



KDXplore
Schema/Data Exploration

KDXplore Documentation

Release Beta 1.1.x

DArT Team

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PDF generation is not flawless so some rendering issues may be present.

Welcome to the KDXplore application user guides. Navigate this help using the left hand menu.

The KDXplore application operates 'standalone', away from the office, Intranet or Internet as depicted in the following illustration. Generally network access is only required when trial/nursery data needs to be uploaded or downloaded from KDDart storage using a network, however this is completely dependant upon your situation and configuration requirements.

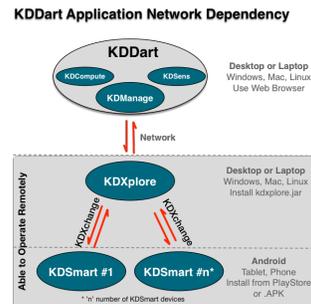


Fig. 1: KDDart Application Network Dependency

As an application it forms an integral part of a bigger **Integrated KDDart Platform**. See the following illustration (Select image to enlarge):

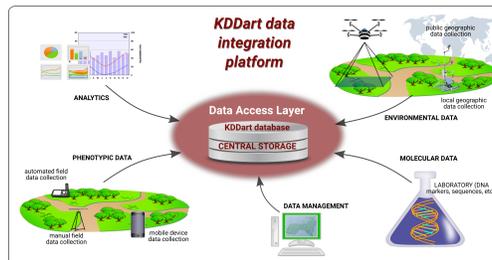


Fig. 2: KDDart System Design Principles - Integrated Platform

The following suggested topics provide a brief overview of KDXplore and the KDDart environment:

- [A brief overview of KDXplore Application](#)
- [Introduction to the KDDart Environment](#) .

For more information on the KDDart Platform, other applications and DArT please explore the following websites:

- www.kddart.org
- www.diversityarrays.com

This documentation is a growing resource which will be expanded as software developments occur and further content is added.

KDXPLORE DOCUMENTATION

Topics covered in this section:

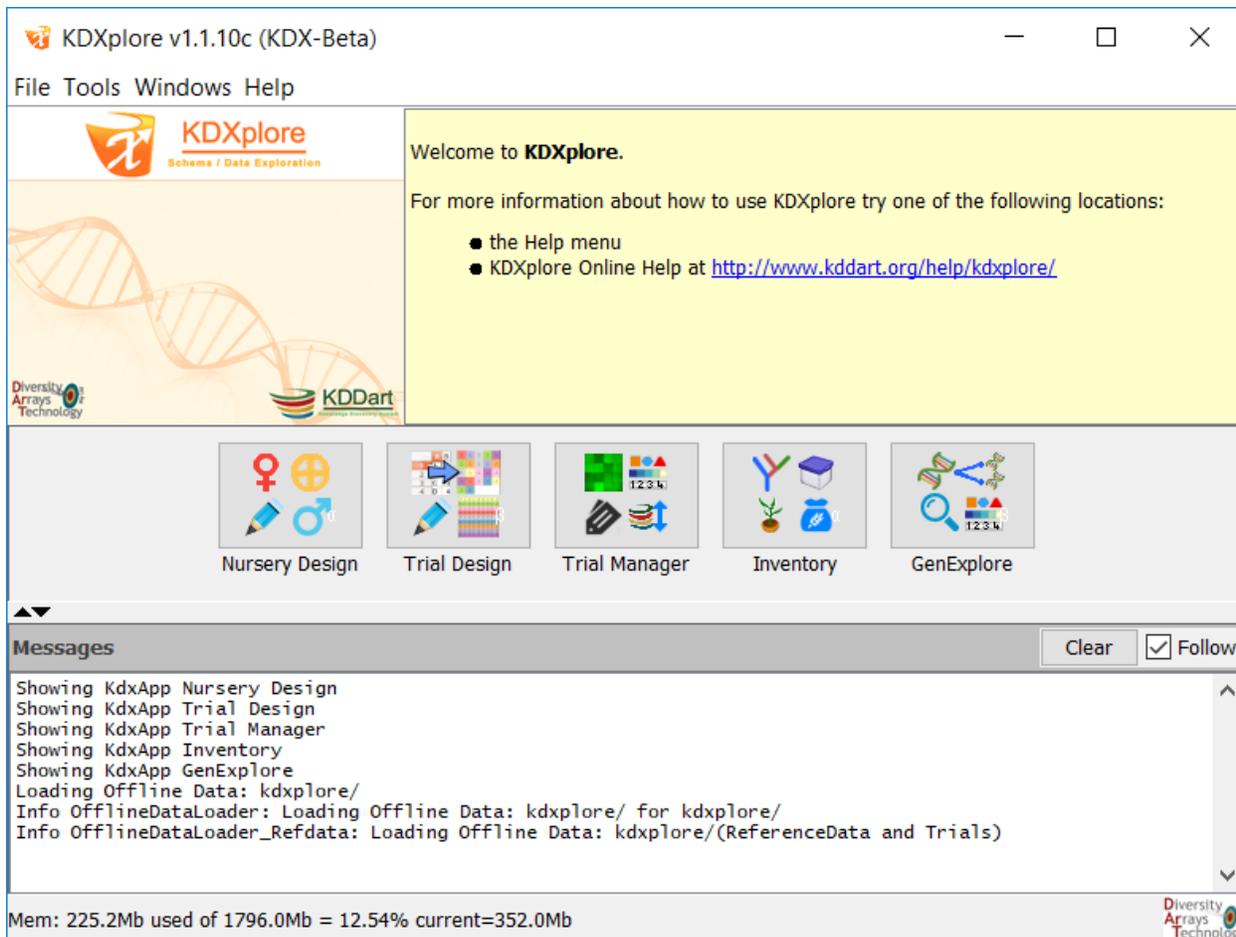
- *KDXplore Documentation*
 - *KDXplore Version and Modules*
 - *KDXplore Alpha/Beta Versions*
 - *Updating KDXplore*

1.1 KDXplore Version and Modules

KDXplore employs a modular architecture which facilitates modular or plugin additions to extend it's functionality. The Trial Manager may be thought of as providing the base level tools to manage Trial, Trait and Tag data. Using modules or plugins allows easier configuration and customisation of different tools to suit a variety of user requirements.

Depending on the configuration of KDXplore modules that are currently added to KDXplore appear as buttons in the middle of the main window, as highlighted in the following image.

Select a module to navigate to it. Navigating to another module will not impact anything in the current module.



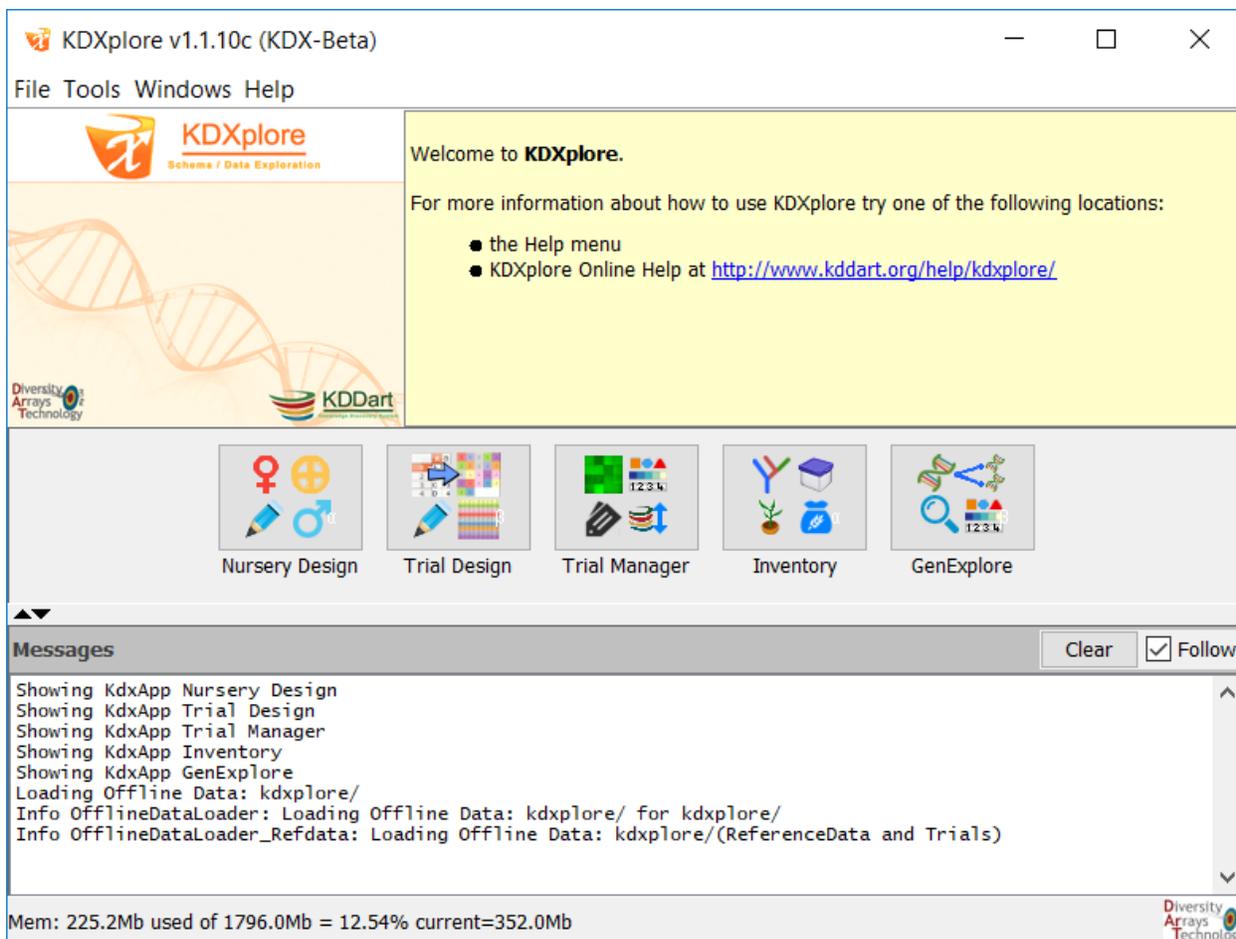
The following table lists the modules available for KDXplore and their release status.

Table 1.1: KDXplore Module Availability - March 2018

Module	Button	Version	Description
Trial Manager	 Trial Manager	Production	Phenotypic data management (offline/online), curation, QA/QC, data exploration/visualisation, Trait management.
Seed Preparation and Harvest	 Trial Manager	Beta	Trial planting and Harvest management, record keeping, inventory management.
GenXplore	 GenExplore	Beta	Genotype/specimen search and inspection, parentage exploration and visualisation (tree), cross designer.
Inventory	 Inventory	Alpha	In depth Inventory, Genotype and Specimen relationship exploration.
Trial Design	 Trial Design	Beta	Design of Trials, automated or manual.
Nursery Design	 Nursery Design	Alpha	Design of Nurseries, automated or manual.

The base version KDXplore, version 1.1.10 illustrated, contains the **Trial Manager** module, listed on left with modules, which is explained in the following sections.

When KDXplore is started the welcome screen will display as in the following illustration:



1.2 KDXplore Alpha/Beta Versions

Alpha and Beta distributions of KDXplore have an expiry date. Thus when a new version of a Alpha/Beta distribution of KDXplore is released it should be downloaded to continue use.

Note: KDXplore cannot be opened following the expiry date and will present the following dialog. The database **will** persist untouched even if the version of KDXplore expires.



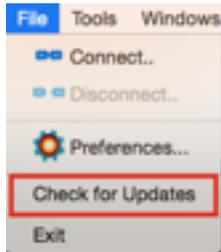
1.3 Updating KDXplore

When a new version of KDXplore has been released an update dialog will be displayed on startup of KDXplore. In this dialog, the update version, update link, Help link and update information is displayed.

Note: Updating KDXplore will **not** effect the KDXplore database's on the machine in any way; all data on the machine will persist through to the next version.



KDXplore can also check for updates at any time manually by clicking the main “File” menu and selecting the “Check for Updates” option.



TRIAL MANAGEMENT

Topics covered in this section:

- *Trial Management*
 - *Trial Manager Main Window*
 - *Manage Trials*
 - * *Import Trials from File*
 - * *Import Trials from KDDart*
 - * *Export Trials*
 - *Manage Traits*
 - * *Adding Traits*
 - *Creating Calc Traits*
 - * *Editing Traits*
 - * *Import Traits*
 - * *Trait Bundles*
 - * *Adding Trait Bundles*
 - * *Editing Trait Bundles*
 - * *Removing Trait Bundles*
 - *Manage Tags*
 - * *Adding Tags*
 - * *Editing Tags*
 - * *Tag Bundles*
 - * *Adding Tag Bundles*
 - * *Editing Tag Bundles*
 - * *Removing Tags and Tag Bundles*
 - *KDXplore - KDSmart Data Exchange*
 - * *Introduction*
 - *What is KDSmart and KDXplore?*

- *Why Use KDXplore?*
- *Data Exchange - Google Drive Method*
- *Data Exchange - KDXchange Method*
- *Setup - Connecting KDXplore to KDSmart Devices*
- *Transfer - Moving data (Trials, Traits and Tags) between KDSmart and KDXplore*
- *KDSmart/KDXplore - CSV Import File Formats*
- *Curation*
 - * *Plot Info & Traits*
 - * *Sample Table*
 - *Plot Inspection*
 - * *Curating Measurements*
 - *Single-Selection Curation*
 - *Multi-Selection Curation*
 - *Trial-Wide Curation*
 - * *Accepting/ Suppressing Measurements*
 - * *Saving Measurements*
 - * *Curation Export*
 - * *Show Outliers*
- *Visualisation Tools*
 - * *Heat Map*
 - * *Scatter Plot*
 - * *Box Plot*
 - * *Field View*

2.1 Trial Manager Main Window

The initial **Trial Manager** window shows the **Trials** stored in the local KDXplore database along with **Traits** and **Tags** for the selected Trial.

The next three annotated examples show the Trial Manager with the Trials tab, Traits and Tags tabs selected highlighting the main window areas.

The main sections of the Trial Manager window highlighted above are:

- **1** **Trials** tab which has been selected.
- **2** **Trials** panel which lists the Trials available within KDXplore's database that can be selected.
- **3** **Trial Details** panel which displays Trial details for the Trial selected.
- **4** **Uses Traits** panel which lists the Traits associated with the selected Trial.

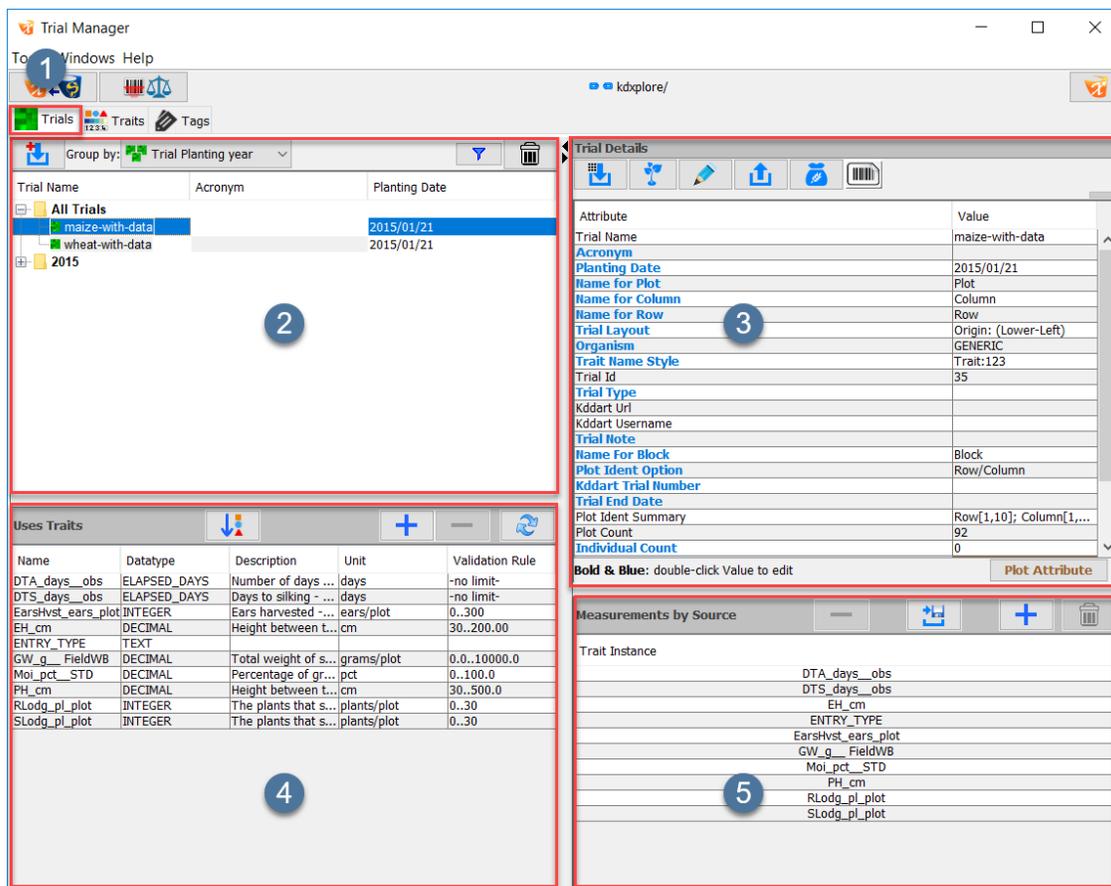


Fig. 2.1: Trial Manager Home screen

- **5** **Measurements** panel which lists the measurements in the trial by the source.

Selecting the **Traits** tab will display the following window:

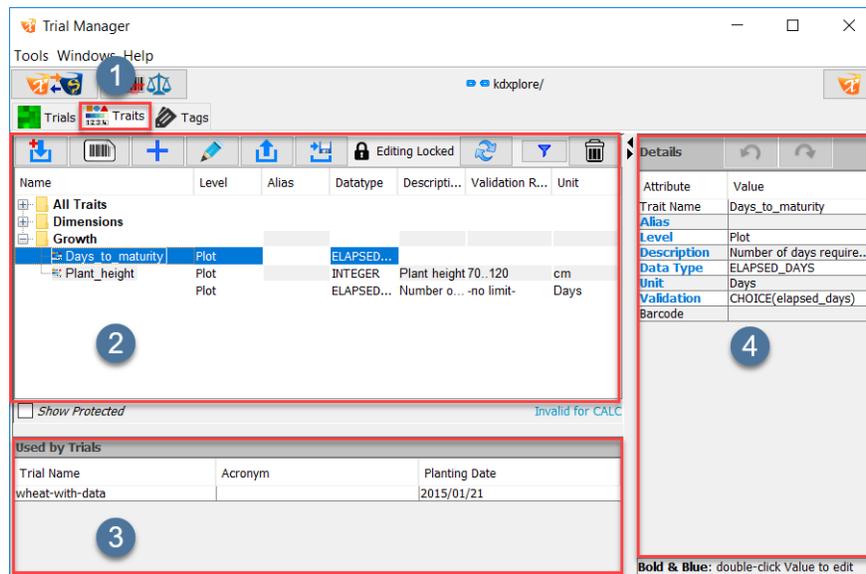


Fig. 2.2: Annotated Traits panel of the Trial Manager window

The main sections of the Trial Manager window **Traits** tab highlighted above are:

- **1** **Traits** tab which has been selected.
- **2** **Traits** panel lists the Traits and Trait Bundles available in KDXplore/KDDart.
- **3** **Used by Trials** panel lists all of the trials that contain the selected trait.
- **4** **Details** panel lists the details of the currently selected trait.

Selecting the **Tags** tab will display the following window:

The main sections of the Trial Manager window **Tags** tab highlighted above are:

- **1** **Tags** tab which has been selected.
- **2** **Tags** panel lists the Tags and Tag Bundles available in KDXplore/KDDart.
- **3** **Details** panel lists the details of the elected Tag.

The following illustration shows section A from above where Trials are displayed and selected.

Trials that are imported into the KDXplore Trial Manager can be grouped by related characteristics. Grouping and filtering makes it easier to quickly locate the required Trial(s) when many Trials are in KDXplore, or when logged into a KDDart database. Trial groups can be displayed based on trial type, KDDart URL, organism, and planting year. To view a trial group, the user will need to:

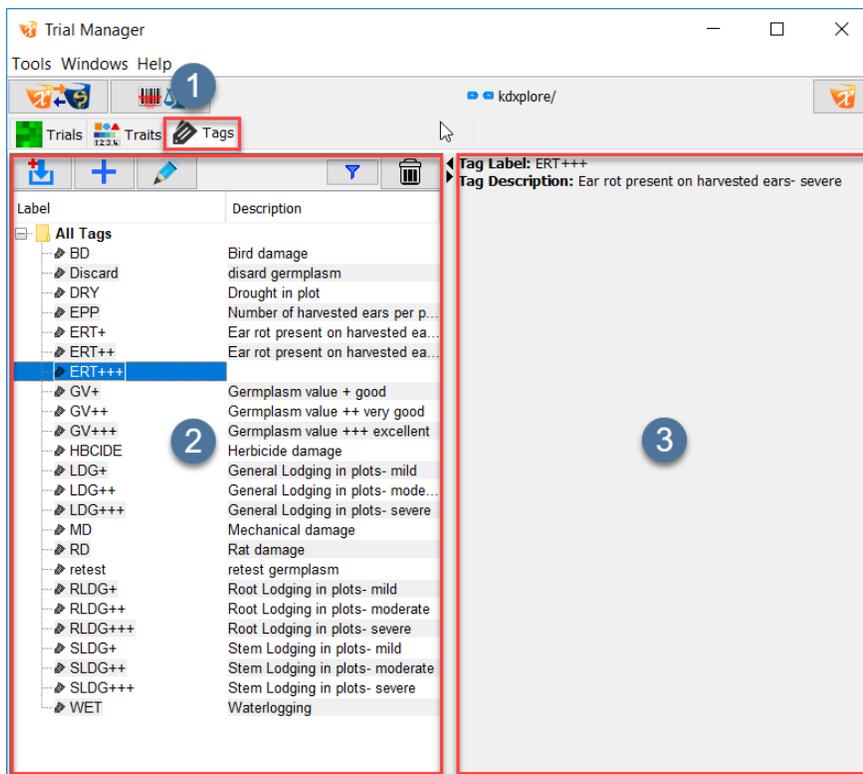


Fig. 2.3: Annotated Tags panel of the Trial Manager window

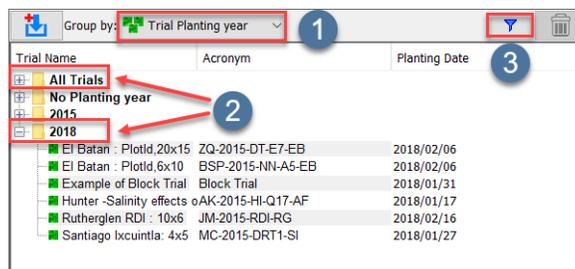


Fig. 2.4: Trial Manager Home screen

Table 2.1: Trial Grouping

Step	Action
1	Select the Group By drop-down menu at 1 which will display the available grouping options.
2	Select a grouping option e.g. Trial Planting Year. Once this is selected, the system will display the trial group that has been. It will always display All Trials by default.
3	Once a trial grouping is selected, it can be changed by repeating the steps above and choosing another trial grouping.

- **2** Demonstrates the selection of the **2018** trial year grouping which is opened and the **All Trials** group which is collapsed.
- **3** Is the filter option which displays a text field below the button for entry of desired Trial Name text.

Note: Functionality to create new types of trial groups will be added in future versions.

2.2 Manage Trials

In Trial Manager, the Trial tab is the default/home view which displays all the information regarding the Trials currently stored in KDXplore. All trials in KDXplore’s offline database are displayed here.

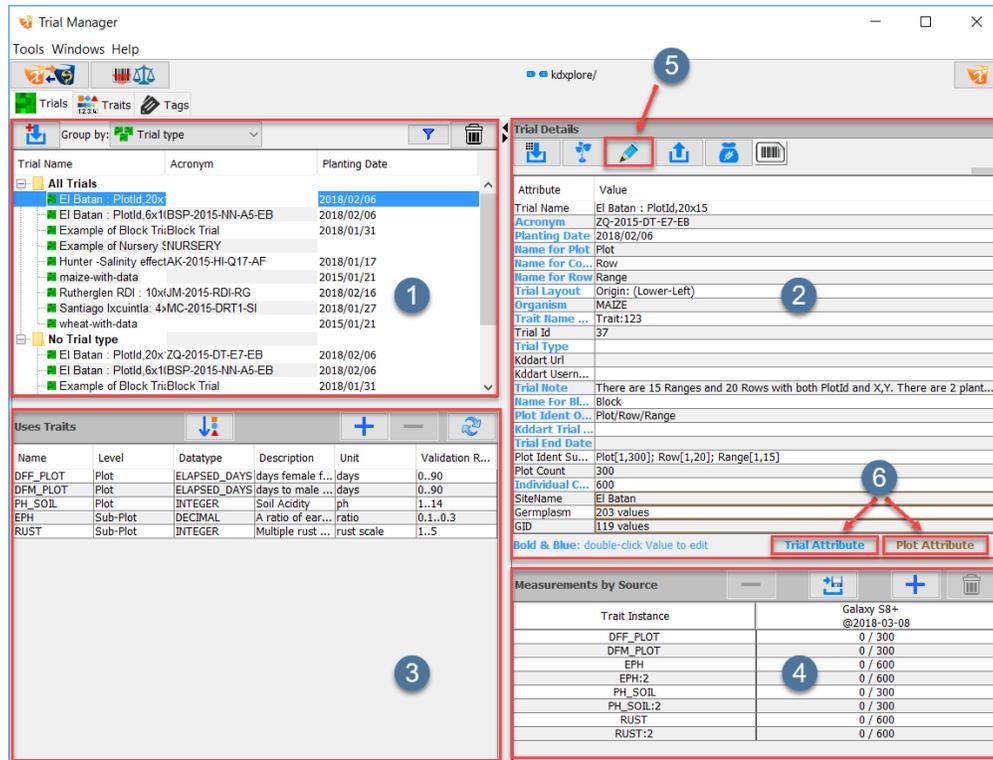


Fig. 2.5: Trial Manager Window

Selecting a Trial in the top left **Trials** panel at **1** will display **Trial Details** in area **2**, **Uses Traits** panel at **3**

and **Measurements by Source** at **4**:

- **Trial Details** - All trials in KDXplore's offline database are displayed here. This displays the information regarding the trial. To edit Trials, either select a Trial by double-clicking it or by selecting the **Edit Current Trial** button at **5**. By selecting either of the two buttons at the bottom of this panel at **6**, both plot attributes, and trial attributes can be visualised. To quickly edit in **Trial Details**, double-click in the values column to change values.
- **Uses Traits** - This area displays the Traits that are currently active for the selected Trial. These Traits are ordered by the user for preference during *scoring* in KDSmart. Traits can be added or removed from Trials by selecting the '+' or '-' symbols at the top of this panel.
- **Measurements by Source** - This area displays the phenotypic datasets for the selected Trial and how populated (in percent) each dataset is. Datasets can be created from this panel. Datasets can also be created for a list of specific Traits to send to KDSmart for scoring. The source of each set of measurements (e.g. phone 1) can be viewed from this panel also.

2.2.1 Import Trials from File

KDXplore can import CSV and Excel XLS or XLSX files easily using drag and drop. For information on file import formats please see the "[KDSmart/KDXplore - CSV Import File Formats](#)" help page. Although .CSV files can be easily imported given almost any column format.

