser goes “up”
- Multi-Trial exports supported
- Remove refs to “Old Scoring Dialogs”

14.73 Version 2.0.22 2015/Sep/16

- Fix Trait Details Validation
- Scoring auto-advance enhancements
 - transitions between Plots
 - units and validation visible
 - skip/back functionality
 - numeric keypad auto-show for INT/DEC
- About/Help available
- Database Save
 - defaults to ZIP of CSVs
 - use timestamped folder name
- Don’t lockdown if no PlantingDate
- Persist FieldView plot selections
- Network checks for KDXchange/KDXplore
- UI visibility improvements

Check at <http://software.kddart.com/KDSmart/> for more information.

14.74 Version 2.0.21 : 2015/Sep/15

- Scoring auto-advance enhancements
 - transitions between Plots
 - units and validation visible
 - skip/back functionality
 - numeric keypad auto-show for INT/DEC
- About/Help available
- Database Save
 - defaults to ZIP of CSVs
 - use timestamped folder name
- Don't lockdown if no PlantingDate
- Persistent FieldView plot selections
- Network checks for KDXchange/KDXplore
- UI visibility improvements

Check at <http://software.kddart.com/KDSmart/> for further information.

14.75 Version 2.0.20 : 2015/Sep/07

14.76 Version 2.0.19 : 2015/Jul/03

14.76.1 Lockdown mode

- Available from main screen for DemoDatabase.
- Preferences screen allows setting of Lockdown Password.

14.76.2 Import Trial/Trait

- Importing Integer values will also accept a decimal point with only trailing zeroes.
- Use default Plot/Column/Row names from Preferences
- Improve support for CIMMYT CSV headings (e.g. Designation)
- Allow import of Traits created from a prior Trial import to update validation rules.
- Display first line of data when importing Trial to assist import configuration.
- Detect and ignore “empty” lines.
- Validate Trait Scores when importing Trial CSV containing data.
- Add “No Instances” Trait Name option.

14.76.3 Preferences Screen:

- Improve heading/sub-heading visibility.
- Add default Plot/Column/Row names for Import
- Use images for OrganismType selection

14.76.4 Scoring:

- Make all Scoring screen icons use black on white.
- Field View: improve visibility. Improve placeholder functionality (before main version after 2.0.10)
- Notifications on successful attachments
- Long press on the main screen Score button brings up the Scoring Configuration Screen.
- Require confirmation of exit from Scoring.
- Require Trial Planting Date if ELAPSED_DAYS traits selected for Scoring.
- Prevent jump to a non-existent Plot
- ‘Remove Trait’ option available on Plot icon.
- Add ‘Trait Alias’ (always user-editable) to assist in use of screen space.

14.76.5 Other

- Use context-sensitive images for Trial Layout configuration.
- Extend use of user-defined names for Plot/Column/Row.
- Performance improvements when switching databases.
- Trait scores now timestamp with yyyy/MM/dd HH:mm:ss
- Export timestamps option for UTC or local; ISO-8601 format used: yyyy-MM-dd'T'HH:mm:ssZZ
- Add instructions for formula to convert ISO-8601 timestamp to Excel.
- Improve Main screen layout
- Improve small screen support.
- Initial support for Trait re-ordering.
- Add barcode support for Plots and Specimens.
- Add planting date support for Plots and Specimens.
- Current Trial/Trait/Tag is highlighted (and stays highlighted).
- Remember import and export directories separately in FileChooser.
- Reinstate FileChooser access to “root” directory.
- Don’t delete Traits that are still in use.
- Added Wheat and Maize icons
- Foundation work for normalising Trait Score buttons:

[Cancel | Clear | N/A | Missing | Set] (but use icons where possible)

- Miscellaneous bug fixes.

14.76.6 Documentation:

- Updated UG Appendices for TraitDataType, CSV Import and CSV Export file formats.