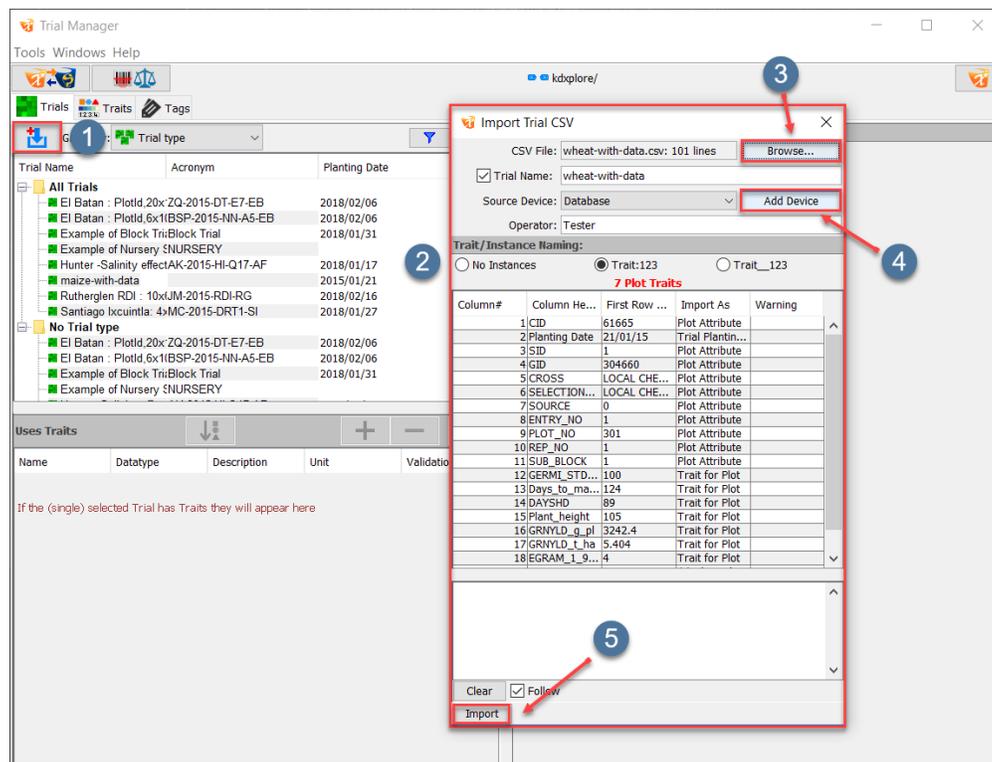


Fig. 2.6: Importing Trials

Trials can be imported from various sources and in different formats. One of the easiest ways is to import a .CSV file which is outlined below:

Table 2.2: Importing a .CSV file

Step	Action
1	Select the Add Trials button at 1 and select the Load From CSV option. This will bring up the Import Trials window at 2 .
2	Either drag and drop a .CSV file into the window, or select the Browse button located at 3 .
3	Select the Add Device button at 4 to link any connected devices to import data (this is optional).
4	Change the <i>Trial Name</i> and <i>Operator</i> if necessary. The Traits that are contained in this file will also be listed in the window. Selecting a Trait by right-clicking it will allow the user to choose import options for that particular Trait i.e. <i>Don't Import</i>
5	Select the Import button at 5 to save the preferences and import the trial.

Note: Whilst this covered the import of a .CSV file, the same process applies for a .XLS or .XLSX file except the user must choose the **Load From XLS** option after choosing to add Trial.

Once a Trial has been imported it will appear in the list in the **Trial Details** panel. Trials can also be imported from KDDart by selecting *Load From Database* and from connected KDSmart devices through the *Load From Tablet Data* option when selecting the **Add Trials** button.

2.2.2 Import Trials from KDDart

KDXplore can also import Trials from the KDDart Database. To be able to do this, you must first be logged into KDDart. To see how to log into KDDart, follow the next set of instructions. If you are already logged in, then skip to the next part.

Table 2.3: Connecting to KDDart

Step	Action
1.	Select the <i>File</i> button at the 1 and then choose the <i>connect</i> option.
2.	The KDDart Login window will then appear as at 2 . Enter your username and password and then select the <i>Login</i> button to log into the KDDart Database.

Logging into KDDart allows the user to easily import Trials with the relevant Traits and Tags attached. The following instructions will demonstrate how to import a Trial from the Database:

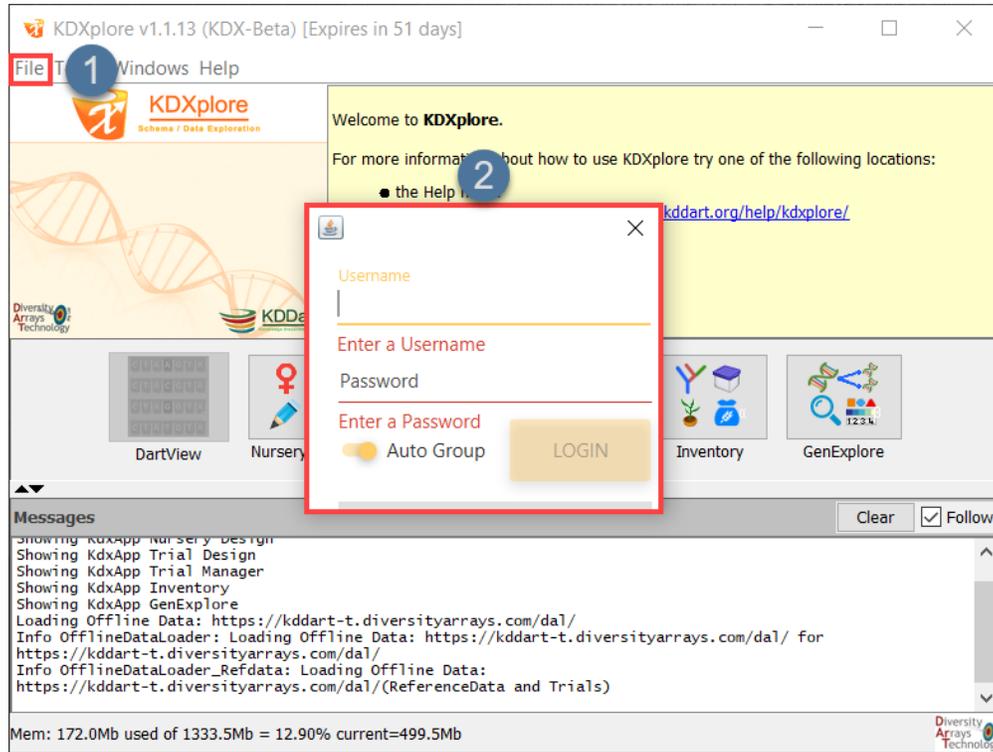


Fig. 2.7: Connecting to KDDart

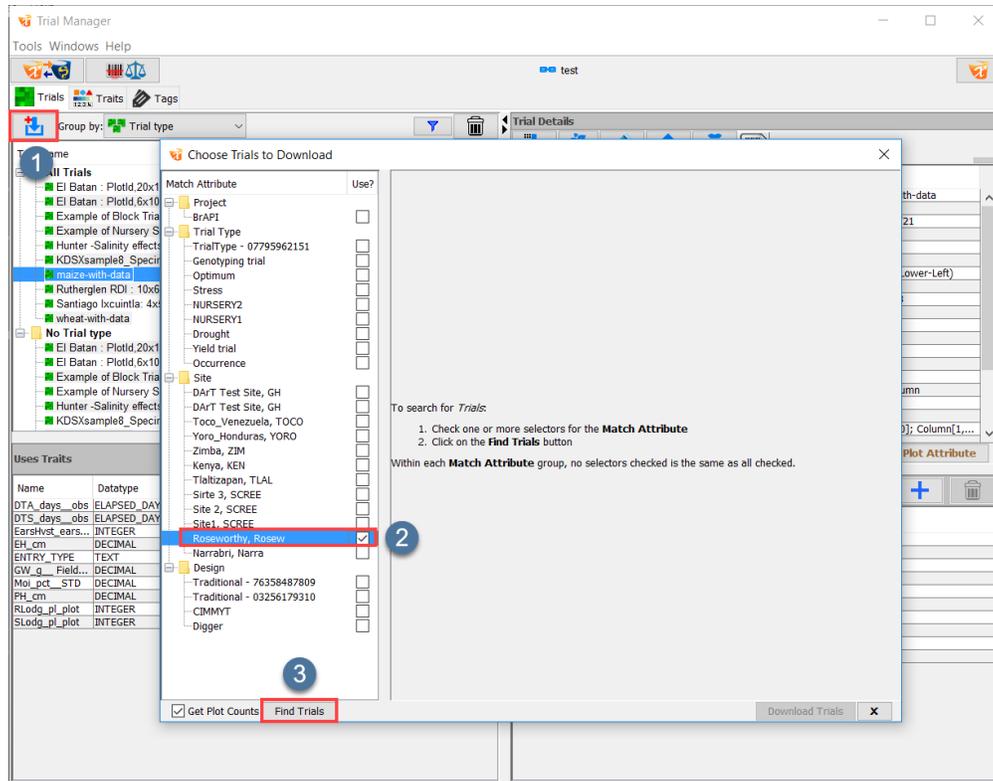


Fig. 2.8: Importing Trials from KDDart Database 1/2

Table 2.4: Importing a Trial from the Database

Step	Action
1	Select the  icon at 1 and choose the <i>Load from Database</i> option to open the Database Import window as seen in the image above.
2	Choose an attribute to search for such as the one at 2 . This example is a location attribute that will only display the Trials that take place at Roseworthy.
3	Select the Find Trials button to search for the Trials. If no attributes were selected, then all Trials in the Database are presented.
4	The search results will then be displayed (such as in the following image). Choose a Trial (or multiple Trials) such as the one in 1 and then select the Download Trials button at 2 to complete the import.

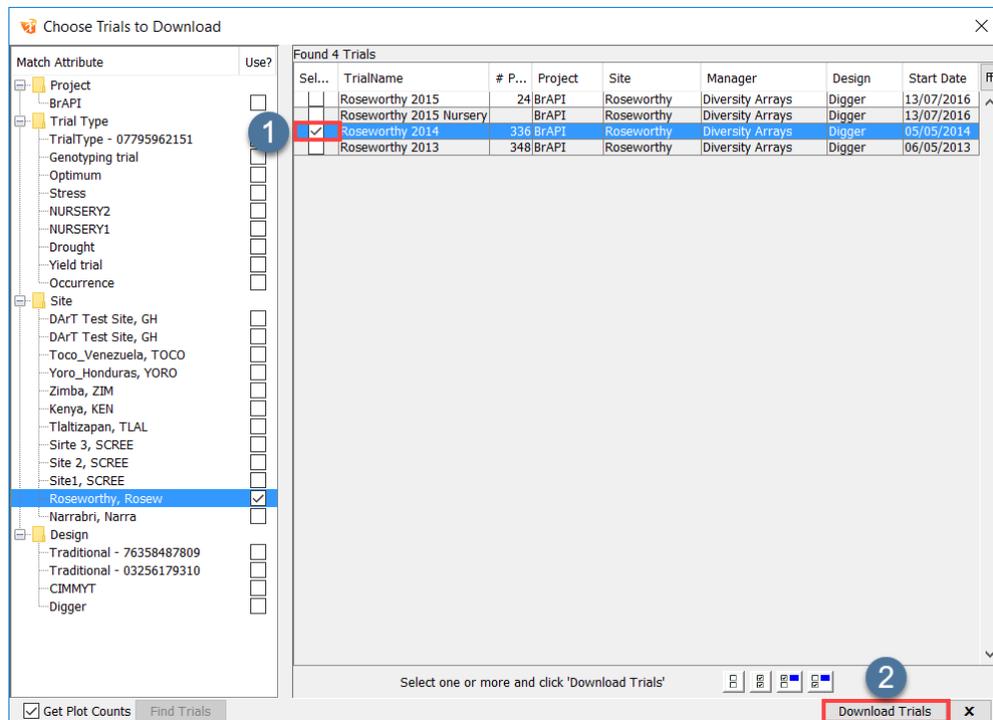


Fig. 2.9: Importing Trials from KDDart Database 2/2

Below is an animation that demonstrates the above instructions:

2.2.3 Export Trials

Trials can also be exported so that it can be used on other devices. The exported files can be either a zip file, .CSV, or can be exported through KDXchange. It can also include media such as photographs. The following image and instructions detail how to export a Trial in the .CSV format.

To export a Trial, follow the steps below:

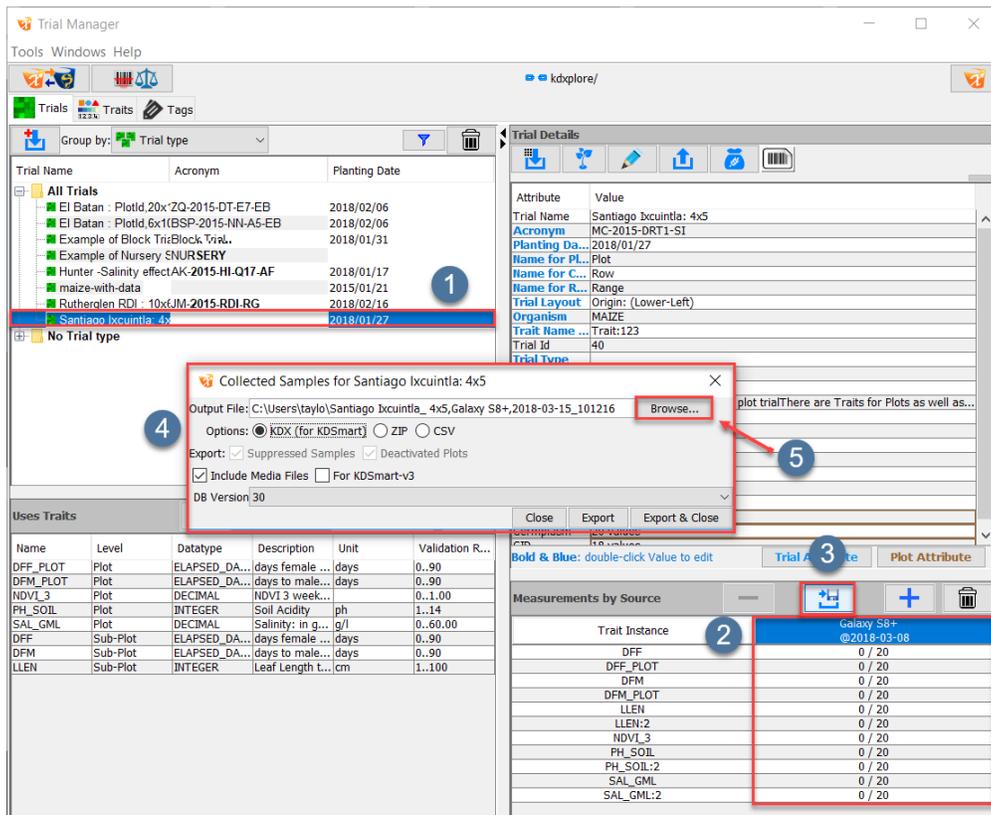


Fig. 2.10: Exporting Trials

Table 2.5: Exporting a Trial

Step	Action
1	To export a Trial in KDXplore select a Trial such as the Trial at 1 .
2	In the Measurements by Source panel, select the column of the dataset for export such as the column at 2 .
3	By then selecting the Export Sampled or Traits for Trial button at 3 , a dialog will open asking details for export as in 4 .
4	Trial Manager will choose a file destination, but to change it, select the Browse button at 5 and then choose a folder in which to export to.
5	Choose the <i>Output Options</i> which will determine the format of the export (KDX, Zip, or CSV).
6	Choosing the <i>Include Media Files</i> option will include any photos that were taken with the samples.
7	Select either the Close, Export, or Export and Close options to finish the export.

2.3 Manage Traits

The **Trial Manager** module has the function to manage Traits that are available to use within Trials.

Actions available include:

- Adding new Traits;
- Removing a Trait (that is not used by any Trial);
- Editing Trait details;
- Viewing Trait information, e.g. Trait validation rules; and
- Organising them, e.g. using Trait Bundles.

The instructions below demonstrate accessing Traits via the **Traits** tab and provide an explanation of the available information:

Table 2.6: Selecting a Trait to Manage

Step	Action
1	In the Trial Manager module, select the Traits tab at 1 to display the Trait information panels.
2	Traits that are currently in KDXplore can be seen here. Selecting a trait such as the Trait at 2 will display information about the selected Trait in the Details panel at 4 . All information about a Trait is shown here including: <i>Trait Name, Datatype, Validation Rule</i> and <i>Barcode</i> .
3	In the Used by Trials panel, the Trials that are in KDXplore that are currently using the selected Trait will appear. For the example, only one Trial is using that Trait and it displays the <i>Name, Acronym, and Planting Date</i> of the Trial.

2.3.1 Adding Traits

Users can add new Traits which can then be added to Trials. These new Traits provide users the flexibility the add Traits after a Trial has been created, e.g. adapting a previously used Trial for a new experiment.

The following image and instructions demonstrate how to add new Traits.

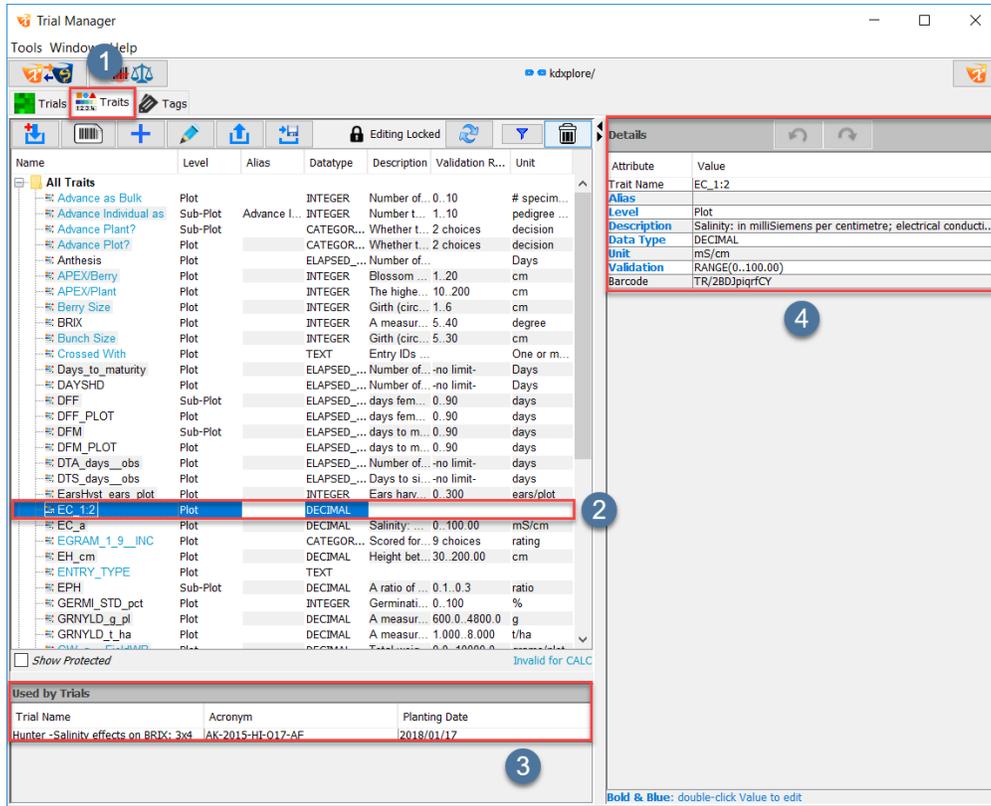


Fig. 2.11: Trial Manager Home screen

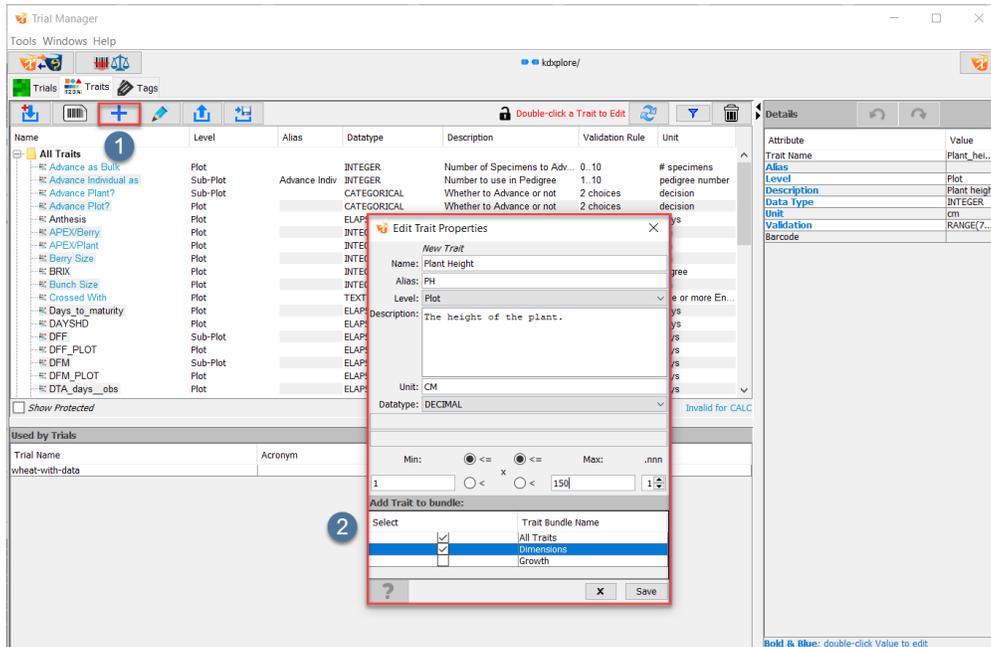


Fig. 2.12: Adding Traits

New Traits can be added by:

Table 2.7: Adding a New Trait

Step	Action
1	Select the Add Traits button at 1 to create a new Trait. This will bring up the Edit Trait Properties at 2 .
2	Within the Edit Trait Properties window are the key Trait fields. Enter the details of the Trait. More information on traits can be found below.
3	Select the Save button to save the new Trait and the Trait will be displayed in the Traits window.

In order to add a new Trait, all of the following details must be entered:

Table 2.8: Trait Details

Attribute	Description
Trait Name	The name for the new Trait. Must be <i>unique</i> and <i>short</i> because it is displayed in the Scoring screen and there may be limited screen space on smaller devices.
Alias	An alternative name for the Trait. This can be something shorter than the Trait name and is optional.
Level	This will define the Trait as one that is relevant on the <i>Plot</i> or <i>Sub-Plot</i> level.
Description	This is an optional longer explanation of the Trait to assist in data entry.
Unit	The unit of measurement in which the Trait can be scored by e.g. centimetres so that a plant leaf can be measured
Data Type	<p>This constrains the values permitted for scoring against the Trait. One</p> <ul style="list-style-type: none"> • CATEGORICAL, • DATE, • ELAPSED_DAYS, • INTEGER, • DECIMAL; or • TEXT;
Validation Rule	The Validation rule optionally restricts the values being entered. The nature of the rule is dependent upon the selection of Data Type and can include a minimum and maximum value.
Add Traits to Bundle	Checkboxes that allow the user to add the new Trait to existing Trait Bundles.

Creating Calc Traits

The **Calc** datatype for Trait's will allow a Traits value to be derived from other Trait data that is available e.g. the user can create a Calc Trait called *PLANT_AREA* which is equal to *PLANT_WIDTH* x *PLANT_HEIGHT*.

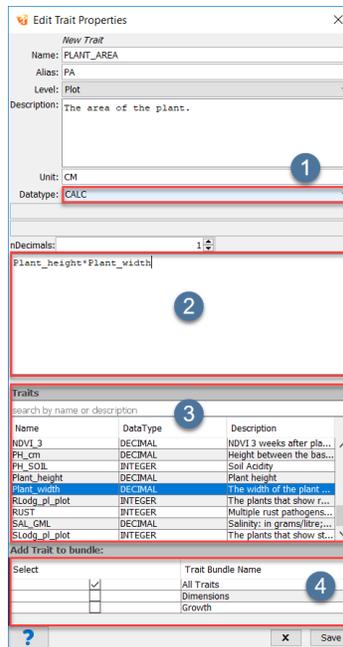


Fig. 2.13: Calc Trait Datatype

Table 2.9: Creating a Calc Trait

Step	Action
1	By selecting the <i>Calc</i> datatype from the drop-down menu at 1 , a second expression panel can be seen in area 2 .
2	Here an expression can be entered representing the derived value. Taking the example used previously, <i>PLANT_AREA</i> * would be: <i>PLANT_WIDTH</i> (asterisk) <i>PLANT_HEIGHT</i> . Traits can be typed, or selected from the Traits panel at 3 .
3	The new <i>Calc Trait</i> can also be added to bundles in 4 .

Once Traits have been added they will appear in the table in area **1**.

2.3.2 Editing Traits

Any details of a Trait can be edited if the user wants to change the characteristics of the Trait.

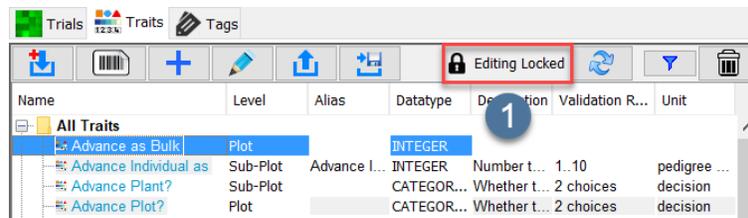


Fig. 2.14: Editing Traits Button

To edit Traits, the user must unlock the option. This can be done by selecting the **Editing Locked** option at **1** in the image above. Trait editing is automatically locked so that details of Traits that are in use by Trials are not changed.

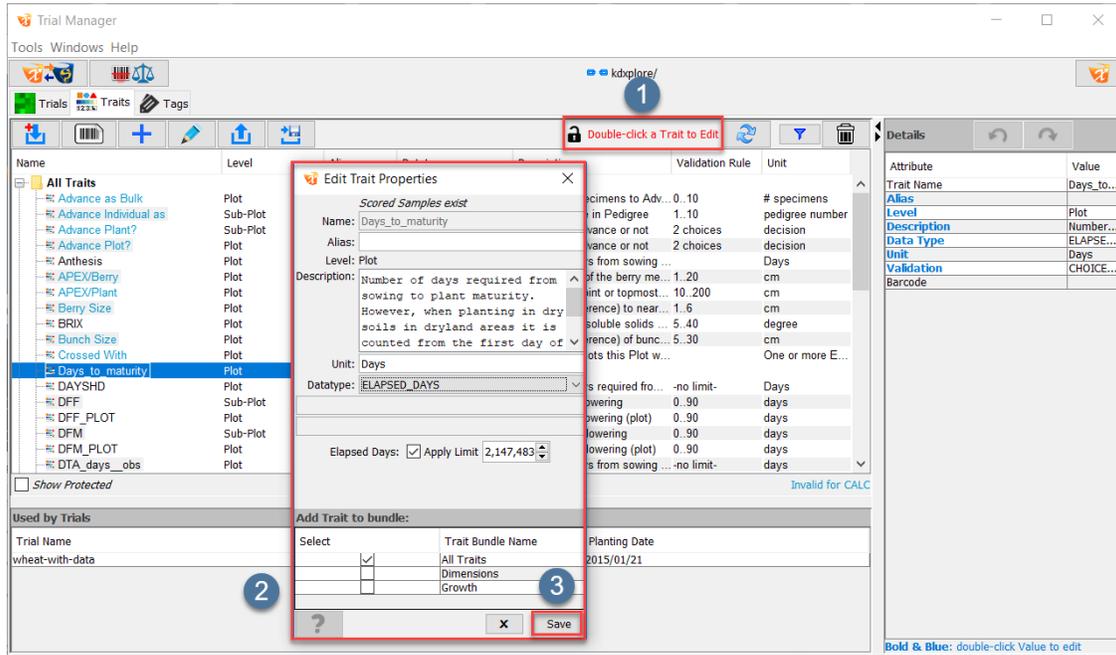


Fig. 2.15: Editing Traits

After Trait editing is unlocked, KDXplore will display that in **1**. To edit a Trait:

Table 2.10: Editing a Trait

Step	Action
1	Select a Trait by double-clicking it. This will bring up the Edit Trait Properties Window as shown at 2 .
2	Make the desired changes to the Trait and then select the Save option at 3 .

Tip: It is best practice to lock Trait editing when finished editing Traits.

2.3.3 Import Traits

The KDXplore Trial Manager module has the ability to import Traits from external sources. Traits can be imported from either KDDart or a CSV file.

Once in the **Traits** tab of KDXplore, select the **Import** button at **1** and then chose either *Load from Database* or *Load from CSV*.

For Trait and Trial file format information please refer to the “KDSmart/KDXplore - CSV Import File Formats” help page.

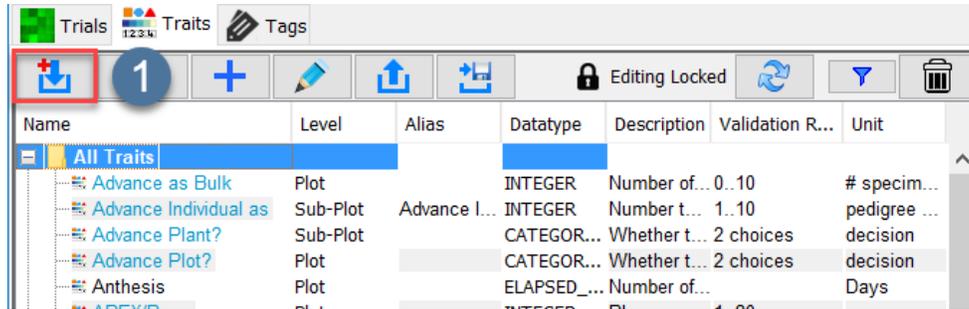


Fig. 2.16: Importing Traits

2.3.4 Trait Bundles

The Trial Manager module allows for the creation of Bundles which are groups of traits that share a common theme. Adding traits to a bundle allows for easier visibility and management of related traits and custom bundles can be created by the user.

2.3.5 Adding Trait Bundles

All traits will be automatically allocated to a bundle named **All Traits**. To create a new bundle, the user can:

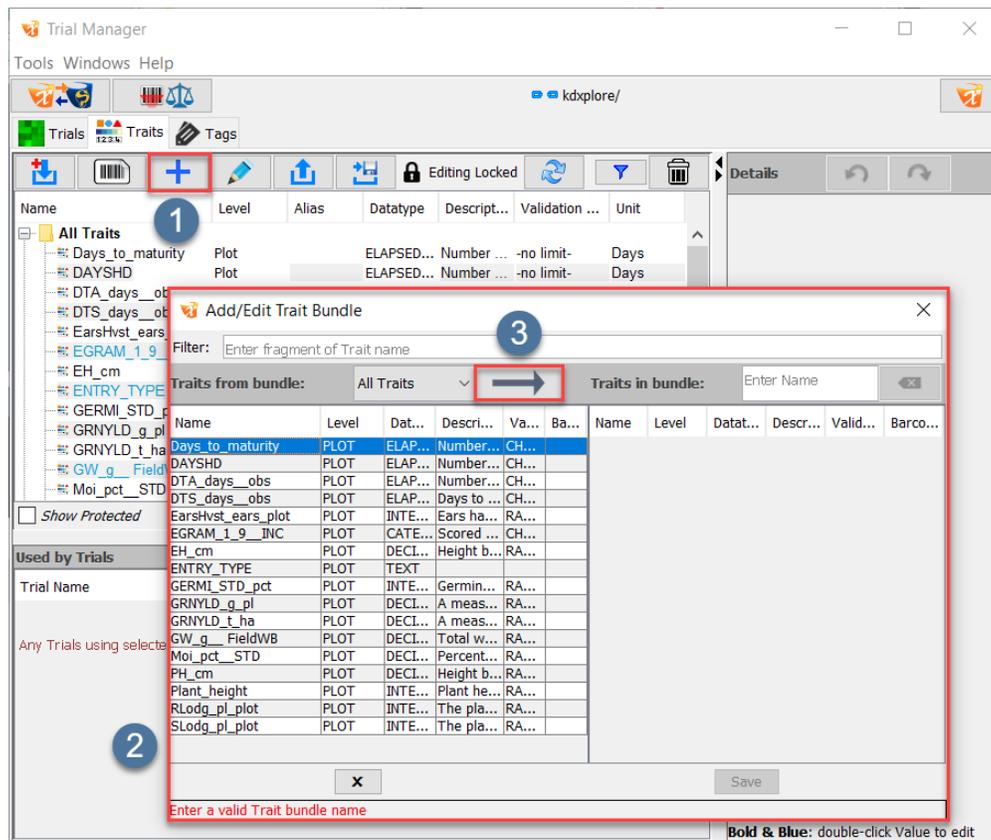


Fig. 2.17: Adding Trait Bundles

Table 2.11: Adding a Trait Bundle 1/2

Step	Action
1	Select the Add Trait button at 1 . It will give you the option of choosing to create a new Trait or bundle. Choose the Add Trait Bundle option.
2	The Add/Edit Trait Bundle window at 2 will open and there will be a list of available traits. If a required Trait is not available, the bundle can still be created and then edited later. Choose the Trait required and select the Add Trait arrow at 3 to add the selected trait to the new bundle. Multiple Traits can be selected at once by <i>shift+clicking</i> or <i>ctrl+clicking</i> (on Windows).

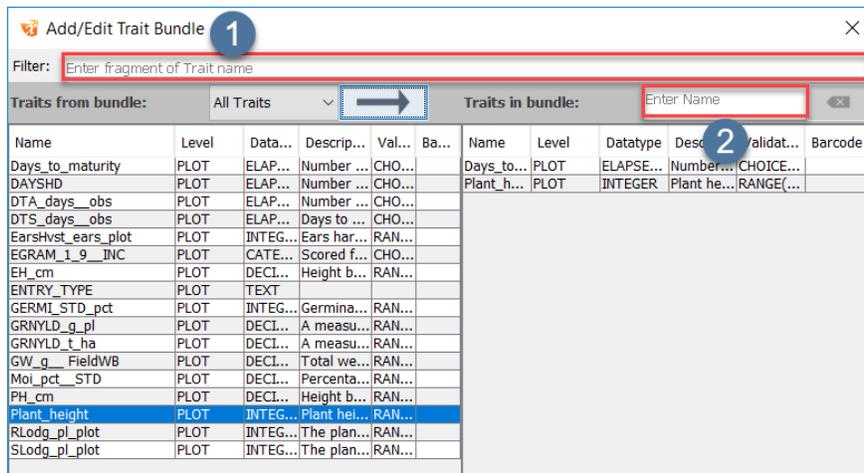


Fig. 2.18: Filtering Traits

Table 2.12: Adding a Trait Bundle 2/2

Step	Action
3	The Filter function at 1 allows for Traits to be searched by Trait names and Traits can be added from the search results.
4	Pick a name for the bundle and enter it into the right panel 2 . After adding Traits and entering a name, the bundle can be saved.

Note: Traits can exist in more than one bundle

2.3.6 Editing Trait Bundles

Once a bundle has been created, it can also be edited to remove or add more traits, or to change the name of the bundle:

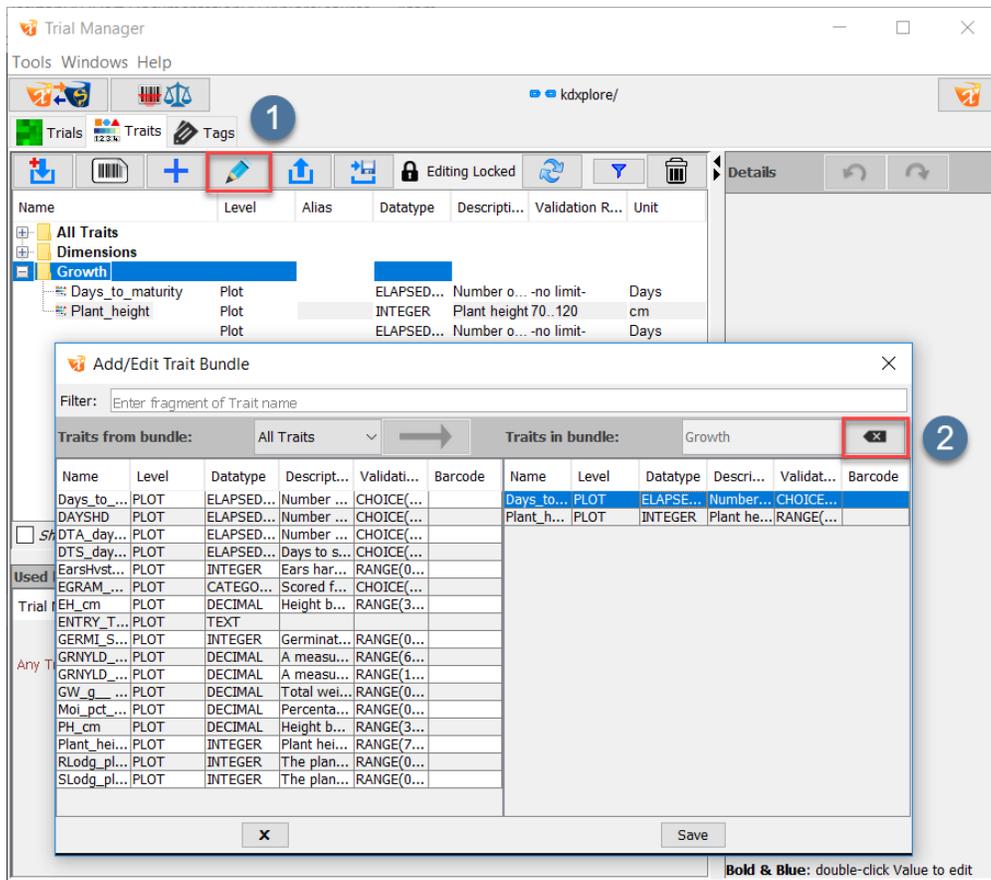


Fig. 2.19: Editing Bundles

Table 2.13: Editing a Trait Bundle

Step	Action
1	Select the bundle to be edited.
2	Select the Edit Bundle button at 1 on the toolbar. This will open the Add/Edit Trait Bundle window and traits can be added as were previously done. If more traits were added to the trial then they will now appear in the left panel and can be selected.
3	To remove a trait, select the trait to be removed in the right panel and select the Remove From Bundle button at 2 .

Note: The **All Traits** bundle cannot be edited or removed.

2.3.7 Removing Trait Bundles

A bundle can also be removed from the list of bundles and deleted:

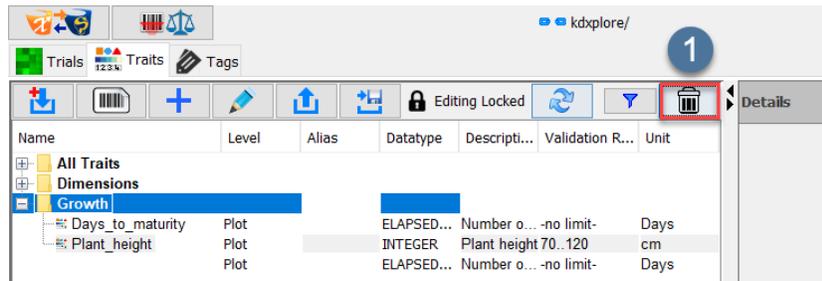


Fig. 2.20: Removing Bundles

Table 2.14: Removing a Trait Bundle

Step	Action
1	Select the bundle to be removed.
2	Then the Remove traits icon can be selected. If you have selected a bundle there will be the option to Delete Trait Bundle .
3	Once this option is selected, a window will open to confirm the removal of the selected bundle.

Note: Once a bundle is removed, it cannot be restored.

2.4 Manage Tags

In KDXplore **Trial Manager**, tags are short, coded descriptions that are used to represent information about a plot in a Trial. Tags available for use in scoring in Trials can be seen, along with definitions in the 'Tags' tab of KDXplore Trial Manager.

To display the Tags that are currently available in **Trial Manager**:

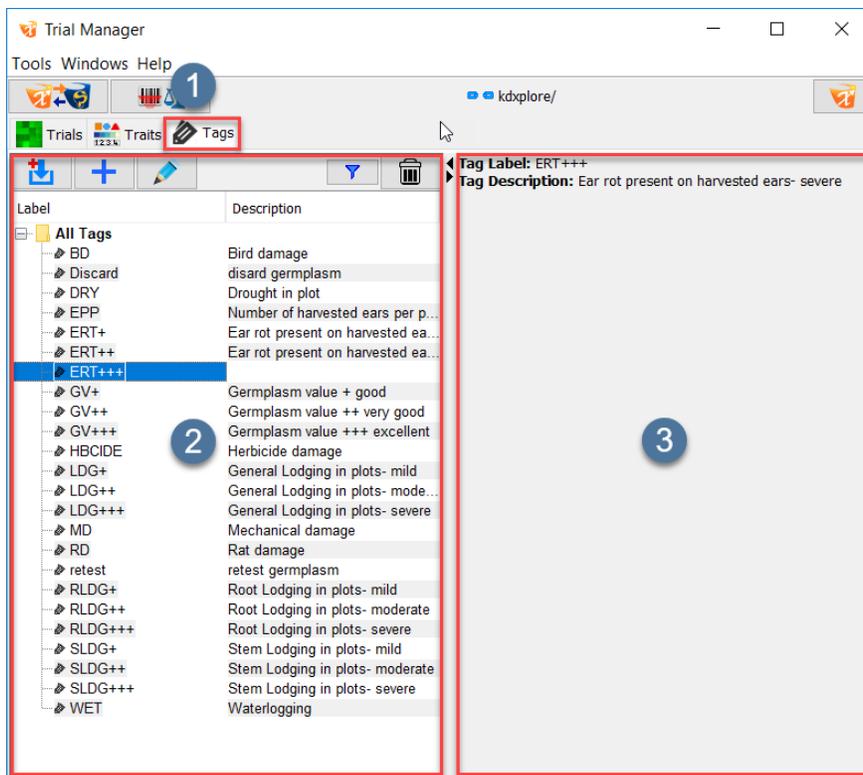


Fig. 2.21: Tags panel of the Trial Manager window

Table 2.15: Displaying Tags

Step	Action
1	To navigate to the Tags tab select the Tags Tab towards the top of the window at 1 .
2	From here, tags can be selected from the list in area 2 .
3	This will display the tag details in the Tag Description Panel which will

2.4.1 Adding Tags

New Tags can be added by the user that can be used in Trials.

To add a Tag:

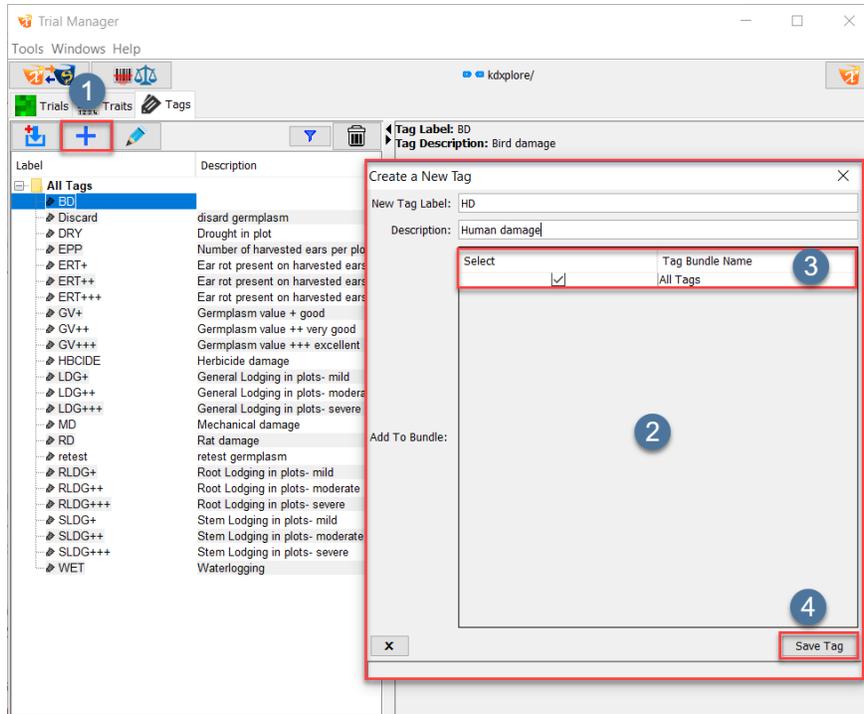


Fig. 2.22: Adding a Tag

Table 2.16: Adding Tags

Step	Action
1	Select the Add Tag/Tag Bundles button at the top of the panel at 1 and then choose the <i>Add Tag</i> option.
2	The Add Tags window will open (shown with 2) which will allow the user to create a new tag by entering a <i>New Tag Label</i> and a <i>Description</i> . Tags must have a unique name in KDXplore, similarly to Traits. This example demonstrates the creation of a tag known as <i>HD</i> which describes as <i>Human Damage</i> .
3	Choose a Tag Bundle with the checkbox at 3 . If there are no user-created bundles then there will only be the <i>All Tags</i> bundle to choose (Note: Creating Tag bundles will be examined later).
4	Once the tag name and details have been entered then select the Save button at 4 .

Once saved, the new tag will be added into the **Tags Panel**

2.4.2 Editing Tags

Previously created Tags can also be edited to better suit a Trial.

Table 2.17: Editing Tags

Step	Action
1	To edit a tag, select the Description field by double-clicking in area 1 . Note that tag names cannot be edited following creation. To change the name of a tag, a new tag should be instead created.
2	Tags can be deleted by highlighting the tag and then selecting the Delete button at 2 .

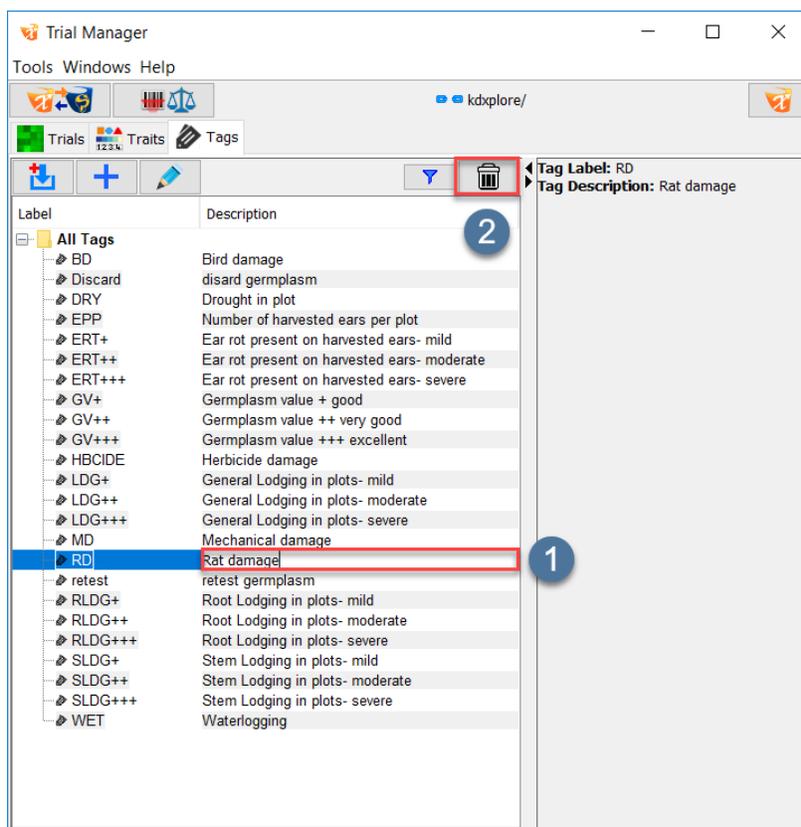


Fig. 2.23: Editing a Tag

2.4.3 Tag Bundles

The Trial Manager module also has the creation on Tag Bundles which, similar to the Traits Bundles, are Tags that share a common theme and allows for better visibility and management of related tags.

2.4.4 Adding Tag Bundles

The steps below are an example of how to add a new Tag Bundle:

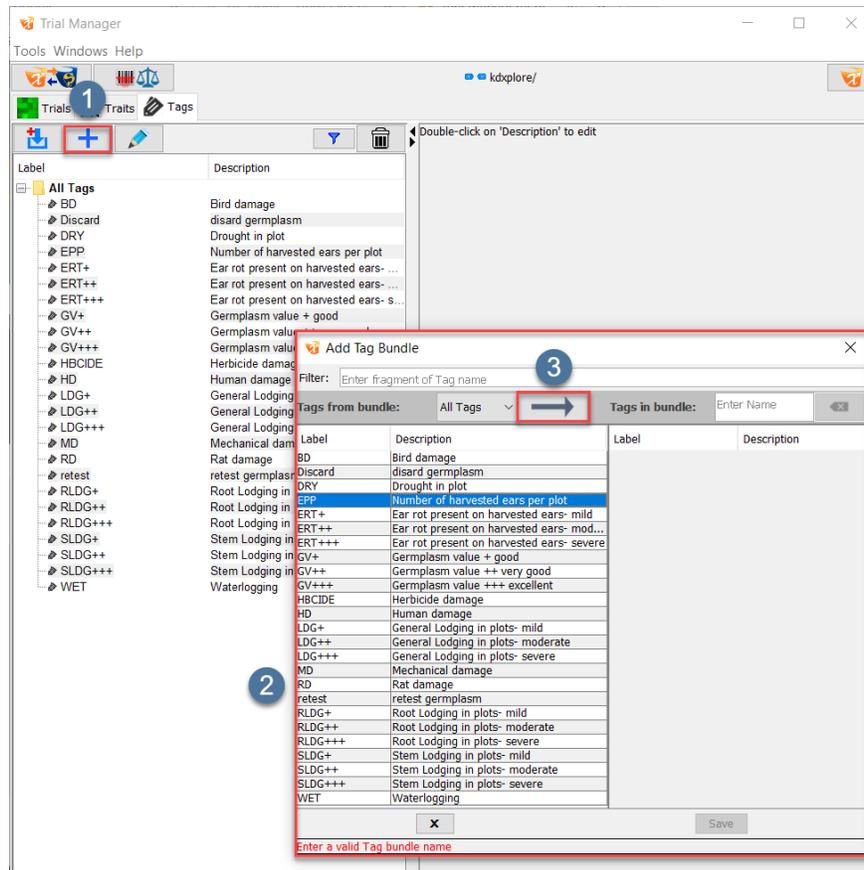


Fig. 2.24: Adding Tag Bundles

Table 2.18: Adding a Tag Bundle 1/2

Step	Action
1	Select the Add Tag button at 1 . It will give you the option of choosing to create a new tag or bundle. Choose the Add Tag Bundle option.
2	The Add/Edit Tag Bundle window at 2 will open and there will be a list of available traits. If a required tag is not available, the bundle can still be created and then edited later. Choose the tag required and select the Add Tag arrow at 3 to add the selected tag to the new bundle. Multiple tags can be selected at once by <i>shift+clicking</i> or <i>ctrl+clicking</i> (on Windows).

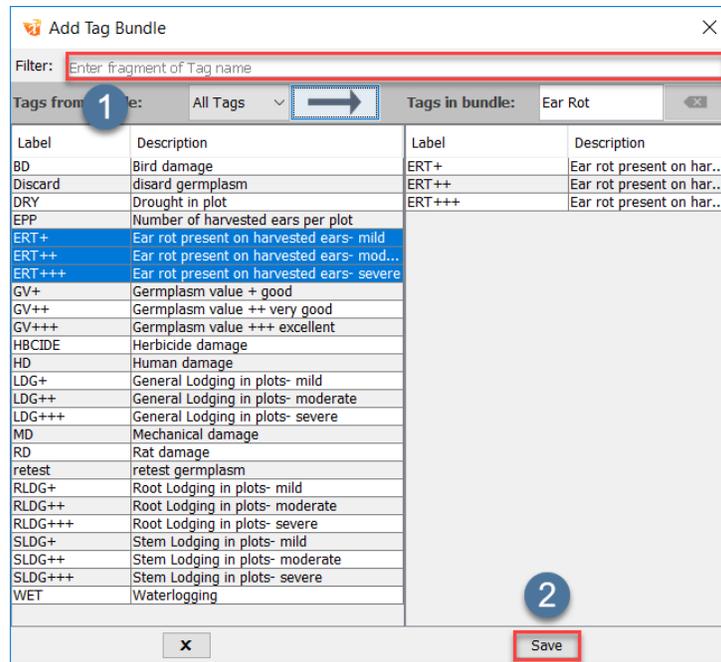


Fig. 2.25: Filtering Tags

Table 2.19: Adding a Tag Bundle 2/2

Step	Action
3	The Filter function at 1 allows for tags to be searched by tag names, and tags can be added from the search results.
4	Pick a name for the bundle and enter it into the right panel 2 . After adding tags and entering a name, the bundle can be saved.

Note: Tags can exist in more than one bundle

2.4.5 Editing Tag Bundles

Similar to Trial Bundles, Tag Bundles can also be edited e.g. changing the name of the Bundle or adding Tags to the Bundle.

Table 2.20: Editing a Tag Bundle

Step	Action
1	Select the bundle to be edited.
2	Select the Edit Bundle button at 1 on the toolbar. This will open the Add/Edit Tag Bundle window and tags can be added as were previously done. If more tags were added to the bundle then they will now appear in the left panel and can be selected.
3	To remove a Tag, select the tag to be removed in the right panel and select the Remove From Bundle button at 2 .

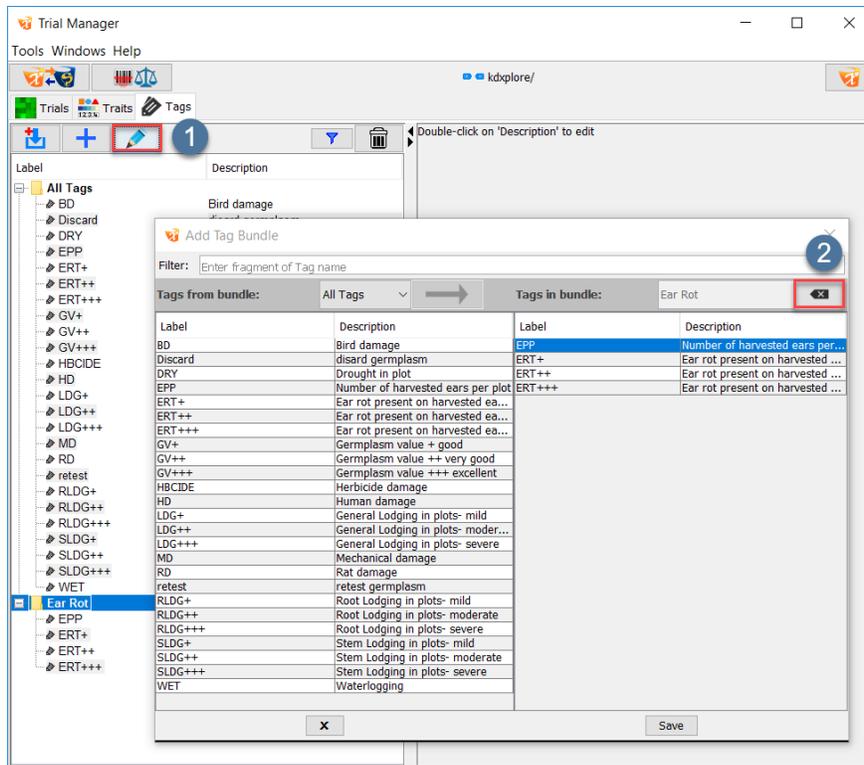


Fig. 2.26: Editing Tag Bundles

2.4.6 Removing Tags and Tag Bundles

If a Tag Bundle is not needed, it can be removed with the following steps below:

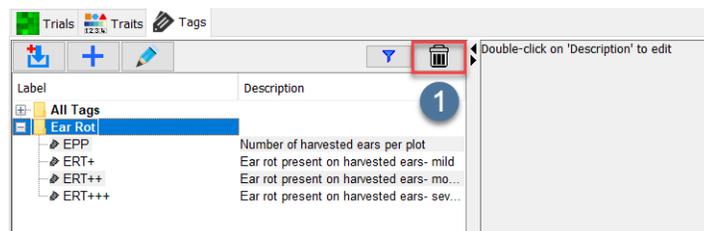


Fig. 2.27: Removing Tags and Tag Bundles

Table 2.21: Removing a Tag Bundle

Step	Action
1	Select the bundle to be removed.
2	Select the Remove tags icon. If you have selected a bundle there will be the option to Delete Tag Bundle .
3	Once this option is selected, a window will open to confirm the removal of the selected bundle.