14.76.7 Internal:

- Architectural Changes to aid KDXplore data interchange (e.g. BMS FieldLog XLS files)

14.77 Version 2.0.18 : 2015/Jun/04

- TraitInstances Select All/None fixed
- FileChooser should now only show .CSV and .TXT files (again)
- Don't allow duplicate Tags to be imported
- Trait values are now loaded if present (date of 1970-01-01 00:00:00)
- Added Trait:123 mode for instance number detection
- PlotId, X, Y are scanned during import - affects PlotIdentOption
- PlotIdent edit values depend on the X,Y,PlotID values in data
- Plot/X/Y name editing also affected by X,Y,PlotId
- Can now edit Trial Note
- Move all "Edit" buttons next to Headings
- Preparation for Comment exports (target for 2.0.19)
- Import Traits reports # not loaded (already in Database)
- Using "Link:" prefix for the join ids in ZIP export
- Preference (Settings) changes

14.78 Version 2.0.17 : 2015/Jun/02

- Fix for Database upgrade issue re "TagPlotUseId"
- Add LinkPlotId columns to relate the rows in the various CSV files
- Source database id columns now identified with "Source" prefix
- Fix crash on Landscape/Portrait orientation change while editing TrialLayout
- Known issue: the "Source" prefix is missing from the samples.csv file so it has two "SampleId" columns

14.79 Version 2.0.16 : 2015/Jun/02

- Build date/time now in About
- Settings: Scoring with white bg
- Support work for KDXplore
- TrialLayout: “Origin Plot Id” and X/Y “Corner”
- Trial SiteName now an Attribute
- TRAITnnn mode for Import and Trait/Instance names
- Fix bug that stopped Tag saves
- Make DeleteTrial work in Portrait
- Import enabled for PlotId trials (Scoring still disabled)
- Add DemoDB indicators to “Play” button and “Start Scoring”
- Enable DatabaseId for Export
- Improve error reporting (instead of crashes)

14.80 Version 2.0.15 : 2015/May/29

- Many changes in this release.
- Too many to fit into the 500 character limit.
- Details on Forum

14.80.1 Application

Database

- Improve robustness of database upgrades
- Added Trial Features:
 - OrganismType
 - TrialLayout
- Support for generic TrialAttributes
- Support for generic PlotAttributes and transfer existing
- specific ones (GenotypeName,Pedigree,etc) to PlotAttributes
- Backup copy of database before upgrade

Import

- Allow selection of .TXT as well as .CSV for CSV import
- Exclude Empty/Blank Headings from Import Setup
- Consolidate Trait and Tag import

- Relax constraints on ValidationRule import
- Allow import into DemoDatabase (AFTER user confirmation)
- Enforce required headings
- Error when duplicate headings encountered
- Prevent import of pre-existing records for Tags and Traits
- Error when duplicate records for Tags and Traits
- Cancel works faster
- Improved performance - Phase 1

Export

- Provide Trial Export variants
 - CSV: Plots-Only
 - CSV: Plots & Specimens
 - ZIP: All data (includes Attachments)
- Normalise headings for all CSV exports
- Coordinate formats for KDXplore data exchange
- Persist folder choice for export
- Allow export from Demo database
- Provide Export All if no Traits/Tags selected

Manage Traits

- Add Display of TraitUnit
- Correct selection of TraitDataType of ELAPSED_DAYS
- Include short TraitDataType next to TraitName in list
- Ensure buttons are visible for Delete Tags/Traits
- TrialLayout editing [KNOWN ISSUE: Small screens]
- Require TrialLayout and Planting Date before scoring

Other Issues

- Fix navigation issues when scoring on small screens (Phone sized)
- Allow clearing of Active Trial (long press on Trial Name)
- Added yyyy/DDD and DDD/yyyy date format options

FieldView

- Reduce size of PlotCell in placeholder FieldView
- Architectural work for future VisitOrder improvements
- Include TraitUnit in dialog titles for Scoring
- Miscellaneous User Interface cleanup
- General Code Cleanup

14.80.2 Documentation

- Updates to Appendices:
- A: Trait Data Types
- B: CSV Import Formats
- C: CSV Export Formats
- In particular, describe SpecimenCount options for Trial Import.