Note: Once a bundle is removed, it cannot be restored.

Why Use KDXplore?

Whilst KDSmart can be used on its own using CSV files for data transfer there may be a need to upscale to multiple KDSmart devices and larger trials. Using KDXplore benefits the user by improving data management and handling.

Some of these benefits are:

- Work more efficiently and productively with Trial and Nursery data offline (away from office networks or Internet) using laptop or workstation, not just small screens of tablets or phones;
- Provides visualisation tools to assist with data exploration and review;
- Provides broader toolset coverage of the breeding cycle;
- Enables easier management and data exchange with multiple KDSmart devices;
- Retains data from each individual KDSmart device with TableName/Operator/When details;
- Facilitates uploading data to a KDDart database when possible (i.e. when a connection to the office network/Internet is available);
- Barcode production for printing to use with KDSmart barcode scoring;
- Facilitates improved consistency amongst multiple KDSmart devices with Trait and Tag editing and distribution;
- Viewing Traits used in different Trials; and
- The ability to exchange data whilst on site so that data can be curated as efficiently as possible.

A few setup steps are required, however this has been made as easy as possible. The communication software between KDSmart and KDXplore is referred to as *KDXchange*.

Data Exchange - Google Drive Method

Google Drive is a quick and easy way of exchanging data between devices and requires little set up 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 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 .

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.

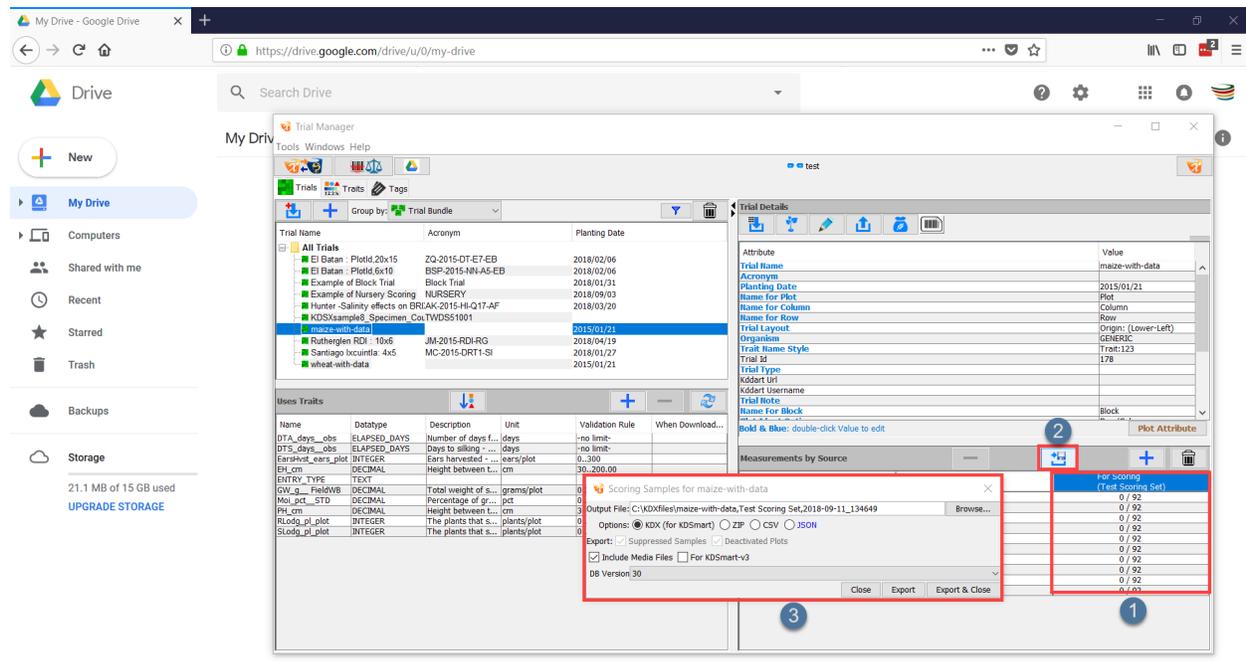
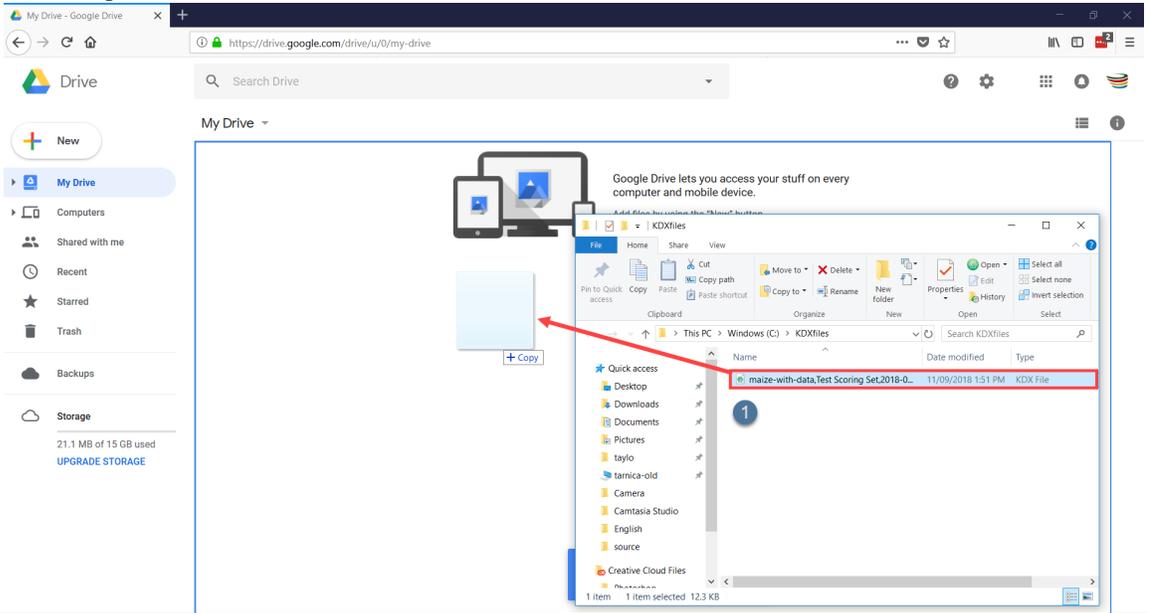


Fig. 2.29: Exporting a Scoring Set

Table 2.22: Uploading Files 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 will display (as at 3) which provides export options. Selecting the <i>Browse</i> button will allow you to choose a location on the computer to save the Scoring Set to. Ensure that the radio button for <i>KDX</i> file 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 will open and ask whether you want to open the containing directory - do this is you want to transfer the file to Google Drive right away.
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 will be a message which confirms that the upload has been completed.



Step 4 - Transferring Files into KDSmart from Google Drive

Files that have been 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.

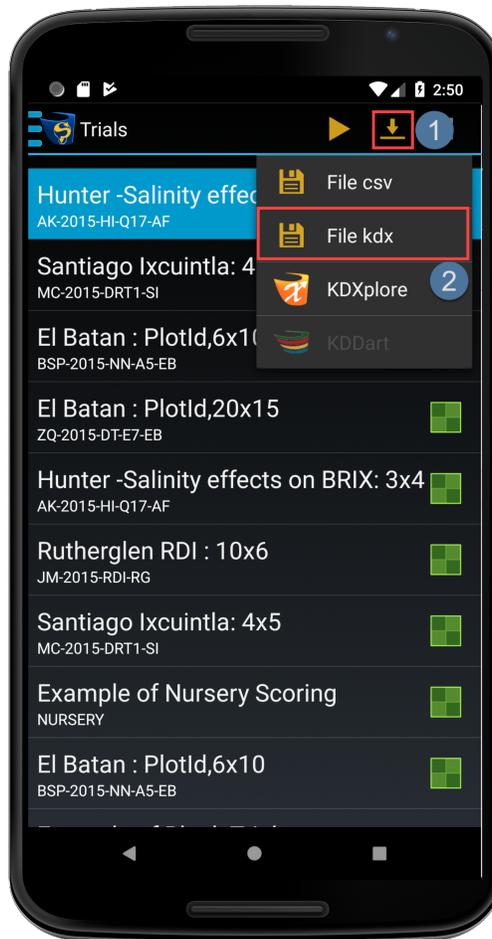
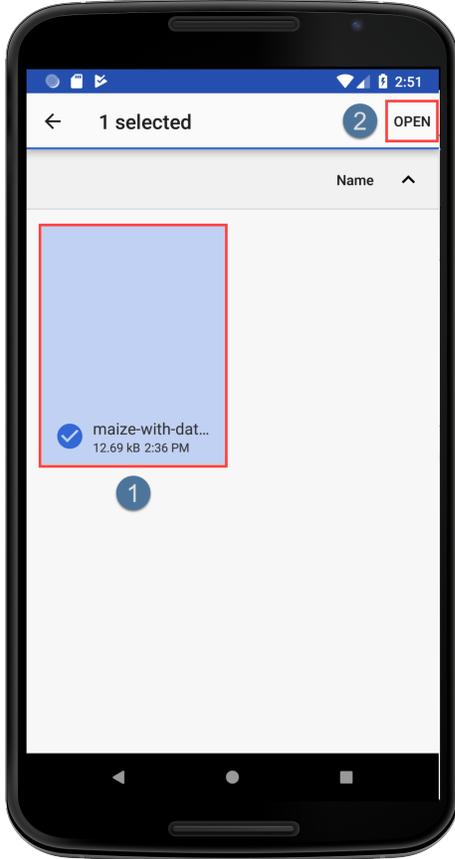
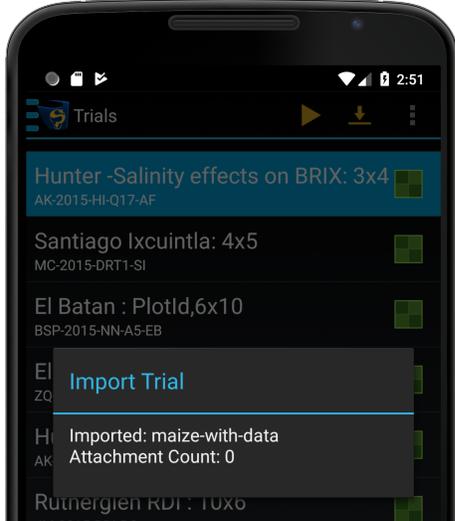


Fig. 2.31: Importing a Trial 1/3

Table 2.23: Importing a Trial 3/3

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 will open Google Drive.
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> 
4.	<p>A successful import will result in the following screen. The attachment message indicates that there are no attachments to the Trial.</p> 
2.5.	<p>KDXplore - KDSmart Data Ex</p>

Step 5 - Transferring Files from KDSmart to Google Drive

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

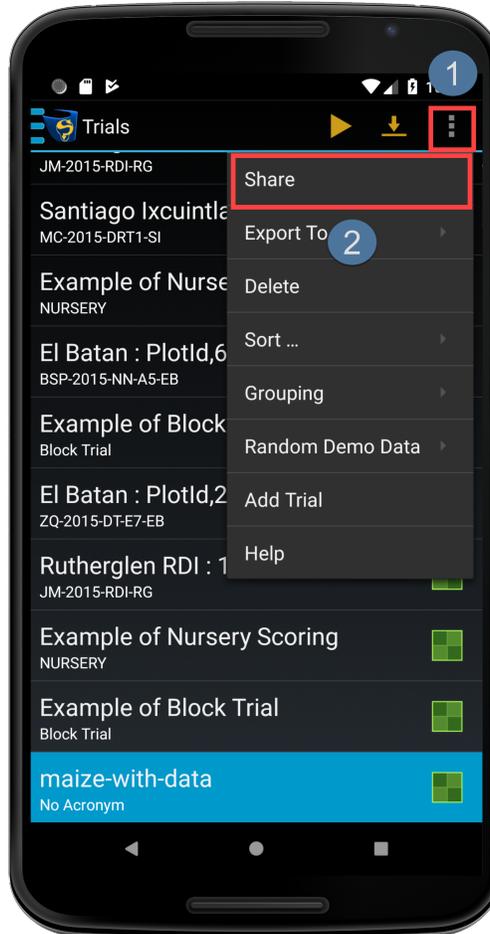
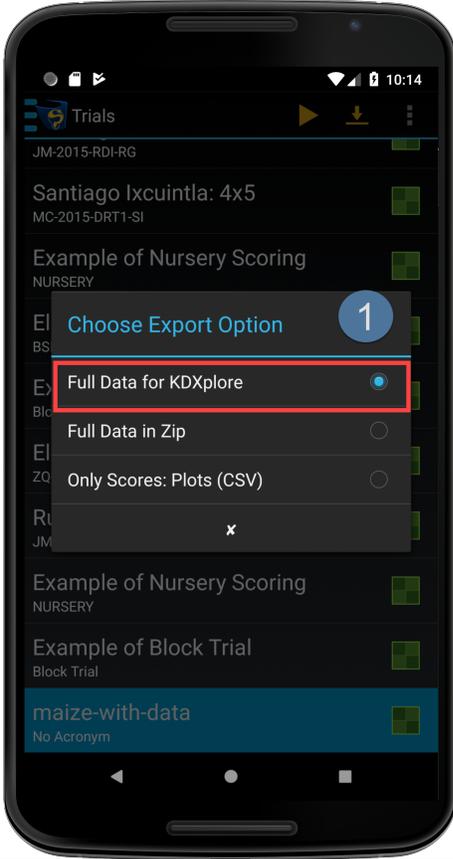
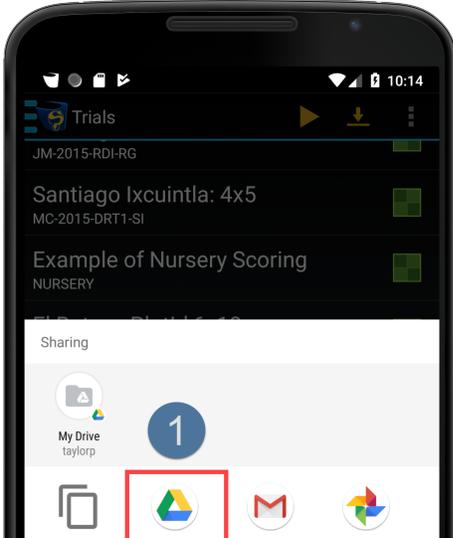


Fig. 2.34: Transferring a Trial 1/5

Table 2.24: Transferring a Trial 5/5

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

Step 6 - Transferring Files into KDXplore from Google Drive

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

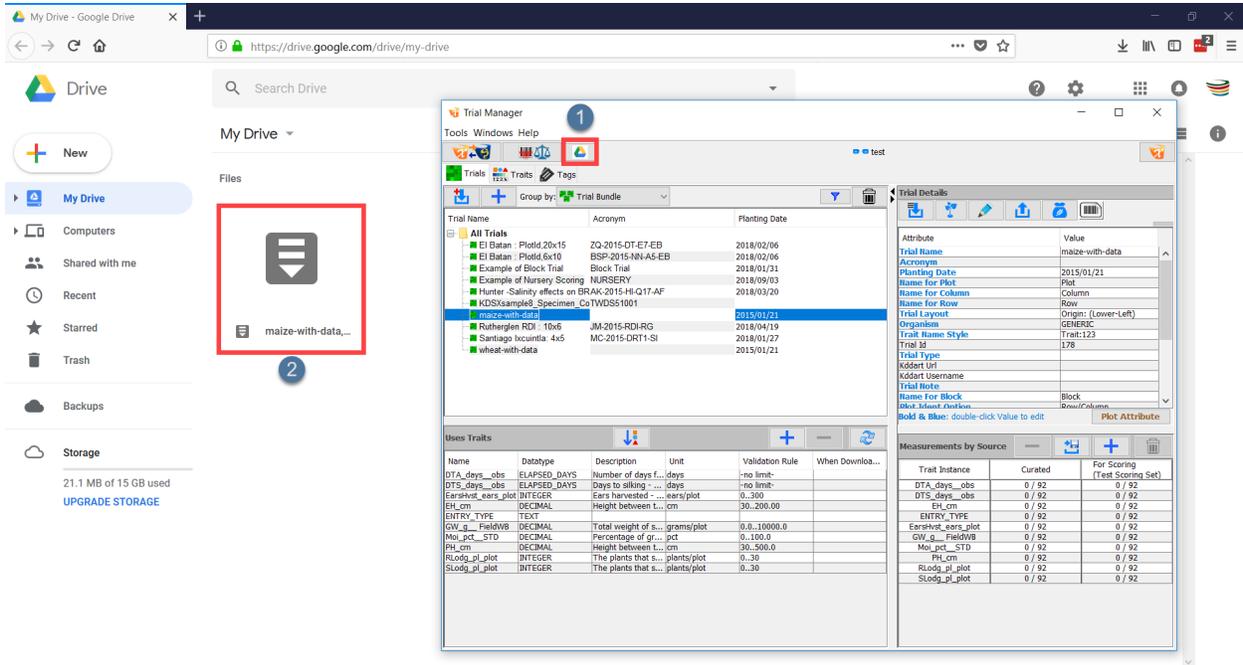
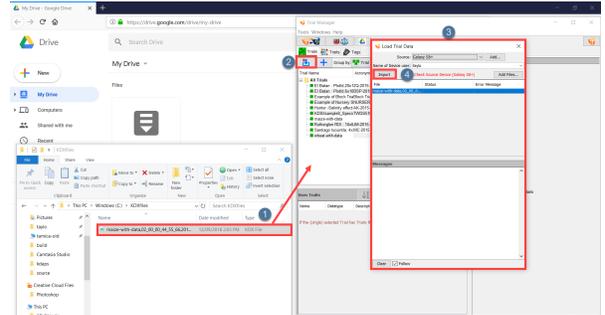
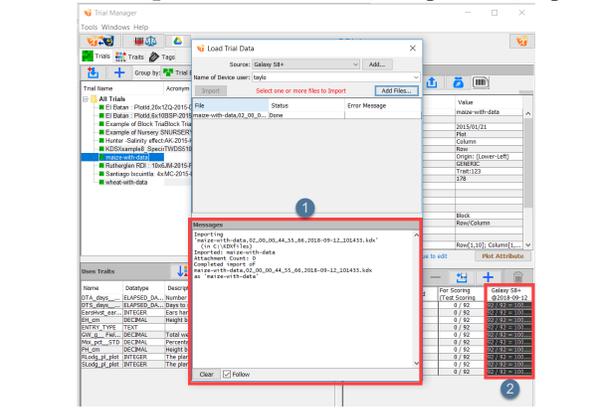


Fig. 2.39: Downloading a Trial from Google Drive

Table 2.25: Import Trial Data

Step	Action
1.	Ensure that Google Drive is opened. If it is not, then there is a Google Drive button in KDXplore which will open 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 will download the file to the default location for your browser (e.g. The Downloads folder).
3.	<p><i>Click+Drag</i> the downloaded file (such as the one 1 in the below image) to the Trials panel in KDXplore. This will display the Load Trial Data window at 3. The Download button can also be selected to display the Load Trial Data window.</p> 
4.	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> .
5.	<p>Select the Import button at 4 to complete the import.</p> 

Data Exchange - 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.

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 set up or activation of your own WiFi Hotspot without needing Administrator user access on the computer. **Before** traveling to “the field” we suggest you prepare, test and become familiarised with this means of connecting devices. Seek support in your organisation if needed.

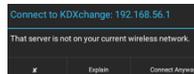


Fig. 2.42: KDSmart - WiFi Connection Warning Example

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



Trial Manager

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.

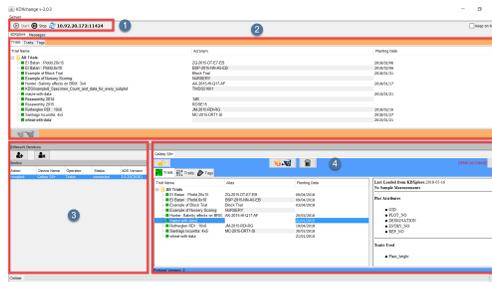


Fig. 2.43: KDXchange Main Window

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:

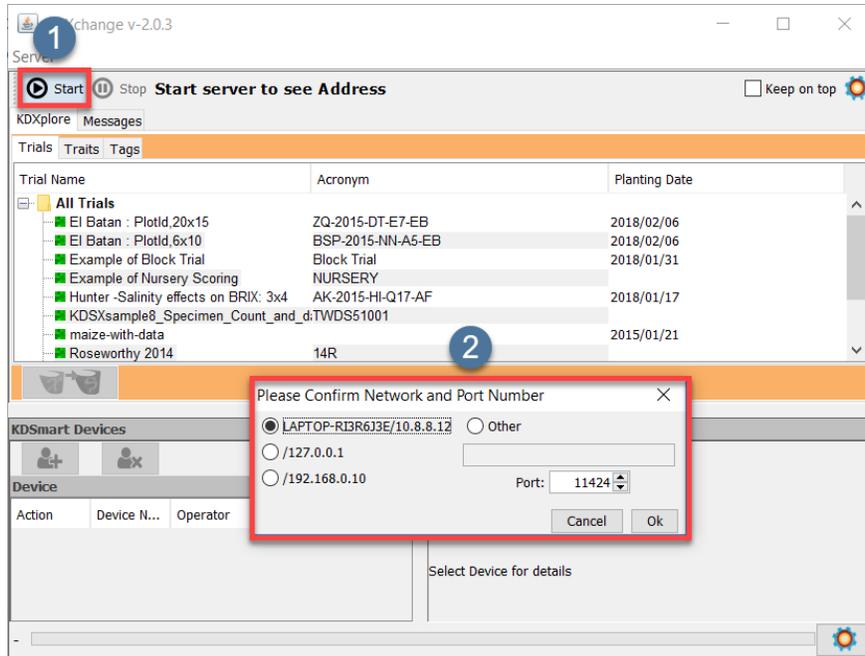
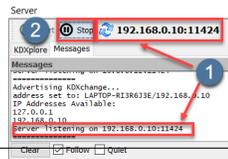


Fig. 2.44: Confirm Network/IP Address and Port number

Table 2.26: KDXchange connection to KDSmart devices

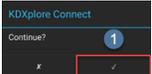
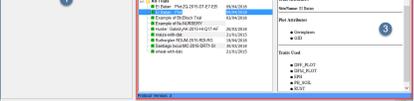
Step	Action
2.1 (KDX)	On the Laptop/PC start KDXplore and select the Trial Manager  icon.
2.2 (KDX)	Select the KDXchange Server  icon at top of the Trial Manager window to open KDXchange.
2.3 (KDX)	Select the Start button (or Shift Start to enter address and/or port number) which is located at 1 on the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



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 2.27: Allowing KDSmart devices

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).
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> 
3.3 (KDS)	<p>A dialogue box asking whether to continue will appear. Choose the <i>tick</i> at 1 to continue.</p> 
3.4 (KDX)	<p>Return to KDXplore on the PC/Laptop and at 1, the KDSmart device will 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>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>
3.5 (KDX)	<p>A dialogue box will open which will ask for information about the device as seen in the following image:</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. The KDXplore will should look like the following image:</p> 
2.5. KDXplore - KDSmart Data Exchange	 <p style="text-align: right;">47</p>

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

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.

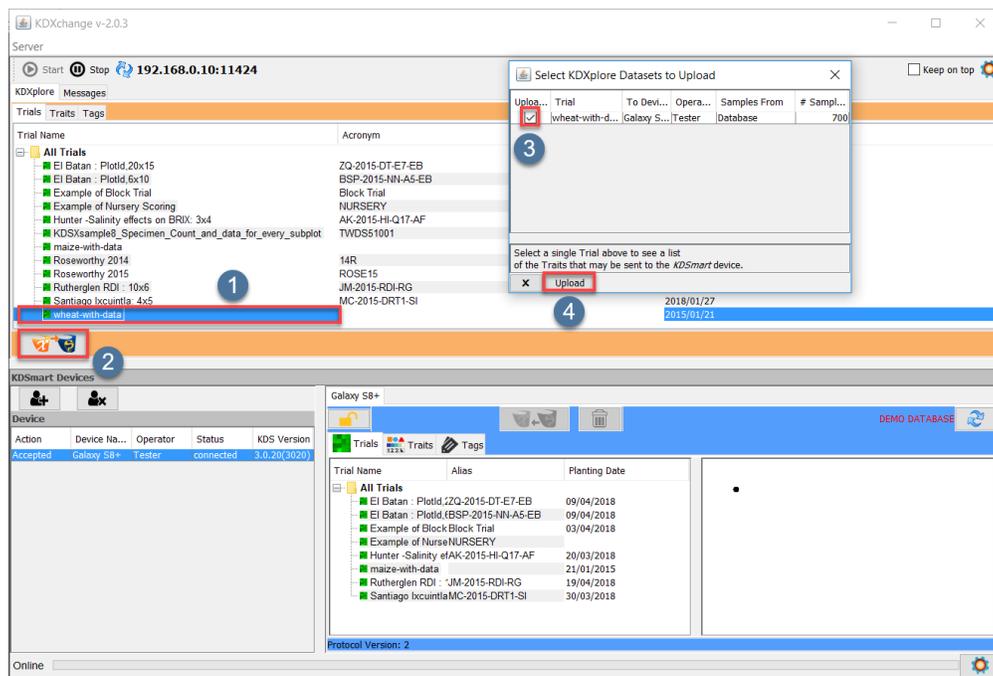


Fig. 2.51: Transfer Steps - KDXplore to KDSmart

Table 2.28: Transferring data from KDXplore to KDSmart

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. 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 will open 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 3 and then select the OK button at 4 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.

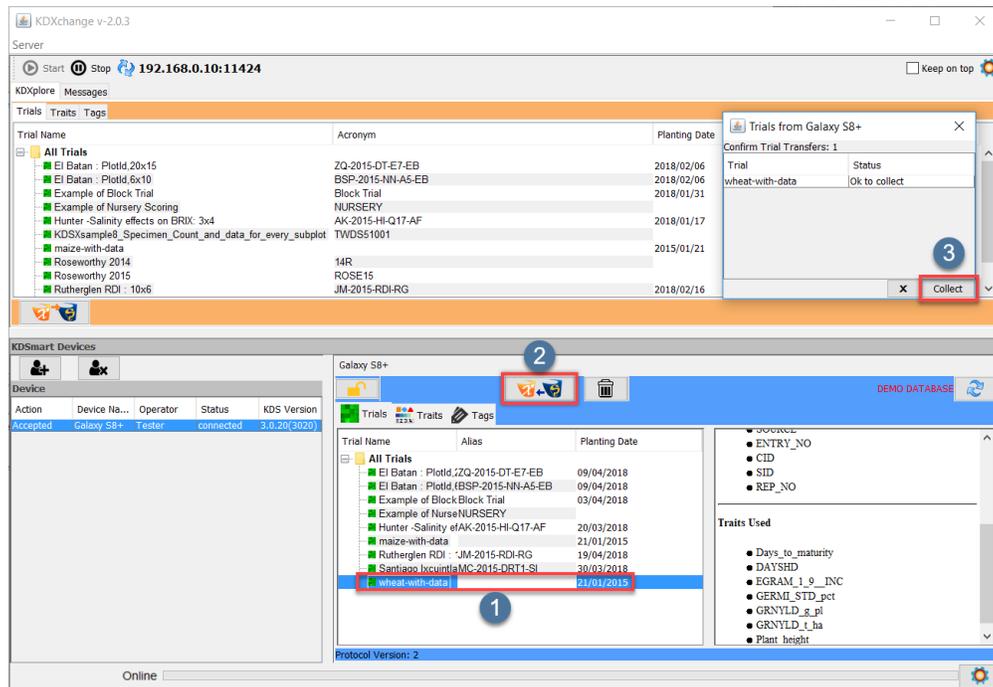


Fig. 2.52: Transfer Steps - KDSmart to KDXplore

Table 2.29: 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 will appear. Select the Collect button at 3 which will confirm the transfer and the Trial will 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. 2.53: 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. 2.54: 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.

2.6 KDSmart/KDXplore - CSV Import File Formats

To find information on importing CSV file formats, follow the link to the following KDSmart Help topic which will open in a new tab.

2.7 Curation

Curation is the aspect of Trial Manager that allows for exploration, visualisation and QC/QA checking of phenotypic data. Entering curation with a new dataset, the aim is to assess data and either accept values from a device as quality information, or to correct values potentially using another data source. This can also be done by editing values manually. The result of curation is phenotypic data that has been pushed to the offline database of KDXplore as known values for the selected Trial and for later export if wished. See below for how to access **Curation**.

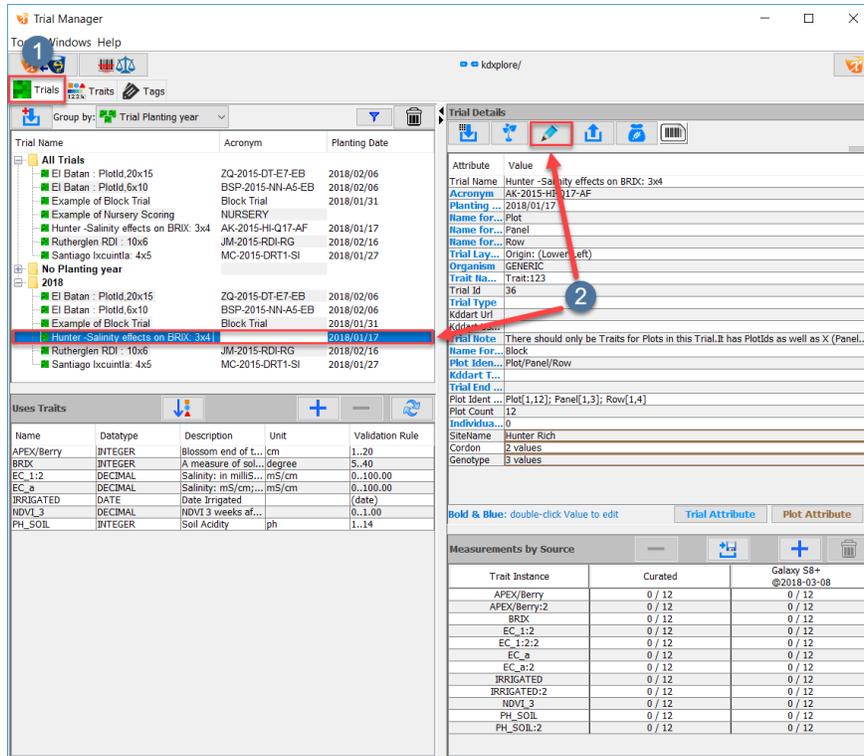


Fig. 2.55: Accessing Curation

To access **Curation**:

Table 2.30: Displaying the Curation Window

Step	Action
1	Curation can be located by entering the Trial tab of Trial manager at 1 .
2	Select a Trial by clicking on it to display the Trial information.
3	Either double-click on the Trial, or select the Edit Current Trial button at 2 to open the Curation window.

- **1 Curation Messages** panel which displays information and messages about events that are occurring in the **Curation** window.
- **2 Values** panel displays information on selected sample values and allows for the editing of values.
- **3 Plot Info & Traits** panel lists all Traits that are in the Trial and contains checkboxes that are used to select Traits that can be used in curation.
- The **Curation Samples** panel displays all information on the *selected* Traits and samples within two tables:
 - **4 Trait Instances** table lists all *selected* Traits that are included in the Trial. There is a colour associated with each Trait Instance which remains consistent across visualisation tools and highlighting.
 - **5 Curation Samples** table displays all sample measurements from *selected* Traits.

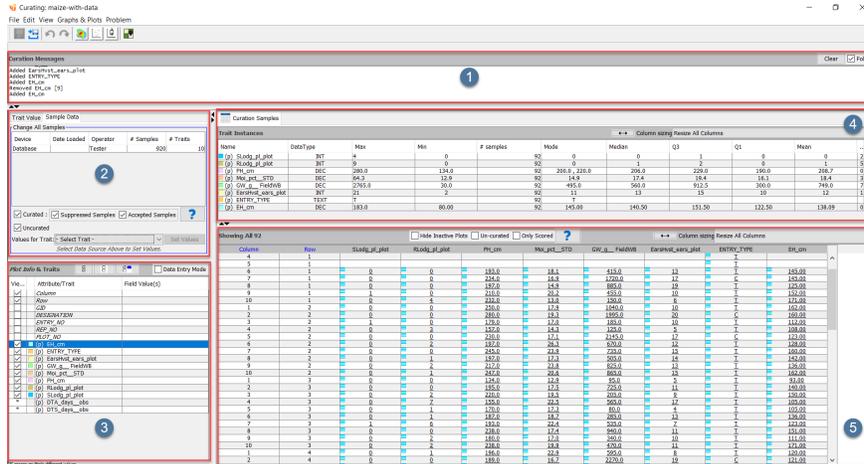


Fig. 2.56: Curation Window

2.7.1 Plot Info & Traits

The **Plot Info & Traits** panel lists all Traits that are included in the Trial that is being curated and plot information i.e. Plot numbers. The purpose of this panel is to select Traits and plot information that can be displayed in the **Curation Sample** panel. The checkboxes allow for quickly changing what is displayed to the user. Any changes to the items selected will be evident in the **Curation Messages** window. To select items, the user can:

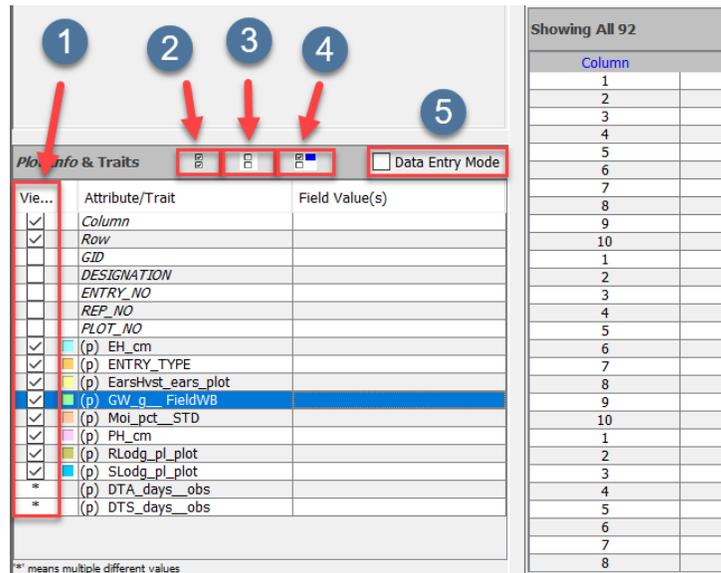


Fig. 2.57: Plot Info & Traits

To display any information about plots and Traits:

Table 2.31: Displaying the Plots and Traits Information

Step	Action
1	Select a checkbox to an associated Trait or Plot Info as represented in 1.
2	If it is desirable to choose all traits, then select the Check Traits button at 2. Plot Info can also be selected by holding down the <i>shift</i> key before selecting the button. Holding down the <i>ctrl</i> key and then selecting the button will result in <i>only</i> Plot Info to be selected.
3	The Uncheck All Traits button at 3 will uncheck all Traits that are currently chosen if it is selected. Plot Info will also be selected by holding <i>shift</i> and only Plot Info will be selected if holding <i>ctrl</i>
4	By selecting the Check Selected button at 4 will only select Traits that are highlighted.
5	The selection of the Data Entry Mode checkbox will allow the user to choose Traits that they can use for the entering of new data.
6	Once The desired Traits have been selected, they will appear in the Curation Samples panel.

2.7.2 Sample Table

Once Traits have been chosen in the **Plot Info & Traits** panel, they will appear in the **Curation Samples** panel and are displayed in both the **Trait Instances** table and the **Curation Samples** tables.

Curated Values appear in the sample table as **Bold**.

Missing Values appear as an **Empty cell**.

The example below demonstrates how to open the **Curation Samples** panel and how to use different aspects of it:

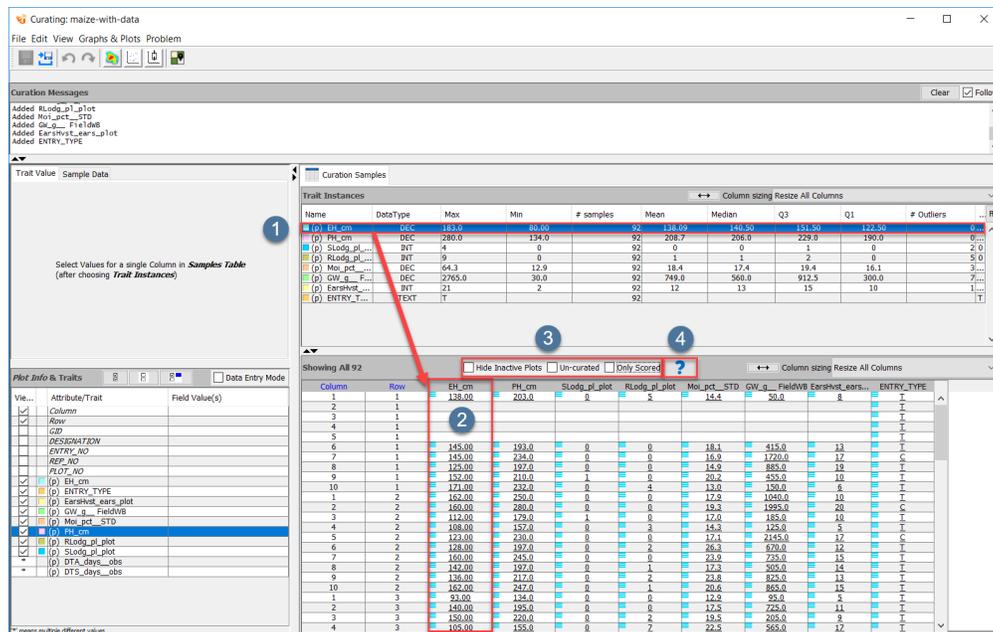


Fig. 2.58: Curation Samples

- Each Trait that appears in the **Trait Instances** table (such as the EH_CM Trait in 1) will correspond to a Trait that is in the **Curation Samples** panel (as seen in 2).

- To present information on a specific Trait in the **Curation Samples** panel, *double-click* any trait in the **Trait Instances** panel.
- The options in area **3** allow the user the choice for displaying sample information;
- **Hide Inactive Plots** allows for hiding plots which have been marked as inactive.
- **Un-Curated** will only include samples that have been curated.
- **Only Scored** displays only samples that have so far been scored.
- The **Help** button at **4** has a help guide to the **Curation Window**.
- Values that are in the database have a symbol represented by 3 blue bars (e.g. **5**). Values from devices are shown with a red corner (if no value has been selected). When there are multiple values from different sources a yellow *caution* triangle is visible in the top left corner of each cell.

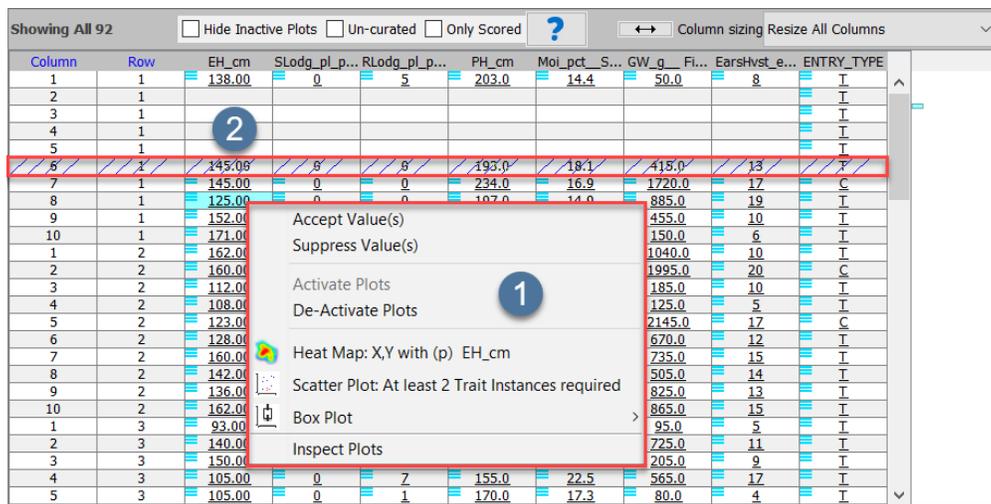


Fig. 2.59: Curation Samples

There are some options for Trait samples that are available to the user in the **Curation Samples** shown at **1** that can be reached by selecting either singular or multiple values, and then *right-clicking* the values:

- **Accept/Supress Values** will either accept values as being valid, or supress values that the user deems as invalid. If this option is chosen then a dialogue box requesting information on the reason why it has been either accepted or supressed will appear.
- **Activate Plot/Reactivate Plot** will deactivate an entire plot e.g. column 6, row 1 at **2**. Note that a deactivated plot will be 'crossed out'. Deactivated plots can be reactivated by choosing the *Activate Plot* option.
- **Heatmap/Scatter Plot/Box Plot** creates a visualisation of the selected data. More will be explained about visualisation in the future.
- **Inspect Plot** opens the **Plot Inspection** window.

Plot Inspection

The **Plot Inspection** window displays a visualisation of a comparison of selected Traits from selected plots. It is highly customisable, and can be saved as a .PNG file or printed directly from KDXplore. To access the **Plot Inspection** window, simply righ click a value or mulitple values, and choose the *Inspect Plot* option.

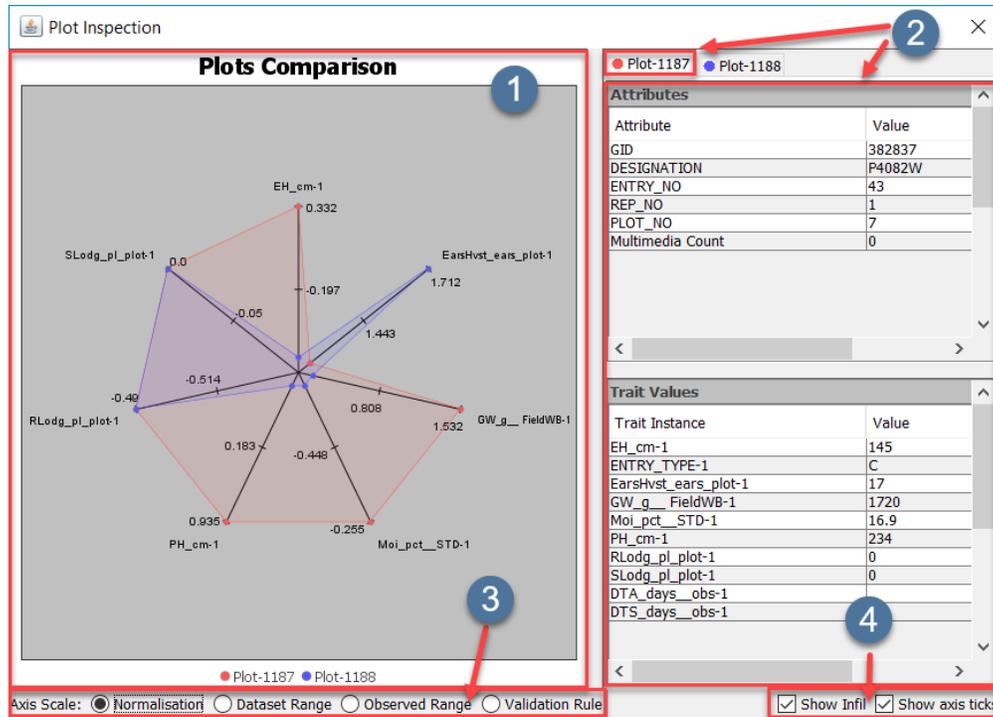


Fig. 2.60: Plot Inspection

- **1** displays the visualisation of the plot comparison. It will change dynamically as different options are chosen. By *right-clicking* this window, there will be the options to change the properties of the visualisation, zoom in/out, print the displayed image, or to save a copy.
- **2** displays the *Attributes* and *Trait Values* of the selected plot. The user can choose any other plots that are included in the visualisation but only the information of one plot can be displayed at one time.
- **3** the **Axis Scale** enables for the user to change the output of the visualisation based on varying options for the dataset e.g. the observed range of all Traits on the selected plots.
- **4** contains basic cosmetic display options.

2.7.3 Curating Measurements

One of the primary functions of the **Trial Management** module is to curate data that is collected from the field before it is uploaded to KDDart. Values can be curated in a number of different ways in KDXplore. Once a value is selected, typing a value will immediately fill the cells and this must be confirmed by pressing the *Enter* key. Values can only be curated to values included by their validation rules, E.g. for EH_CM with a validation rule of (30...200). KDXplore will not let the user choose values that are below 30 or above 200. Simple statistics can be displayed when there are multiple sample sources for the selected measurements. These statistics are displayed in the **Trait Values** panel.

Single-Selection Curation

The most simple way to curate Trial data is to curate a single value. The examples below demonstrates how to curate a single measurement.

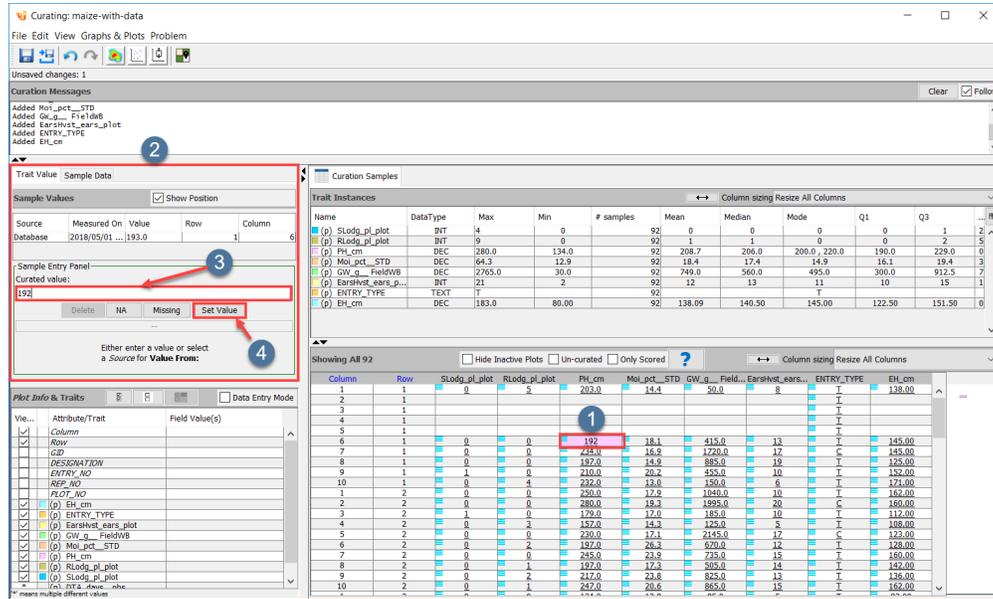


Fig. 2.61: Curation of a Single Sample

Curating a single measurement can be done by:

Table 2.32: Single Selection Curation

Step	Action
1	Select a single measurement such as the one at 1 . This will display the measurement information in the Values panel at 2 .
2	Enter the new value into the text-field at 3 . You will be able to see that as you type this value, the corresponding value in the Trait Instances panel will also change in real time.
3	It will not be set permanently until you select the Set Value button at 4 .

All previous changes and edits are listed in the **Values** panel as seen below:

If the user would like to make a change to a previous edit, then they can choose that particular section and edit that e.g. If a value is set to missing and then the curation is saves, there is no option to *undo* the changes in values. In this situation, the user can select the particular edit such as **1**, and then *delete* the change (at **2**) which will revert the sample value to its original value.

Multi-Selection Curation

The **Value** panel also has the functionality of displaying multiple samples at once. This allows for the selection of multiple samples to curate at once and can make curation of multiple samples easier and more efficient.

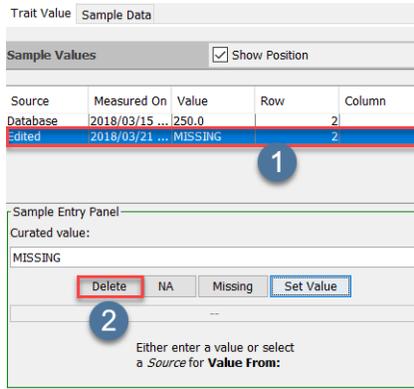


Fig. 2.62: Changing a Curation Edit

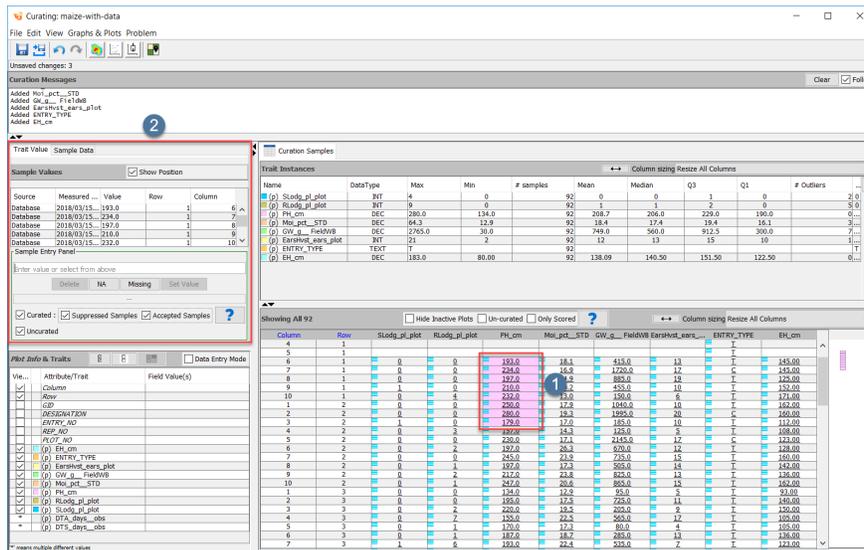


Fig. 2.63: Curation of Multiple Samples

In the above image, the user has selected multiple samples in **1** and they are all displaying in the **Values** panel in **2**. Samples are curated the same as in *Single-Selection Curation*, however there are additional display options such as the ability to display/not display *curated* and *un-curated* values.

Trial-Wide Curation

Specific Trait instances can be curated across the entire Trial. The below example provides an example of how to access this function.

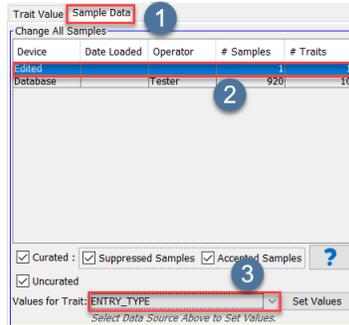


Fig. 2.64: Curating All Values of Trait Instances

Navigating to the **Sample Data** tab of the sample editor panel seen in area **1**, the dataset available for the trial can be seen. By selecting a dataset that is not the database set such as in **2**, sample measurements for one, or multiple selected Trait instances can be curated for the entire trial. Select the Trait instance or option by using the drop down seen in area **3**.

Warning: If changes to samples are made, then they need to be saved which can be done when exiting the **Curation** window and or by choosing the **Save** button at the top of the window.

2.7.4 Accepting/ Suppressing Measurements

A quick and simple way of curating measurements is by *accepting* or *suppressing* values. It will be necessary to *accept* values if there are measurements from multiple devices in the dataset. The *accepting* is the choice of one of the values as the correct one and *suppressing* a value marks it as the incorrect value.

This can be done by *right-clicking* on a sample as in **1** and then either choosing *Accept Values(s)* like in **2** or *Suppress Values(s)* as in **3**. This will open a dialog (as seen below) where the sample source can be *accepted* or *suppressed*. This is where you select a device (or data source) from the drop-down menu.

Accepting a measurement

Suppressing a measurement

Values can also be accepted from visualisation tools, as seen below. Specific visualisation tools are covered in the following sections.

Column	Row	SLodg_pl_plot	RLodg_pl_plot	PH_cm	Moi_pct_STD	GW_g	FieldWB	EarsHvst_ears...	ENTRY_TYPE	EH_cm
1	1	0	5	203.0	14.4	50.0	8		I	138.00
2	1								I	
3	1								I	
4	1								I	
5	1								I	
6	1	0	0	193.0	18.1	415.0	13		I	145.00
7	1	0	0	234.0	16.9	1720.0	17		C	145.00
8	1	0	0	197.0	14.9	885.0	19		T	125.00
9	1	1	0	210.0	20.2	455.0	10		T	152.00
10	1	0	4	232.0	13.0	150.0	6		T	171.00
1	2	0	0	250.0	17.9	10				
2	2	0	0	280.0	19.3	19				
3	2	1	0	179.0	17.0	18				
4	2	0	3	157.0	14.3	12				
5	2	0	0	230.0	17.1	21				
6	2	0	2	197.0	26.3	67				
7	2	0	0	245.0	23.9	73				
8	2	0	1	197.0	17.3	50				
9	2	0	2	217.0	23.8	82				
10	2	0	1	247.0	20.6	86				
1	3	0	0	134.0	12.9	9				
2	3	0	0	195.0	17.5	72				
3	3	0	2	220.0	19.5	20				
4	3	0	7	155.0	22.5	56				
5	3	0	1	170.0	17.3	80				

Fig. 2.65: Accepting or Suppressing Measurements

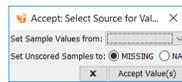


Fig. 2.66: Accepting Sample Measurements From Curation Table

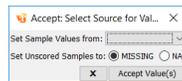


Fig. 2.67: Suppressing Sample Measurements From Curation Table

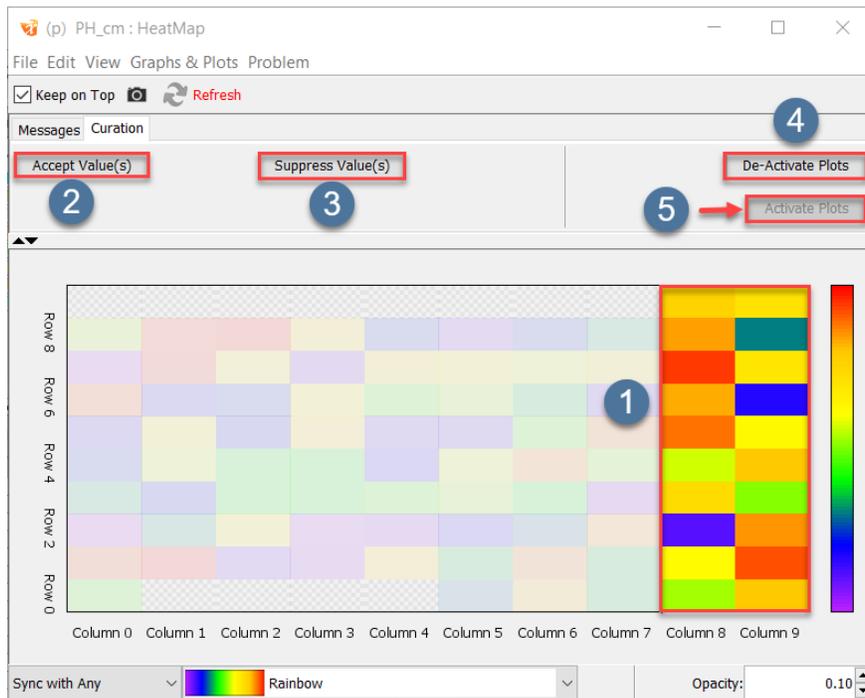


Fig. 2.68: Accepting Sample Measurements From Visualisation Tools

Note: if there is no sample source for values the curated values of cells will be changed to **MISSING**.