14.81 Version 2.0.14 : 2015/May/22

- Increase PlotInfo font size
- Update PlotInfo
- Settings summary in 4.0.3 now updating
- Fix boundary value problem when Scoring
- Handle null Acronyms
- Report import errors
- Allow date import format of dd/mm/yy as well as ISO yyyy-mm-dd
- Export directory now user choice
- skipped 11,12 to bring version code into alignment with fix-number

14.82 Version 2.0.10 : 2015/May/20

- Fix bug in Scoring
- Use Plot Identification in Scoring UI
- IsControlPlot boolean changed to PlotType as a String
- Enforce PlotId integer during CSV Import
- Until schema migration is complete you MUST provide PlotRow and PlotColumn
- and you MAY also provide PlotId. After migration you will be able to provide
- PlotId INSTEAD OF Row/Column.

14.83 Version 2.0.9 : 2015/May/15

- Add Trial.NameForPlot
- PlantingDate replaces StartDate
- Begin standardising Scoring buttons: Cancel/Unset/NA/Missing/Set
- Handle orientation change for Trait and Tag Editing
- Preparing for Trial/Plot Attributes
- Tag description now Mandatory
- Audible and Haptic feedback and notifications
- Also for Range errors during Trait value entry
- FieldView display available for Phones
- Plot/Add Specimen enabled
- Auto-advance for Tags when no Traits scored
- CSV Import UI
- Documentation updates

14.84 Version 2.0.8 : 2015/May/15

- 2.0.7 changed an Image to an ImageButton in Trait Instance setup and this unexpectedly affected all functionality.

14.85 Version 2.0.7 : 2015/May/15

- Export Trial available for DemoDB
- Export Trait available for DemoDB
- Trait Instance Choice: menus to Add Trait,Add Instance,Change Order (temporarily disabled)
- Simplify Export Traits and Trials
- Add Select All for Trait long-click Selection
- Disable screen rotation for Scoring Activity
- Remove extra prompt for Specimen Activate/Deactivate

14.86 Version 2.0.6 : 2015/May/13

- Improve demarcation on Plot/Specimen Header Rows
- Reduce font size for “Plot Info”
- Improve error reporting for CSV import
- Defer Trait insertion in database until after validation

- Disable notification on invalid numeric until after redesign
- Repair an NPE logic trap
- Fix incorrect navigation when travelling “down” in Serpentine
- Change Kill/Revive to Deactivate/Activate
- Sample Rows are now hidden when a Specimen is deactivated
- Disable menu items that aren’t currently activated

14.87 Version 2.0.5 : 2015/May/12

- Jump to Plot highlights the correct button
- Improve confirmation before deleting Traits
- Fix Trait/Tag Edit/Add issue introduced in 2.0.4
- Fix error when taking photo annotation
- Audio annotation menu item temporarily disabled
- Map updated to show active Plot and Group
- Reverse order of button labels when required for Serpentine
- Note that the Map is a temporary placeholder and will be replaced by a fully functional version in a future alpha release.

14.88 Version 2.0.4(7) : 2015/May/08

- Fix some issues on 4.0.3 on Samsung GT-P3110 for CIMMYT
- Tabs for Manage Trial/Tags in the ActionBar for increased visibility
- Tabs for Scoring Configuration in the ActionBar
- Increase visibility of Trait Instance Message on Scoring Config
- Improve behaviour consistency of Select All/None in Trait Instance selection
- “Up” navigation for Scoring works for Android 4.0.3
- Fix unreadable layout for Edit Trait dialogs
- Scrollbar is always visible in Trial Details
- Display progress when initialising Scoring
- Preparatory work to fix orientation change for Scoring (still more to do)
- Lock icon is now between Trait Name and Value
- Add “Planting Date” to CSV import (defaults to Trial Start Date)
- Prepare support for MISSING option (not yet visible in UI)

=== Below is what fits in 500 chars Version 2.0.4(7)

- Fix issues on 4.0.3 on Samsung GT-P3110 for CIMMYT
- Improve Tab visibility for Trait/Tags and Scoring Config

- Increase visibility of Trait Instance msg on Scoring Config
- Behaviour consistency of Select All/None in Trait Instance select
- “Up” navigation for Scoring on 4.0.3
- Fix layouts for Edit Trait
- Scrollbar always visible in Trial Detail
- Display Scoring setup progress
- Lock icon between Trait Name and Value
- Add “Planting Date” to CSV import
- Add MISSING value (not yet in UI)