2.7.5 Saving Measurements

Any changes made to Trial data in the **Curation** window will need to be saved to take effect. When sample measurements are curated in KDXplore they do not become the “database” value for that plot until they are saved. Before exiting curation, if changes have been made a dialog will appear confirming exit-without-save. All device measurements will still remain once curation is complete.

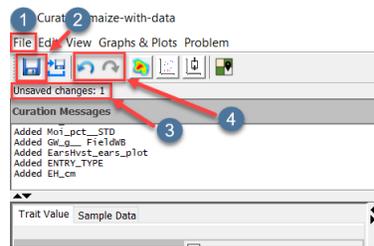


Fig. 2.69: Saving Sample Measurements

Accepting sample measurements from visualisation tools

Select the **Save** button at **2** to save the curated values into the KDXplore offline database. Measurements can also be saved by selecting the **File** option at **1**. The **Curation** window also displays the amount of changes that have been made in **3** which can inform the user as to whether they need to save or not. The **Undo/Redo** buttons at **4** allow changes to be undone or redone.

2.7.6 Curation Export

Data from Trials can be exported from KDXplore through the *Curation Export* function. This allows for data to be more easily curated in the **Trial Management** module and then exported as a file so that it can be shared with other devices. The image below provides an example of how data might be exported.

Curated data can be exported by:

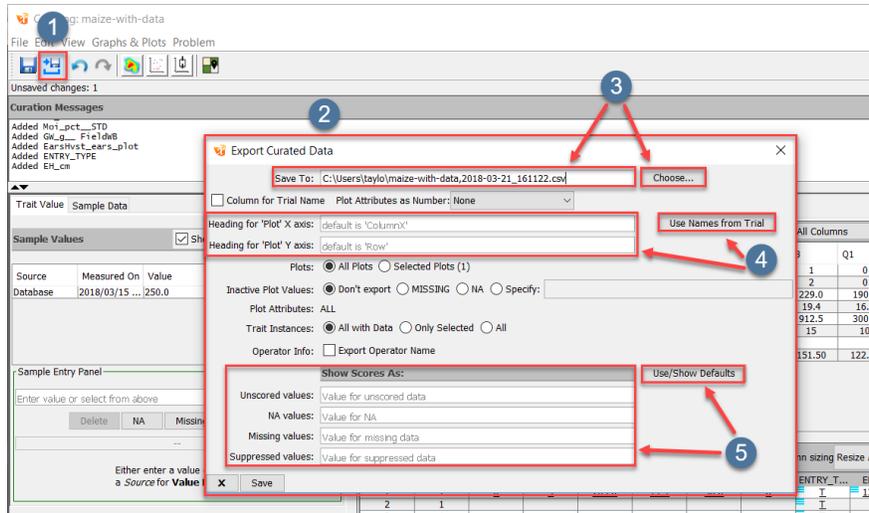


Fig. 2.70: Exporting Sample Measurements

Table 2.33: Exporting Curated Data

Step	Action
1	Select the Export button seen in area 1 . This will open the Export Curated Data window as seen at 2 .
2	Either enter a desired file path into the text-field, or select the Choose button in 3 to choose a location for the exported data.
3	Choose a name for both the <i>X Axis</i> and <i>Y Axis</i> in 3 . The default name for these axes are <i>Column</i> and <i>Row</i> , and by choosing the Use Names From Trial button will allow the user to set their own names for these axes to the exported data.
4	Determine the options for: <ul style="list-style-type: none"> • Plots - Whether to export all plots or only selected plots. • Inactive Plot Values - How the export will treat inactive plots. • Plot Attributes - Shows that all plot attributes will be exported. • Trait Instances - Whether to export only Trait instances with data, those that are selected, or all. • Operator Info - The choice to export the name of the Operator e.g. Tester
5	The area in 5 allows for setting particular values when exporting. The Use/Show Defaults button will set the default value for each field e.g. the <i>Missing Values</i> field will be set to <i>MISSING</i> .

2.7.7 Show Outliers

The ability to display outliers in data measurement will enable the user to determine possibly incorrect or notable measurements. The example below demonstrates how to display outliers for a particular Trait.

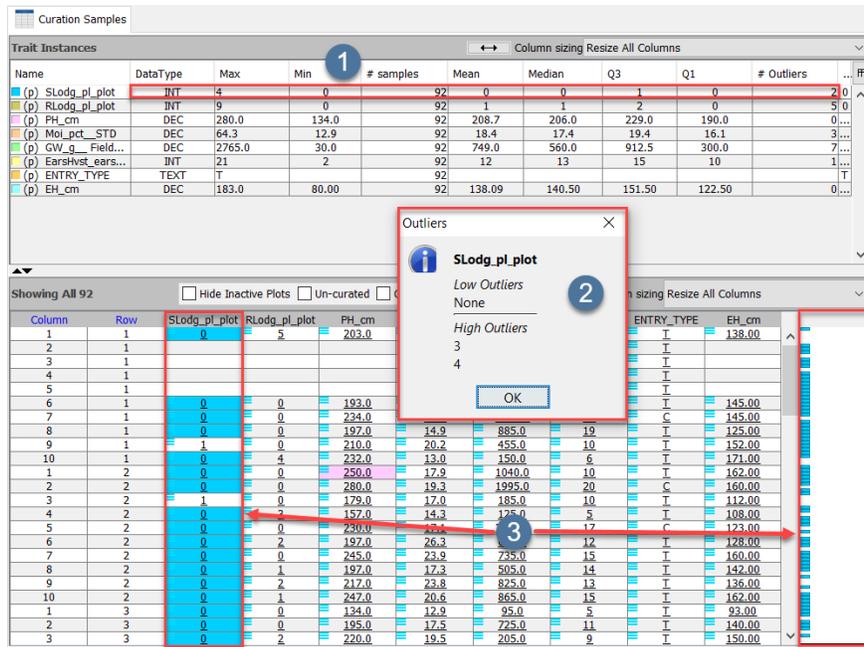


Fig. 2.71: Displaying Outliers

This can be done by:

Table 2.34: Showing Outliers

Step	Action
1	Right-clicking a trait in the Trait Instance table (i.e. 1), the option to Show Outliers can be selected from the menu.
2	Selecting this will display the values of outliers in a dialogue that is opened at 2. It will also highlight the outlier measurements in the Curation Samples table and visualisation tools at 3.

2.8 Visualisation Tools

KDXplore's Trial Management Module provides users with a variety of data visualisation options.



Fig. 2.72: Curation Options

Visualisations for Trait Instances can be generated from both **Trait Instance** tables, the **Curation Sample** table, or from the tool bar at the top of the **Curation** window. Simply *right-click* a Trait Instance in the **Trait Instance** table

or a group of samples in the **Curation Sample** and select the intended action e.g. Heat map. The following examples will detail the steps for creating each type of visualisation.

2.8.1 Heat Map

The Trial Management Module can create a *Heat-Map* which is a representation of the experiment data that is displayed as varying colours.

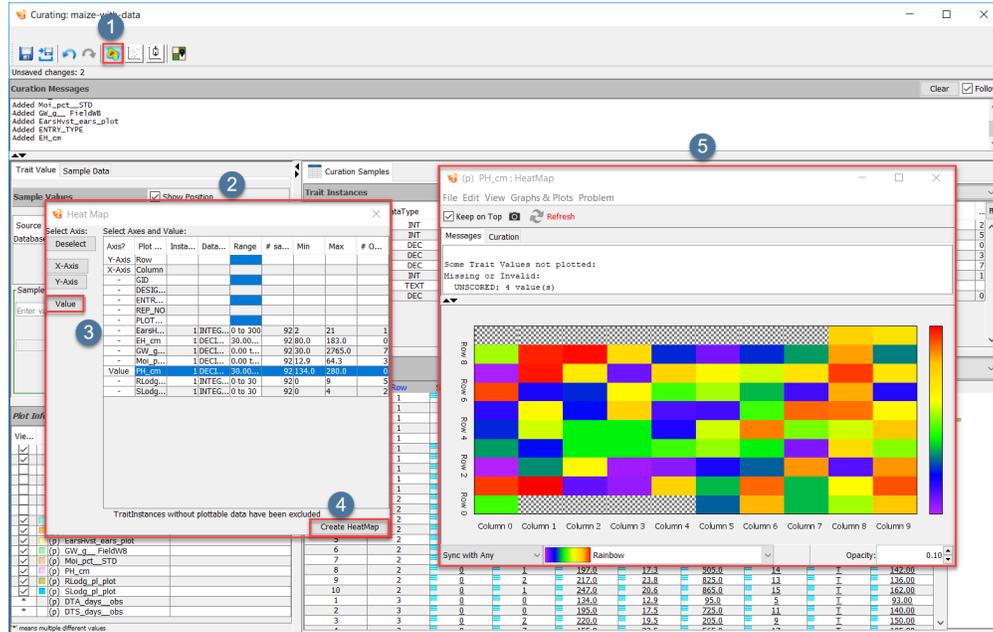


Fig. 2.73: Heat Map Generation

To generate a heat map:

Table 2.35: Generating Heat Maps

Step	Action
1	First select the Heat Map button at 1 . This will display the Heat Map window at 2 .
2	Select both the axes and a value to display. The axes are set to the X and Y axis (which in this case are the <i>Column</i> and <i>Row</i>) by default. Select a trait instance and then the Value button at 3 .
3	Once the desired values have been chosen, select the Create Heat Map button at 4 .
4	This will display the heat map in a separate window at 5 .

2.8.2 Scatter Plot

The Trial Management module also has the function of creating a *Scatter Plot* to represent experiment data.

To begin creation of a scatter plot:

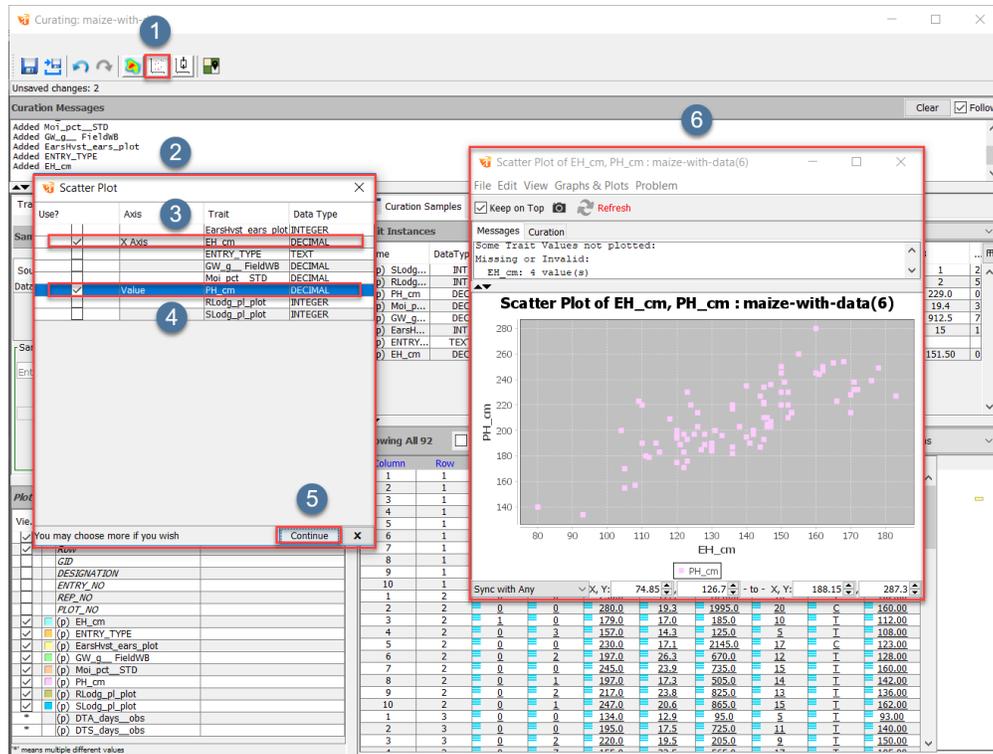


Fig. 2.74: Scatter Plot Generation

Table 2.36: Generating Scatter Plots

Step	Action
1	Select the Scatter Plot button at 1. This will display the Scatter Plot window at 2.
2	The first checked Trait Instance will be the X-value in the to-be-generated scatter plot. Multiple Trait Instances can be plotted to the same plot by selecting multiple value instances. In the example above, the value <i>EH_CM</i> was chosen first at 3 so it was automatically defined as the X-axis. The next value to be chosen was the <i>PH_CM</i> at 4.
3	Once the desired Traits have been chosen, select the Continue button at 5. The scatter plot will be generated and displayed as in 6.

2.8.3 Box Plot

Another graph that can be created is the *Box Plot*.

To begin creation of a box plot:

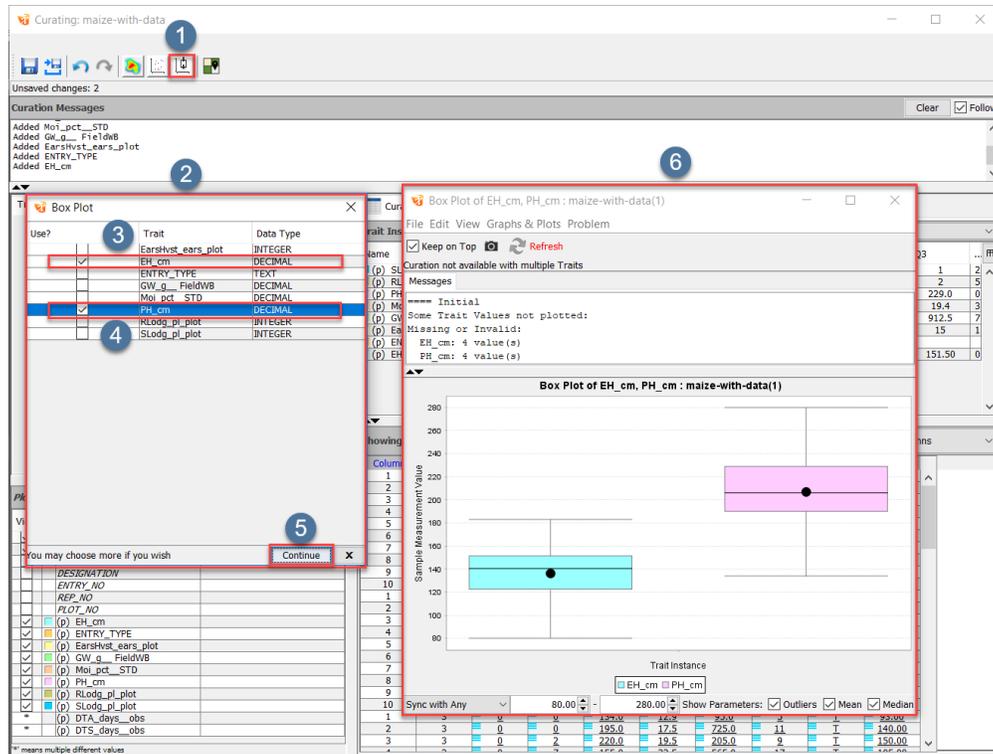


Fig. 2.75: Box Plot Generation

Table 2.37: Generating Box Plots

Step	Action
1	Select the Box Plot button at 1. This will display the Box Plot window at 2.
2	The first checked Trait Instance will be the X-value in the to-be-generated box plot. Multiple Trait Instances can be plotted to the same plot by selecting multiple value instances. In the example above, the value <i>EH_CM</i> was chosen first at 3 so it was automatically defined as the X-axis. The next value to be chosen was the <i>PH_CM</i> at 4.
3	Once the desired Traits have been chosen, select the Continue button at 5. The box plot will be generated and displayed as in 6.
4	Outliers, mean and median can all be seen on plot and deactivated using the check boxes at the bottom of the Box Plot window.

2.8.4 Field View

The *Field View* allows the user to have a top-down view of a grid which represents the plots of the experiment. The following image details steps for opening *Field View*.

To open the **Field View** window:

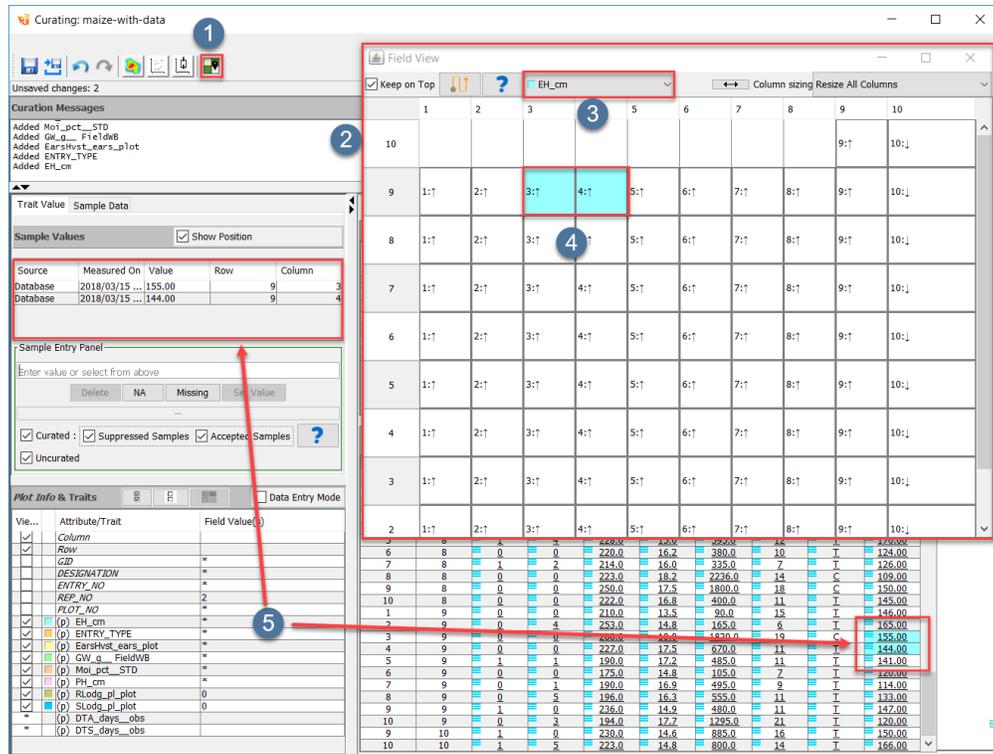


Fig. 2.76: Field View

Table 2.38: Opening the Field View Window

Step	Action
1	Select the Field View button at 1 and then choose the <i>Field View</i> option. This will open the window at 2 .
2	The user can select a Trait Instance to display at 3 .
3	By selecting specific plots as in the ones at 4 , the user will be displaying these plots in the Values panel and the Curation Samples table as seen at 5 .

KDXPLORE CURATION OVERVIEW

Topics covered in this section:

- *KDXplore Curation Overview*
 - *Main Curation Window*
 - * *Field Overview*

3.1 Main Curation Window

Table 3.1: KDXplore Curation Window Components

1	<p>Selecting in the <i>HeatMap</i> shows them in the <i>SamplesTable</i> and vice-versa.</p> <p>Selection of data points in a <i>ScatterPlot</i> or a region of a <i>BoxPlot</i> will also select the corresponding rows in the <i>SamplesTable</i>. This is done by clicking the mouse and dragging in these tools.</p>
2	<p>The selected also show as coloured markers next to the table's scroll-bar.</p>
3	<p>The <i>Plot Type</i> can be selected in the <i>HeatMap</i> and is drawn with a "cross" overlay in the <i>HeatMap</i>.</p>
4	<p><i>Inactive</i> or "De-activated" are drawn with a diagonal overlay in both the <i>HeatMap</i> and the <i>SamplesTable</i> (and also the main <i>FieldView</i>).</p> <p>You can hide the <i>Inactive</i> by using the "Hide Inactive Plots" checkbox in the heading above the <i>SamplesTable</i>.</p>

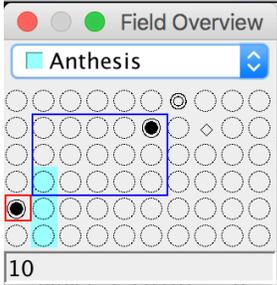
3.1.1 Field Overview

The *Field Overview* is activated using the icon in the top left corner of the *FieldView*.

The following table describes the different symbols which show the status of each **Plot**:



Fig. 3.1: Curating Data Example

	Definition	
(blank)	No	
	Deactivated	
	No Trait Instance selected	
	Value is from Database	
	Not yet curated (click to see value)	
	Curated (click to see value)	
	Curated value set as MISSING	
	Curated value set as NA	
	No measurements available	
? or -	Internal Error (please report)	
	<p>Blue rectangle indicates the visible part of main <i>FieldView</i></p> <p>Blue shaded are those that were selected in the <i>FieldView</i> or <i>Sample Table</i>.</p> <p>Click on a to show current value (the marked with red)</p> <p>Double-click a to move <i>FieldView</i> to show that</p> <p>The dropdown at the top of the <i>Overview</i> is the same as <i>Trait</i> dropdown</p> <p>In <i>FieldView</i> as changing it causes the "active" to be changed.</p>	

KDXPLORE GENXPLORE

• **Topics covered in this section:**

- *KDXplore GenXplore*
 - *Getting Started*
 - *Connecting to Database*
 - *Searching for Genotypes*
 - *Genotype Table*
 - * *Making a new Germplasm list*
 - *Genotype Information*
 - * *Exporting to CSV*
 - * *Exporting to Helium*
 - *Genotype Genealogy Tree*
 - * *Changing Genealogy Tree Depth*
 - * *Genealogy Tree options*
 - *Genotype Cross Information*
 - *Genotype Trait Information*
 - *Cross Designer*
 - * *Rank and Expected Crosses*
 - * *Punnet Square Crosser*
 - *What To Do With Generated Progeny*

4.1 Getting Started

GenXplore allows Specimen and Pedigree data to be explored for searched Genotypes. From GenXplore the database can be queried on the basis of different search criteria for certain individuals (Genotypes).

After searching genotypes pedigree, detailed parentage information, cross information and phenotypic information can be viewed.

GenXplore is also aimed at cross design which can be performed after a list of individuals is created. When a cross is designed in GenXplore the user will be warned if the cross has already been made.

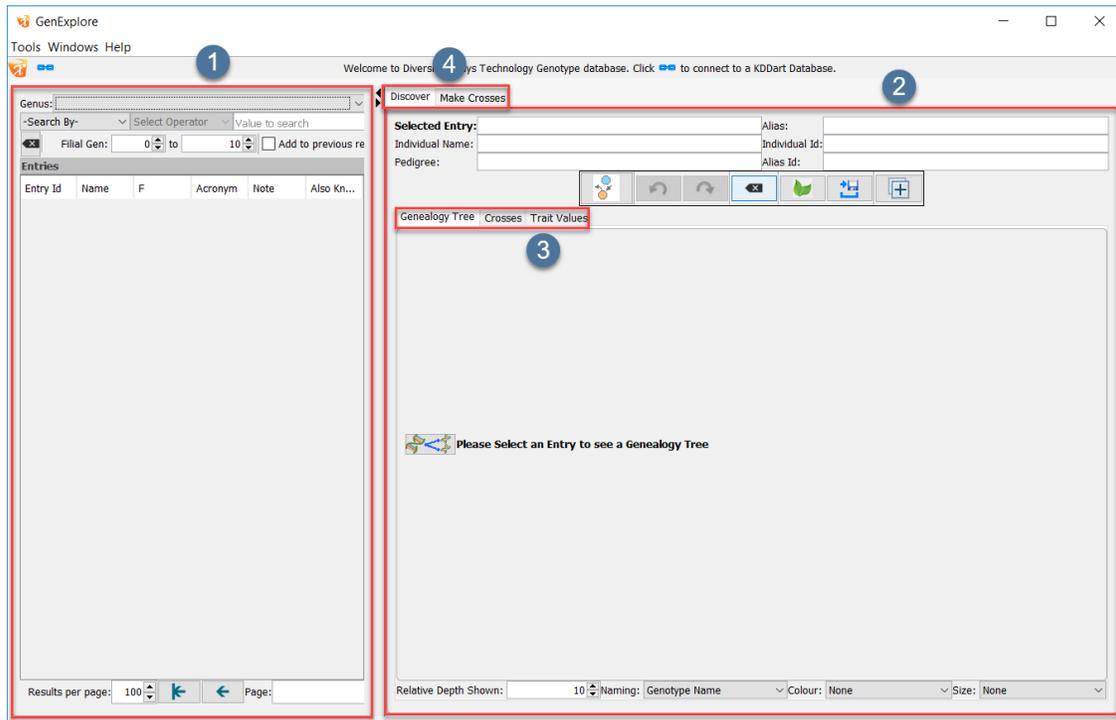


Fig. 4.1: Navigating to GenXplore from the Home Screen

Table 4.1: Tour of the GenXplore Window

Step	Action
1	From the main KDXplore main window, select the GenXplore  button to display the GenXplore home screen.
2	The Search panel at 1 contains search controls at the top.
3	The Genotype Information panel is located on the right-hand side at area 2 . The topmost fields become populated when Genotypes are searched.
4	The tabs at 3 change the display from Genealogy Tree, Crosses and Trait Values.
5	The tab at area 4 is used to navigate to the Crossing panel which is illustrated in the next image.

4.2 Connecting to Database

When the laptop/pc has a network connection KDXplore can login to KDDart. Login requires:

- The URL for the database;
- A valid User Name and Password; and

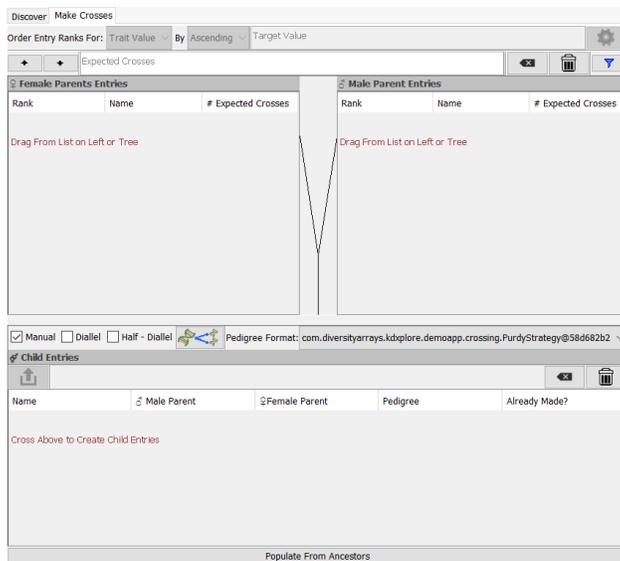


Fig. 4.2: GenXplore Crossing Panel

- The Group Name, if applicable.

The following image shows the GenXplore window and the login steps are described below:

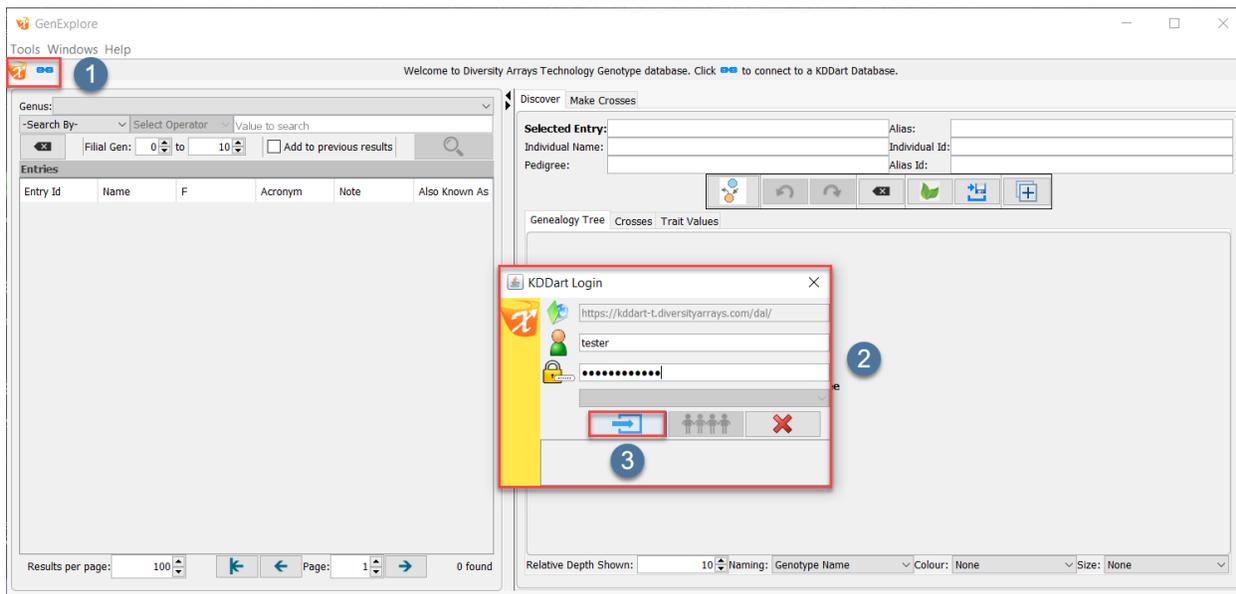
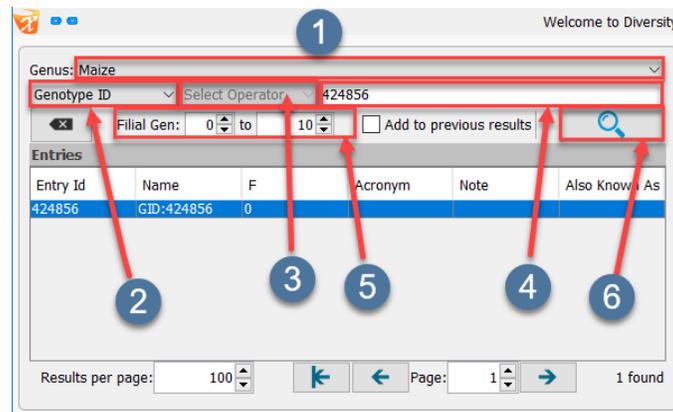


Table 4.2: Connecting to a database

Step	Action
1	To connect to a database in GenXplore click the button seen at 1 .
2	This will open a login dialog 2 .
3	Enter the database URL in the first field (or select from the drop down of previous database URLs), then the username and password. Choose a login group (if applicable) from the fourth field drop down menu.
4	Select the login button 3 to login.

4.3 Searching for Genotypes

After a database connection is made Genotype searches can be performed as outlined next.



Searching Genotypes with GenXplore

Table 4.3: Searching for Genotypes

Step	Action
1	Select the genus to search for from the Genus drop down menu 1 . This will populate with all genus's available when a database is connected.
2	Select the search criteria from the drop down menu 2 .
3	Select the search modifier for the criteria chosen from the drop down 3 . In this example, there are no other options so choose so the area is <i>greyed out</i> .
4	Enter the search term in the field at 4 . Using the example, the search is for the genotype ID '424856'.
5	Filial generation of results shown can be adjusted at 5 .
6	Once search parameters have been set, select the Search button or press <i>Enter</i> 6 .

Searched results will be shown in the table below the search controls. This is explained in the following section.

4.4 Genotype Table

All Genotypes can be searched in the **Search** panel. The instructions below demonstrate how to search for a Genotype by *Genotype ID*.

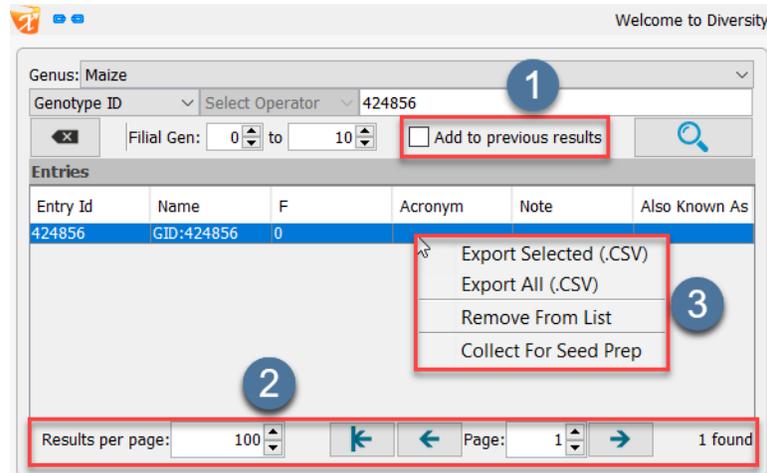


Fig. 4.3: Genxlore Genotype Table Showing Search Results

Table 4.4: Displaying Search Results

Step	Action
1	The Search panel displays the search results. The columns appearing are user configurable with the default display showing: Id, Name, Acronym, Note, Filial generation (F), and Alias (“Also known as”).
2	Navigation of search results is by <i>Page</i> using the controls in area 2 where the <i>Results per page</i> setting can be adjusted.
3	Search results can be accumulated by selecting the <i>Add to previous results</i> checkbox at 1 .
4	Selecting a search result 3 will display <i>Genotype Information</i> in the right panel. Selecting the search result with the Right mouse button will reveal a menu as illustrated. Results may be removed from the displayed table; selected rows can be exported to .CSV file; or collected to prepare for Seed Prep/Trial Design (See Trial/Nursery Design in section SECTION NUMBER for more information).

4.4.1 Making a new Germplasm list

The GenXplore module has the ability to collate Genotypes into lists that can be created and edited by the user. These lists allow for easier and more efficient analysis of specific Genotypes. The below instructions detail how to use search results to create a new Germplasm list:

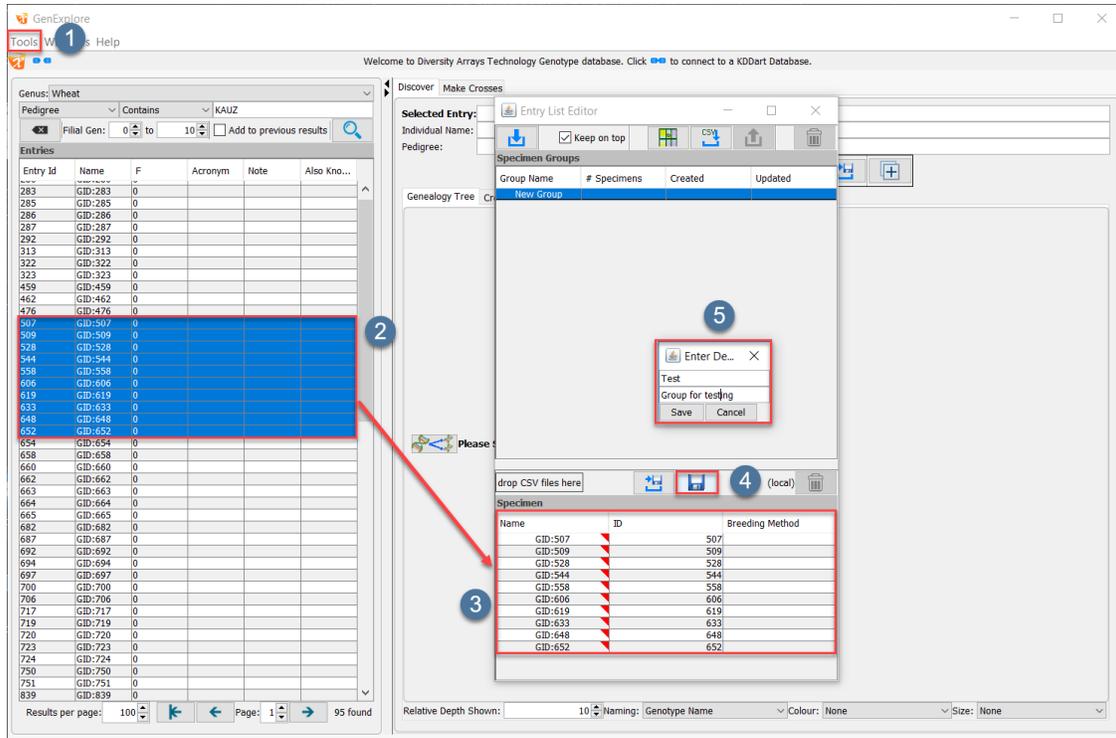


Fig. 4.4: Creating A New Germplasm List

Table 4.5: Creating A New Germplasm List

Step	Action
1	To create a new Germplasm list, select the Tools menu at 1 and choose the <i>Entry List Editor</i> option. This will open up the Entry List Editor window.
2	Select entries such as the ones selected in 2 and <i>click and drag</i> the selected entries to the Entry List Editor's Specimen List panel in 3 .
3	Select the Save button at 4 which will bring up the Enter Details window at 5 .
4	Enter the details and select Save to create a new Germplasm List.

Note: After a new list is prepared it, can be saved as a specimen group, used in Trial design (see **SECTION NUMBER**) or exported.

4.5 Genotype Information

Genotype information for the selected search result, from the *Genotype table* is displayed in the fields at **1** in the below image:

Viewing Genotype Information

Discover Make Crosses

Selected Entry:	<input type="text"/>	Alias:	<input type="text"/>
Individual Name:	<input type="text"/>	Individual Id:	<input type="text"/>
Pedigree:	<input type="text"/>	Alias Id:	<input type="text"/>

1        

Genealogy Tree Crosses Trait Values

 Please Select an Entry to see a Genealogy Tree

Relative Depth Shown: 10 Naming: Genotype Name Colour: None Size: None

The **Tool Bar**, appears below the Genotype information fields which operate as follows:

Table 4.6: Buttons

Button	Response
 Genealogy Tree Build	Collects the parentage, cross and phenotypic data for the selected genotype.
 Previous	Navigate to the previous Genotype.
 Next	Navigate to the next Genotype.
 Clear	Clears the selected entry.
 Export to Helium	Exports or imports data with Helium.
 Export	Exports data.
 Expand	Opens the Genotype Information panel in a separate window.

4.5.1 Exporting to CSV

The following steps will demonstrate how to export Genotype Information to a CSV:

Table 4.7: Exporting Genotype Parentage Information To CSV

Step	Action
1	Select the Collect Genotype Information button  to collect information for the selected genotype.
2	Next, select the CSV export/import button  and select the Export option.
3	Select the file location and select Save .

4.5.2 Exporting to Helium

The following steps will demonstrate how to export Genotype Information to Helium:

Table 4.8: Exporting Genotype Parentage Information To Helium

Step	Action
1	Select the Collect Genotype Information button  to collect information for the selected genotype.
2	Next select the Helium Export/Import button  and select the “Export” option.
3	Select the file location then select Save . The subsequent file can then be opened in Helium for viewing.

4.6 Genotype Genealogy Tree

The GenXplore module can create a Genealogy Tree for any selected Genotype ID. The following instructions outline how to do this:

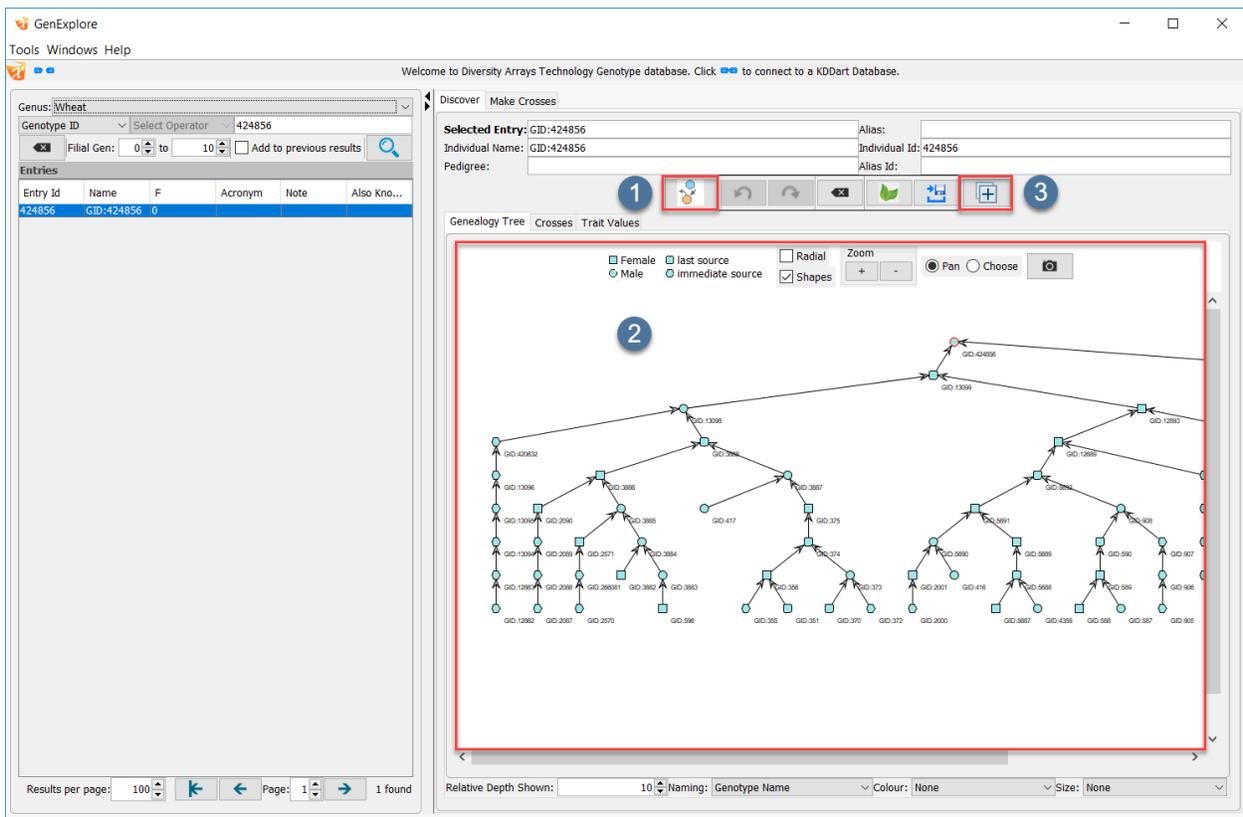


Fig. 4.5: Generating a Genealogy tree for selected genotype

Table 4.9: Generating a Genealogy tree for selected genotype 1.1

Step	Action
1	By selecting a Genotype from the Genotype table and selecting the  button at 1 , the panel below will be populated with the Genealogy tree structure or ancestry of the selected genotype appearing in area 2 .
2	Undocking the panel, by selecting the  button seen in area 3 , provides a closer view.

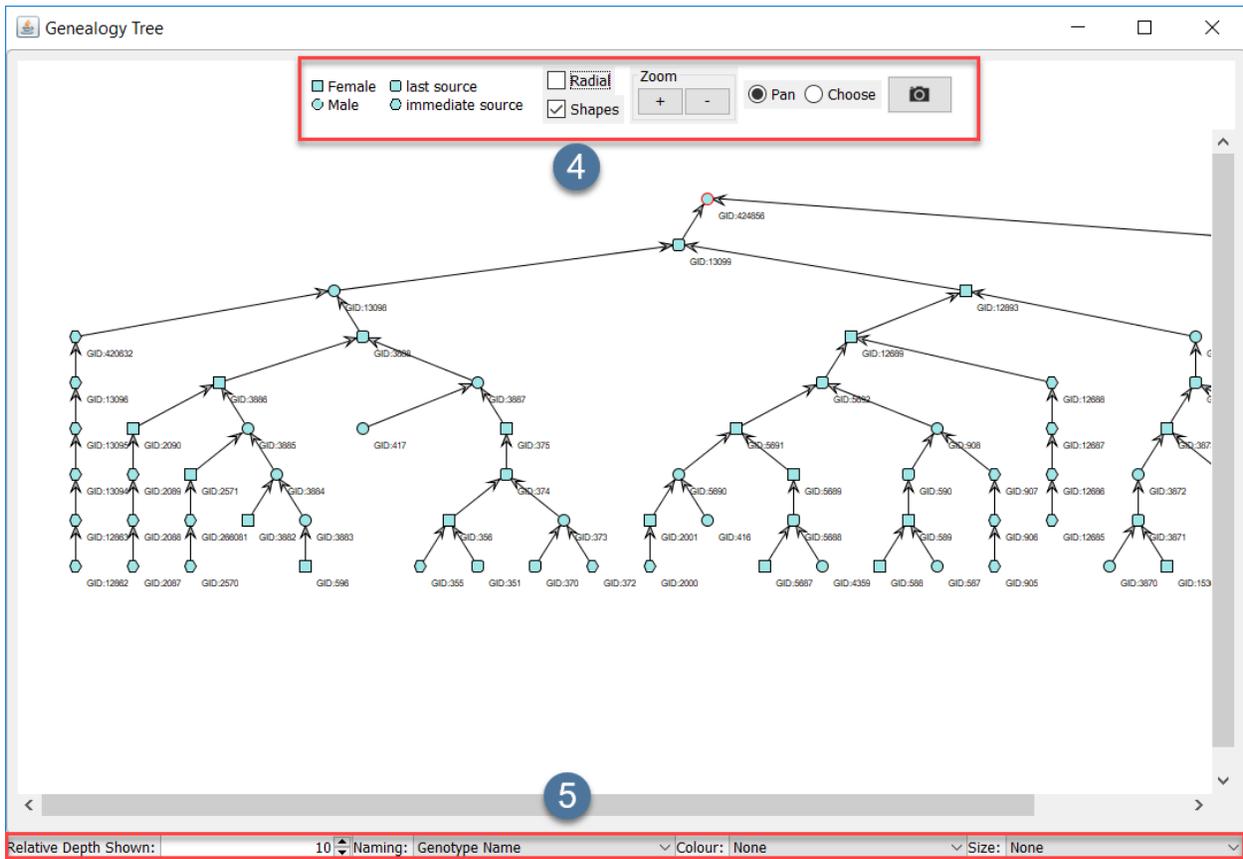


Fig. 4.6: Generating A Genealogy Tree For Selected Genotype

Table 4.10: Generating a Genealogy tree for selected genotype 1.2

Step	Action
3	Controls for the Genealogy tree can be seen in area 4 and area 5. The controls in area 4 have Zoom control, whether to pan when dragged or select nodes, display the tree in radial format and save the tree to .PNG file. The top controls also contain a legend for what the shape of Nodes in the tree represent, and the colour. The shape of the nodes and the colour in this instance represent the known (or unknown) sex of the nodes of the tree, when they were used to create progeny (also seen) in the tree.
4	Controls at the bottom of the panel seen in area 5 allow the user to set what criteria, size and colour should be represented as. E.g. the size of each node in the tree could be representative of the # of crosses it was involved in, or maybe how many ancestors it has (length of line). The controls in area 5 also contain options for the naming of nodes, e.g. whether to display ID, name of genotype or acronym.
5	To the furthest left of the controls in 5 is a selector for what level of ancestry to show. In the instance shown here the tree is very large. This can be reduced by only showing 5 generations (as seen below).

4.6.1 Changing Genealogy Tree Depth

The Genealogy Tree that is generated will automatically show 10 levels of depth. The image and steps below outline how to change the depth of the tree.

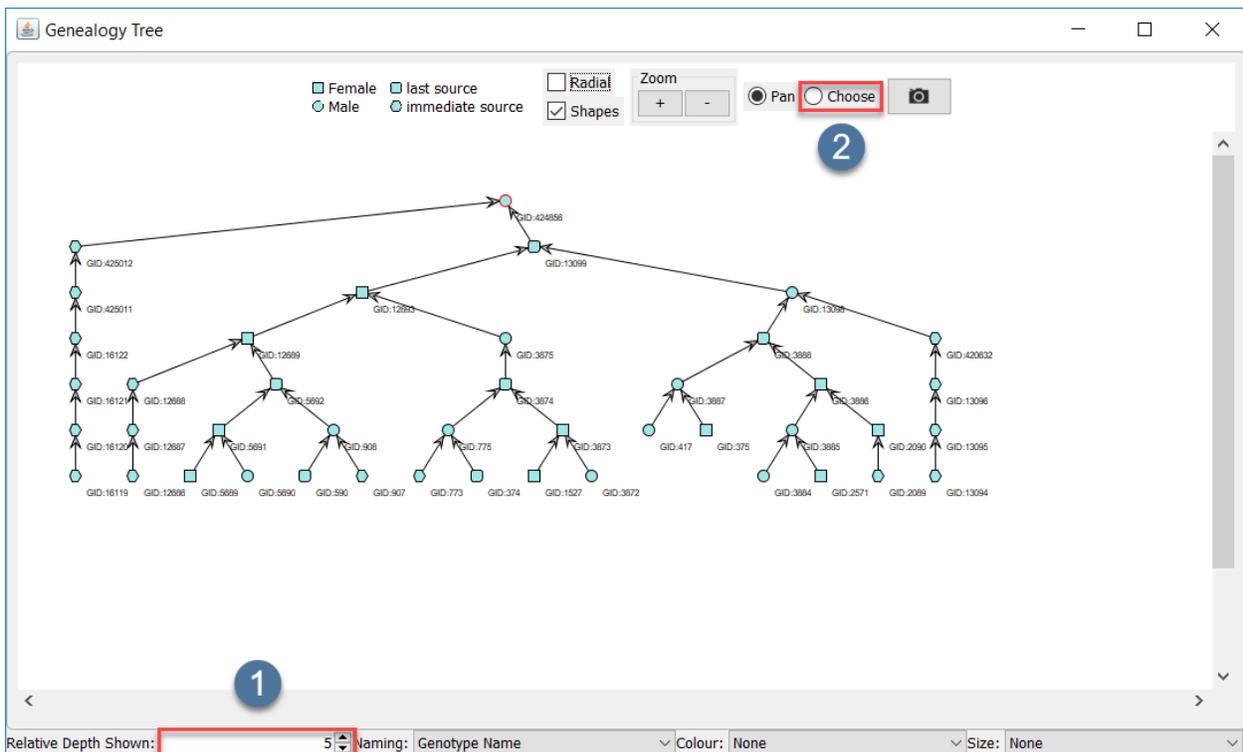


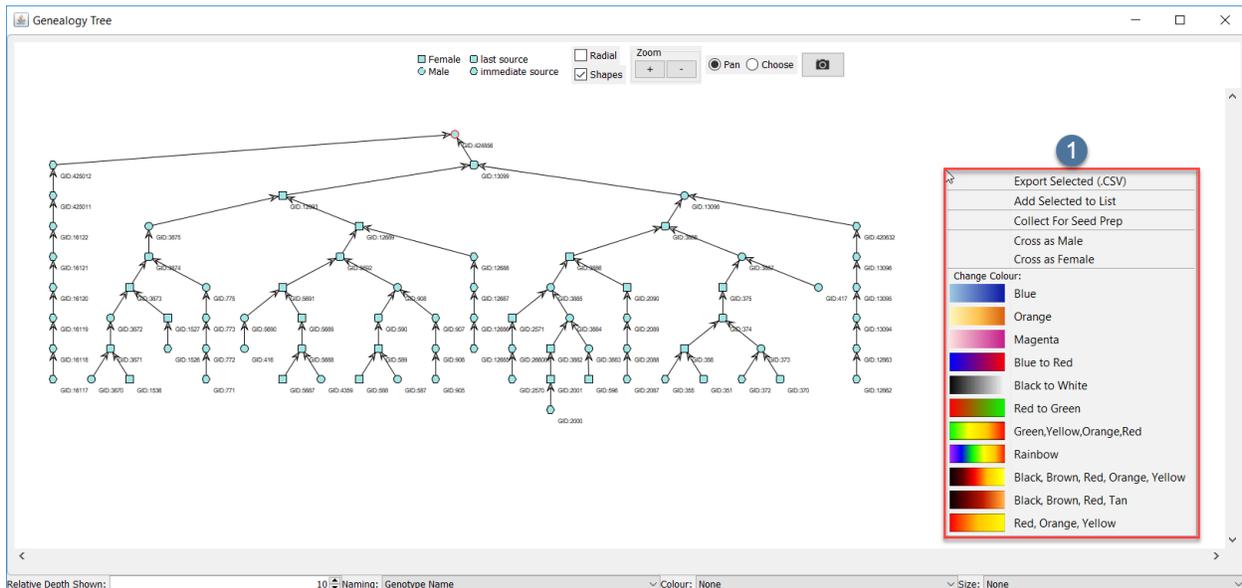
Fig. 4.7: Changing Genealogy Tree Depth

Table 4.11: Changing Genealogy Tree Depth

Step	Action
1	Enter the desired amount of tree depth such as the level of '5' as shown in 1 . Nodes can also be selected and dragged manually around the panel area.
2	Select the Choose option in 2 .

4.6.2 Genealogy Tree options

Once genotypes are selected, *Right-Clicking* anywhere will present a number of options as seen below:



Genealogy Tree Options

From the options the user can:

- Export selected genotypes to .CSV format
- Add selected Genotypes to the list in the genotype table
- Collect genotypes for Trial/Nursery Design.
- Cross Genotypes as Female (Automatically adds to crossing table - *see section 12.*)
- Cross Genotypes as Male (Automatically adds to crossing table - *see section 12.*)
- Change the colour scheme used for node rendered (When a numeric genotype info. is chosen for node colour, the colour scheme used to display it is set here.)

4.7 Genotype Cross Information

The genealogical history of any Genotype crosses can be shown in the **Cross Information** panel as seen below:

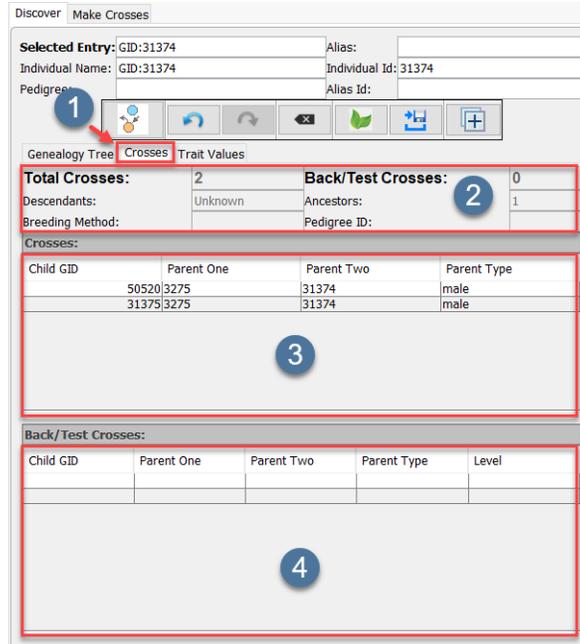


Fig. 4.8: Cross Information Display For Genotype

- **1** **Crosses** tab displays the overall cross information for the selected genotype.
- **2** **Cross Information** panel displays the overall cross information including total crosses and total back/test crosses.
- **3** **Crosses** panel is a list of crosses that the selected genotype has been involved in. The resulting genotypes (By name and ID) can also be seen here.
- **4** **Back/Test Crosses** panel is a list of back/test crosses for the selected genotype. Note that the **Crosses** panel will not contain these entries.

4.8 Genotype Trait Information

Some Genotypes may have Trait information attached to them. To display the Trait information, the user will need to search for, and select a Trait, and then follow the instructions below:

Table 4.12: Displaying Trait Information

Step	Action
1	To display phenotypic data for the selected genotype select the Trait Values tab in area 1 .
2	The Traits and respective values for the selected genotype will display in area 2 . Selections from this table will display the Trait description in area 3 .
3	Trial information for the selected Genotype will be visible from this screen also in the panel in area 4 .

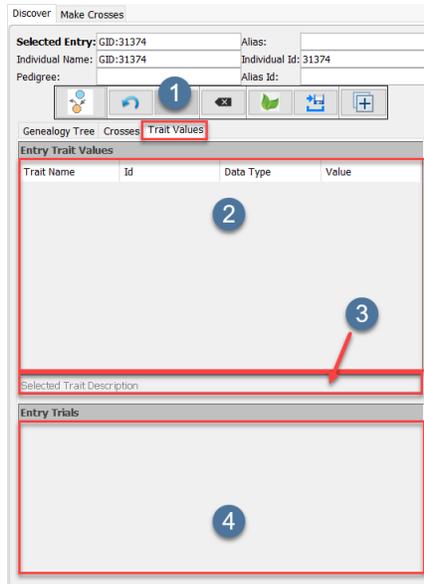


Fig. 4.9: Genotype Trait Information

4.9 Cross Designer

The GenXplore module gives users the ability to design crosses between various Genotypes. After searching for, and selecting Genotypes in the **Search** panel, Genotypes can be dragged into the **Crossing** panel. After selecting Genotypes for crossing, the below instructions will demonstrate how to create the cross.