14.89 Version 2.0.3 : 2015/May/06

- Fixed navigation to target plot from Map
- Fix Interrupted Scoring on Phones (e.g. to answer a call)
- Update Context Help
- Improve Sample detection for AutoAdvance
- Resume Scoring from previous position
- Fix plot/specimen for demo data generation
- Re-included some Android devices
- Implement workaround for Lollipop bug on Trait Instance selection
- Remove Group Indicator for single instance Traits
- Move Select/All and Select/None to the head of the Trait Instance list

14.90 Version 2.0.2 : 2015/Apr/10

- Help menu on all screens
- Trait Instance Selection
- Tablet screen reconfiguration from usability testing
- Plot Options, Plots Per Group 1,2,4 and Organism Type
- Use System Notification on invalid numeric input
- Base Auto-Advance in place - needs feedback
- Edit/Add for Trait and Tag available
- CSV Import design changes
- Import From and Export To menus
- Demo Database reset included in Settings
- Architectural changes to database for enhanced attribute support
- Increased tablet support

- ... and lots more!

14.91 2.0.1 : 2015/Mar/30

14.92 2.0.alpha3 : 2015/Mar/27

14.93 2.0.alpha1 : 2015/Mar/12

14.94 2.0.alpha0 : 2015/Feb/25

GLOSSARY

The following terms are used within the KDDart platform:

Accept/Suppress Values Either accepting values as being valid, or suppressing values that the user deems as invalid. This is useful when multiple users have collected data on the same trait and have differing values.

Attachments Photos/video captured from the devices camera, audio from the microphone or file(s) uploaded and attached.

Auto-Advance Scoring A KDSmart feature which allows the user to concentrate on only those Traits for which a measurement has not been provided. It automatically advances to the next un-scored trait to be scored which allows for quicker and more efficient scoring.

Bundles A mechanism for grouping traits and tags to assist with their management e.g. a bundle of tags for varying degrees of bird damage: BD, BD+, BD++, etc.

Collection Order The way of progressing or walking through a trial or area in which data is to be collected.

CSV Comma Separated Values - A widely used, simple text format for transferring data usually created in a spreadsheet and saved in the CSV format. The first row of the file provides the column names and each row following is a data record.

Curation The management of data including accepting, changing, or deleting values that are collected i.e. changing a value for a trait that was entered incorrectly.

Data Exchange Exchanging data between KDXplore and KDSmart. A connection can be established with KDX-change.

Days Since Planting Ability to enter a date (i.e. by selecting 'Today') which is automatically converted to the number of days since planting, e.g. for recording anthesis.

KDDart Refers to the KDDart Knowledge Discovery System which features centralised database storage for storing phenotypic trial data.

KDXchange The server software within KDXplore and KDSmart which enables them to communicate, for example to copy trials, traits or tags between the devices. This is not a separate application.

Phenotypic Observable characteristics of an individual specimen i.e. The collection of phenotypic data involves recording observable characteristics such as plant height.

Plots and Sub-Plots Trials contain multiple 'plots' - areas, spaces or even pots, uniquely identified by a plot ID or by coordinate (Column/row ID) pairs, or both. Sub-plots are individual specimens within a plot.

Scoring Set A scoring set is a set of trait instances and samples that can be sent from KDXplore to a KDSmart device for scoring. When the data is scored and returned to KDXplore, it appears in the scoring set as a progress meter. Scoring sets can be named and only the trait instances needed to score have to be added (only those trait instances specified for the set in KDXplore are sent to KDSmart).

Specimen The single *unit* or *entity* under investigation and refers to a *sub-plot* or an *individual*. Multiple specimens can be scored within a plot and not all specimens need to be scored.

Tags Shorthand labels to enable quick annotation of a specimen from a pre-set selection list.

Traits The phenotypic characteristic being monitored or scored for each plot or specimen (e.g. height, colour, etc.).

Trait Instance A single occurrence of a trait being used. Multiple trait instances can be used in a trial so that one trait can be used more than once.

Trait Order The order that traits are scored within KDSmart. This order can be changed in KDXplore and KDSmart.

Trial or Nursery This refers to a study, experiment, nursery, project, etc. Multiple trials may be loaded into KDSmart.

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