Table 4.13: Designing Crosses In GenXplore

Step	Action
1	Navigate to the Make Crosses tab by selecting at 1 .
2	The Genotypes selected for crossing can will be visible at area 2 and 3 after being dragged to those locations. Genotypes to-be-crossed as female are displayed in the left table and male genotypes are in the right table.
3	The  at 4 , when selected checks each cross has not been previously made and generate the names for subsequent intermediate child entries in the lower area 5 .
4	Attempting a cross that has already been made will display a warning dialog that can be seen in the image below. Crosses made previously will also display in the table in area 5 .

4.9.1 Rank and Expected Crosses

The concept of Rank and expected crosses are that the genotypes chosen for crossing have an intended rank or importance.

For each parent genotype, crosses will be performed with each corresponding genotype of the opposite sex with the same rank, if expected crosses is larger than 0. Expected crosses then corresponds to how many ranks below the genotype will cross with genotypes of the corresponding sex.

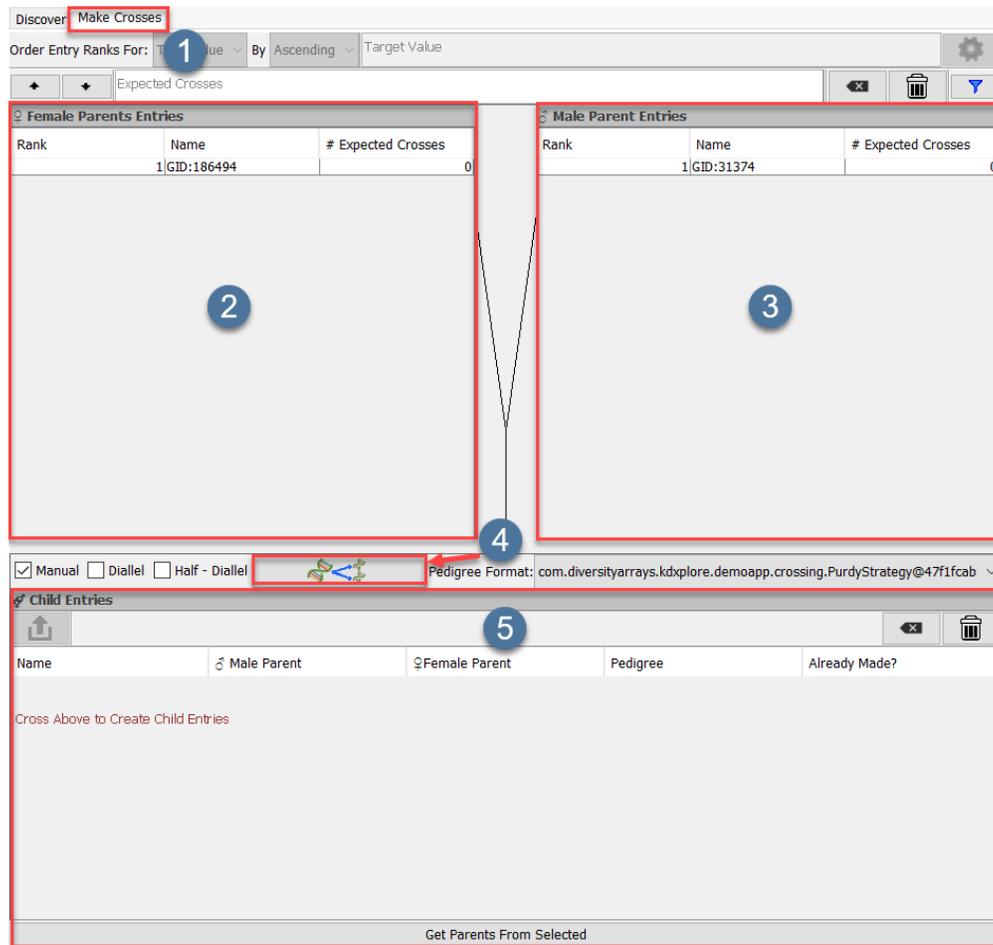


Fig. 4.10: Designing Crosses In GenXplore

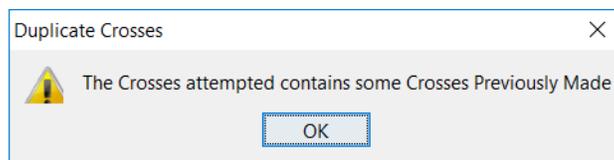


Fig. 4.11: Duplicate Crosses

For a less advanced crossing setup see the following section.

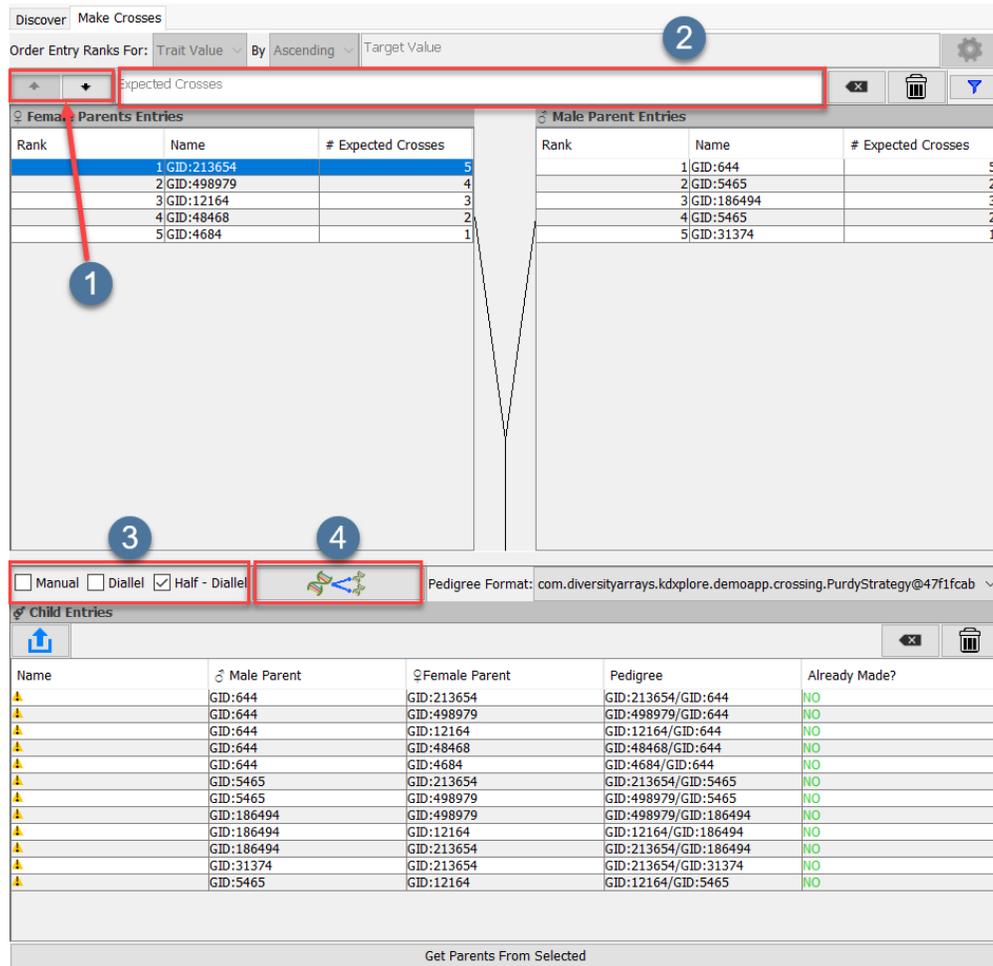


Fig. 4.12: Rank and Expected Crosses Cross Designer

Table 4.14: Rank and Expected Crosses Cross Designer

Step	Action
1	Rank of genotypes for crossing can be adjusted by selecting a genotype in either parent list and using the arrows seen in area 1 .
2	Expected crosses for genotypes can be adjusted by selecting a genotype in either parent list and entering the expected crosses values in area 2 .
3	Preset values for Diallel and Half-Diallel can be set by selecting the check boxes in area 3 .
4	Once parameters are set, the  seen in area 4 can be selected to perform the crosses.

4.9.2 Punnet Square Crosser

The *Punnet View* allows the users to cross Genotypes but has a simpler display to choose male and females to cross. The below instructions outline how to use this view.

Discover Make Crosses

Order Entry Ranks For: Trait Value By Ascending Target Value

Expected Crosses

♀ Female Parents Entries			♂ Male Parent Entries		
Rank	Name	# Expected Crosses	Rank	Name	# Expected Crosses
1	GID:213654	5	1	GID:644	5
2	GID:498979	4	2	GID:5465	2
3	GID:12164	3	3	GID:186494	3
4	GID:48468	2	4	GID:5465	2
5	GID:4684	1	5	GID:31374	1

Manual
 Diallel
 Half - Diallel
 
 Pedigree Format: com.diversityarrays.kdxplore.demoapp.crossing.PurdyStrategy@47f1fcab

Child Entries

Name	♂ Male Parent	♀ Female Parent	Pedigree	Already Made?
▲	GID:644	GID:213654	GID:213654/GID:644	NO
▲	GID:644	GID:498979	GID:498979/GID:644	NO
▲	GID:644	GID:12164	GID:12164/GID:644	NO
▲	GID:644	GID:48468	GID:48468/GID:644	NO
▲	GID:644	GID:4684	GID:4684/GID:644	NO
▲	GID:5465	GID:213654	GID:213654/GID:5465	NO
▲	GID:5465	GID:498979	GID:498979/GID:5465	NO
▲	GID:186494	GID:498979	GID:498979/GID:186494	NO
▲	GID:186494	GID:12164	GID:12164/GID:186494	NO
▲	GID:186494	GID:213654	GID:213654/GID:186494	NO
▲	GID:31374	GID:213654	GID:213654/GID:31374	NO
▲	GID:5465	GID:12164	GID:12164/GID:5465	NO

Get Parents From Selected

Fig. 4.13: Punnet Square Crosser

Table 4.15: Crossing with Punnet View

Step	Action
1	Selecting the button with the  button seen in area 1 of the crossing panel will open the Cross Editor window at 2 .
2	Inside this dialog seen in area 3 are the selected genotypes for crossing. X-axis is female entries. Y-axis is Male entries. By selecting cells in this matrix, you are selecting crosses to be performed.
3	In area 4 the options for including a back cross and test cross can be checked.
4	Once crosses have been designed, the Cross button seen in area 5 can be selected to perform the crosses.

4.10 What To Do With Generated Progeny

Generated progeny can be used in Trial/Nursery design (See **** Trial/Nursery Design **** chapter). Progeny acsesions are then performed in Harvest (See **** Harvest **** chaper).

KDXPLORE HARVEST

Note: This Module Is In Alpha

Topics covered in this section:

- *KDXplore Harvest*
 - *Overview*
 - * *Aims*
 - * *Advantages*
 - * *General Workflow - Nursery Harvest*

5.1 Overview

5.1.1 Aims

The Harvest module in KDXplore helps to facilitate the harvest process in Nursery Trials. It aims to do this with as little impact to an organisation's workflow as possible.

5.1.2 Advantages

Some advantages of the Harvest module/plugin are the:

- Ability to work offline facilitates use in the field or storehouse, only requiring an Internet connection for the final upload step;
- Agnostic to organism;
- Agnostic to units of measurement;
- Flexibly designed to fit on top of or supplement an organisation's previous harvest workflow;
- Allows potentially inexperienced users to direct the process safely;
- Adds a layer of digital book keeping to previously defined harvest work flows;
- Easily select naming conventions from a customisable list for newly created Specimen/Genotypes; and
- Attempts to automatically generate Pedigree's from KDDart's genealogy data, which are then editable.



Fig. 5.1: Starting screen of the Harvest wizard

5.1.3 General Workflow - Nursery Harvest

Table 5.1: Nursery Harvest Workflow

Step	Description
Field Item Retrieval	Defining which Plots/Specimens were harvested (with KDSmart).
Naming and Coding	Applying customisable ontology conventions to new Specimen/Genotypes and Pedigree's.
Generating new Genotypes	Creating new associated Genotype DB Items with newly generated Pedigree's.
Item Transferral	Weighing/measuring the harvested material (for inventory), supplemented by the device server tool.
Storage Validation	Validating where the harvest material will be sent, and allocating it there in KDDart.
KDDart upload	Uploading all changes to KDDart, setting the Trial to 'Harvested'. Checks for conflicts before this

KDXPLORE INVENTORY

Note: This Module Is In Alpha

Topics covered in this section:

- *KDXplore Inventory*
 - *Overview*
 - * *Aims*
 - * *Advantages*
 - * *General Workflow*

6.1 Overview

6.1.1 Aims

The KDXplore Inventory module provides users with a means to locate and quantify items or germplasm which represent planting or harvest material - e.g. a seed bag.

This can be performed by exploring the relationship between Genotype, Specimen and Items in KDDart. For example, the user (knowing a Genotype ID) can query KDDart for all associated Specimens, then view the associated material that is available in storage.

6.1.2 Advantages

Inventory functionality contained within KDXplore has the following main design features:

- Ability to assist with checking if a number of germplasm (which might be planned to use in a Trial) have sufficient material for planting.
- Ability to explore associated Specimens for a Genotype object in KDDart.
- Find the storage location(s) of certain material for a Specimen or Genotype.

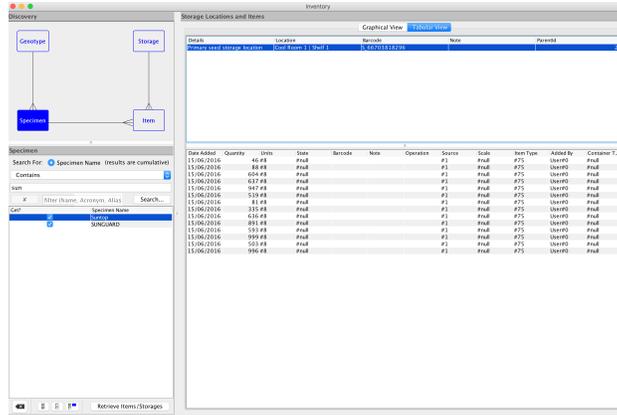


Fig. 6.1: Inventory Utility search screen

6.1.3 General Workflow

Table 6.1: General Inventory Workflow

Step	Description
1.	Enter the Genotype or Specimen Id
2.	Choose from the selection list the available materials to view
3.	Query and present in a tabular form Item data, and Storage data for selected entities.

KDXPLORE PREFERENCES

Topics covered in this section:

- *KDXplore Preferences*
 - *KDXplore Preferences*
 - * *Preferences Layout*
 - * *Resetting to Default*
 - *Offline Database Manager*
 - * *Exploring Offline Databases*
 - * *Refresh Downloaded Data*
 - * *Clear Offline Cache Files*
 - * *Backup Database*

7.1 KDXplore Preferences

KDXplore preferences appear contextually throughout the general user interface of KDXplore in each module. For instance the preference for what constitutes a “low” seed-bag in the Seed Preparation module can be easily set from the first step of Seed Preparation. Although, as this is a KDXplore preference it can also be adjusted from the main preferences menu.

1. The main preferences window can be accessed from anywhere in KDXplore by selecting the main “File” menu



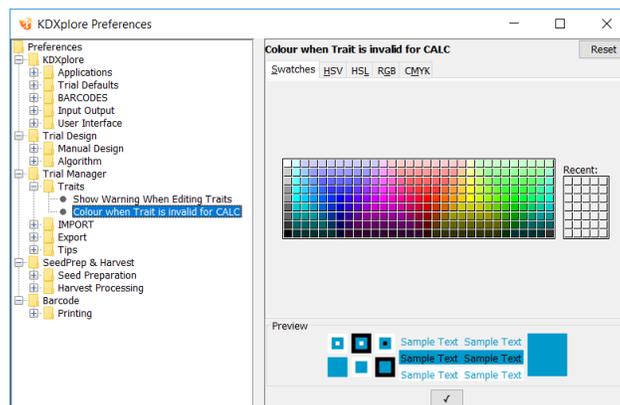
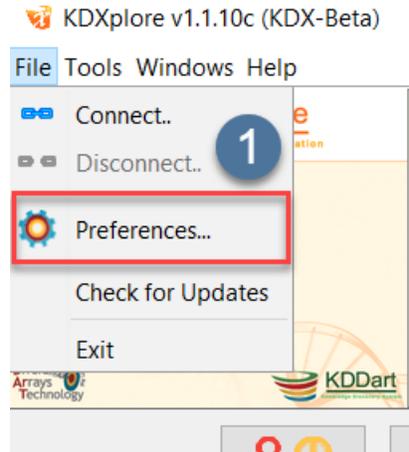
and then the **Preferences** option appearing at the:

- Top of screen on Mac; or
- Top of KDXplore window frame on Windows.

Navigating to the preferences menu

2. Selecting the option seen in  in the above image will open the window seen below.

The Preferences Window



7.1.1 Preferences Layout

KDXplore preferences are organised in a hierarchy, where preferences are grouped based on module such as “Seed Preparation”, then further grouped based on subsections, such as “User Interface”.

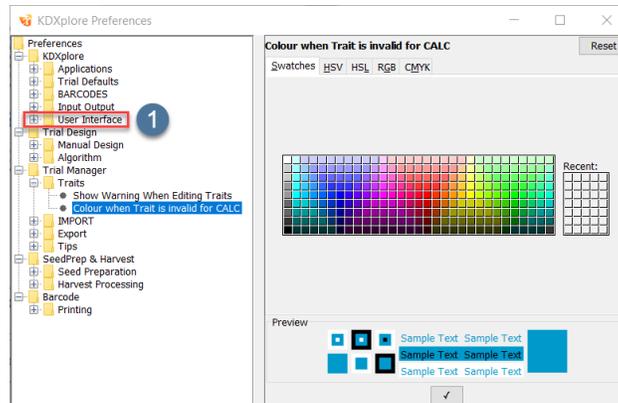
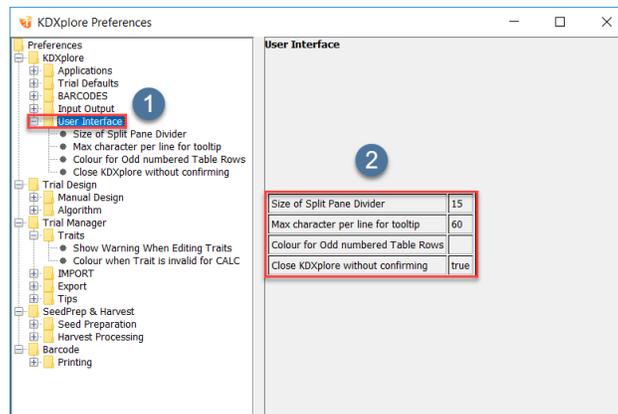


Fig. 7.1: Preferences Window

1. Selecting the arrow next to a preference group as seen in **1** will expand the group. Alternatively, double clicking will perform the same action.
2. Sub groups applicable to a module are now visible. Selecting a sub group as seen in **2** displays the preferences within that subgroup as seen in **3**.



Preference Subgroup Display

3. Further expanding the subgroup structure will present the preferences themselves. Selecting a preference as seen below in **4** will show controls in **5** for altering the selected preference. In the example below a colour preference has been selected.

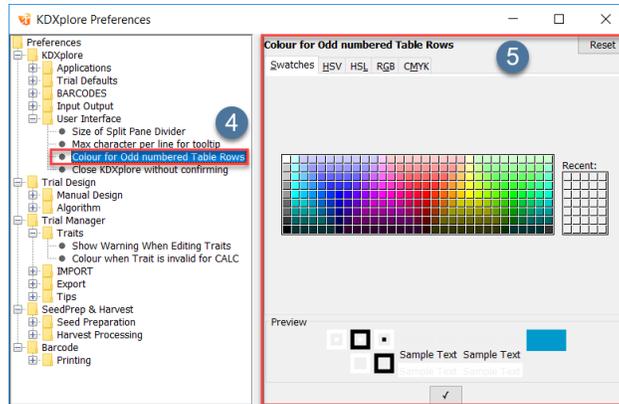


Fig. 7.2: Editing a Preference in KDXplore

7.1.2 Resetting to Default

1. Preferences in KDXplore can be reset to default by selecting the “Reset” button seen in **1** in the main KDXplore preferences window.

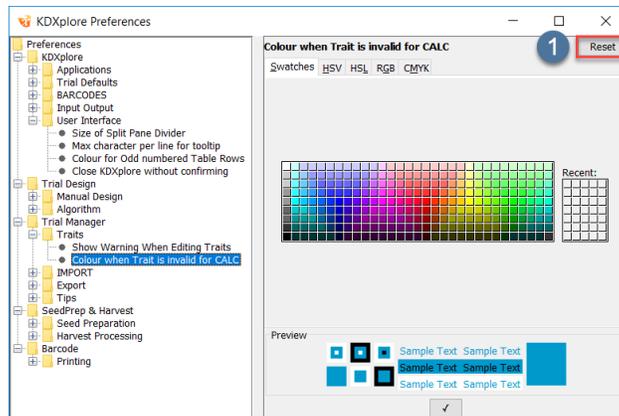


Fig. 7.3: Resetting All Preferences to Default

7.2 Offline Database Manager

KDXplore is capable of housing multiple different offline databases simultaneously. Every time KDXplore is connected to a new online Database a prompt will display requesting to create a new offline database to manage that connection in isolation. This simplifies managing multiple large datasets or online connections.



Fig. 7.4: New Database Connection Dialog

1. To explore the offline databases available in KDXplore navigate to the main “Trial Manager” window and select the button with the KDXplore symbol seen below in **1**.
2. The displayed window lists the available databases in KDXplore. By selecting one and choosing the “Make Current” button seen in **3** users can switch between offline databases.
3. An option is also presented here in **4** to delete the selected database entirely.

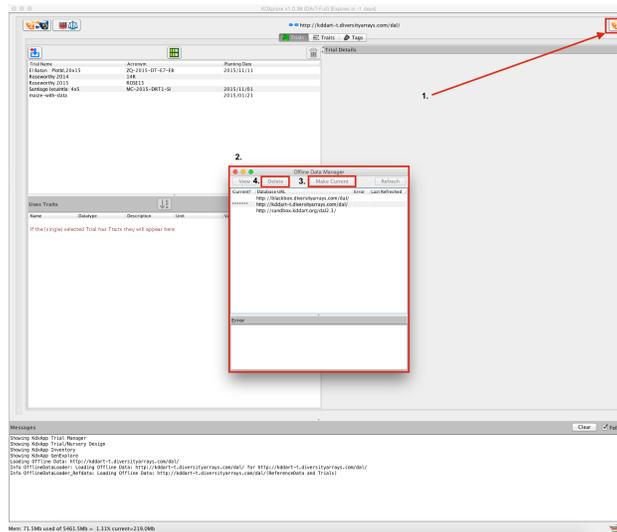


Fig. 7.5: Opening The Offline Database Manager

7.2.1 Exploring Offline Databases

In KDXplore offline data in any number of offline databases can be seen and explored.

1. By navigating to the Offline Database Manager as seen in the previous section, selecting a database and clicking the “View” button seen in **1**.
2. A dialog will open with the offline database explorer as seen below in area 2.
3. In **3** the selected database URL (for online connection) and User name can be seen.
4. In area **4** tabs are organised into groups. By selecting a tab, such as “Item-Related” the panel below in area 4. is populated with expandable panel containing the data.
5. In **5** a list of “General Units” or units of measurement that are currently in the offline database can be seen.
6. In **6** all downloaded trials can be seen. By selecting the tab label “Traits” at the top of **6** all traits in the offline database can be seen.

7.2.2 Refresh Downloaded Data

When KDXplore is connected to KDDart for the first organisational data relating to vocabulary, units of measurement, items etc. is downloaded and stored for later use as context in KDXplore. This data can be refreshed at any time.

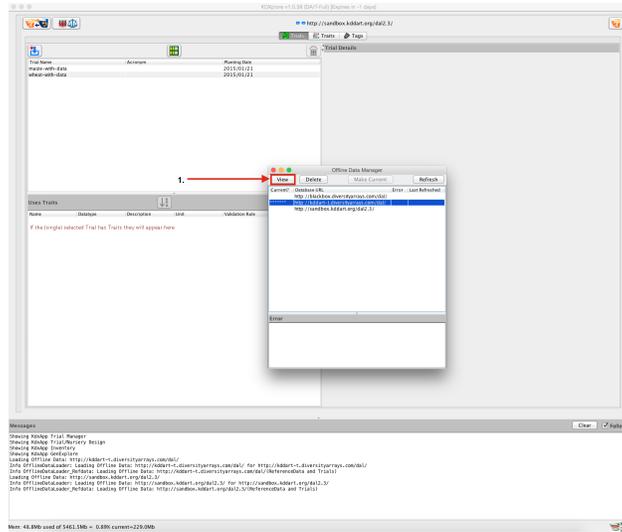
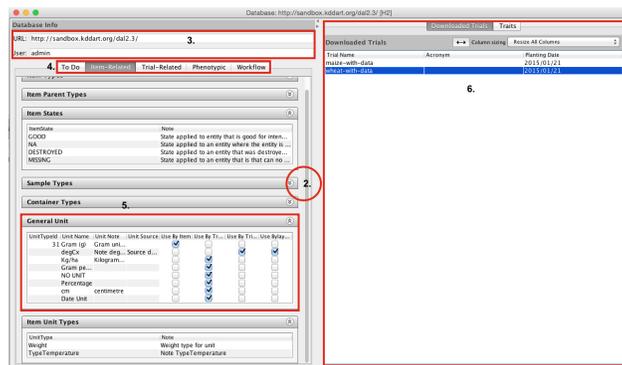


Fig. 7.6: Opening The Offline Database Explorer



1. To refresh downloaded data from a KDDart database, navigate to the main offline database explorer (as seen in the previous section). Whilst the offline database explorer window is open an additional main menu will be presented for KDXplore labeled “Data” as seen in **1**. 3. Selecting this menu will present a drop down where the option “Refresh from Database” can be selected as seen in **2**.

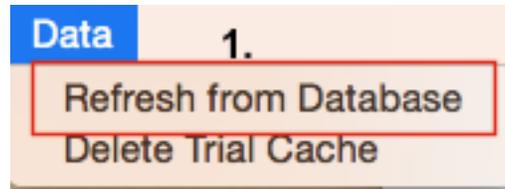


Fig. 7.7: Refreshing Downloaded Offline Data

7.2.3 Clear Offline Cache Files

Performing some download actions in KDXplore will add additional cache isolated from the offline database. This seclusion is sometimes necessary to simplify complex relationships between multiple objects within KDXplore. This cache can be cleared (deleted permanently) at any time.

1. To delete cached Trial data navigate to the main offline database explorer (as seen in the previous section). Whilst the offline database explorer window is open an additional main menu will be presented for KDXplore labeled “Data” as seen in **1**. 3. Selecting this menu will present a drop down where the option “Delete Trial Cache” can be selected as seen in **2**.

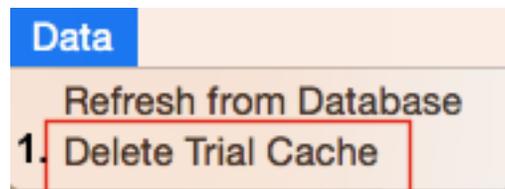


Fig. 7.8: Deleting Trial Cache in KDXplore

7.2.4 Backup Database

Tip: In KDXplore back up of the offline database can be performed at any time. Although there is no danger of KDXplore losing data integrity, it is always recommended that database backup be stored on an alternative machine or backup medium.

1. Navigate to the “Check for Updates” menu in KDXplore as seen in the Update section of the first chapter of KDXplore’s help.
2. Select the “Backup Database” option to save the any of the offline databases.
3. A dialog will open as seen in **1** where the databases intended for backup can be selected. The file location of the backup can also be set here.

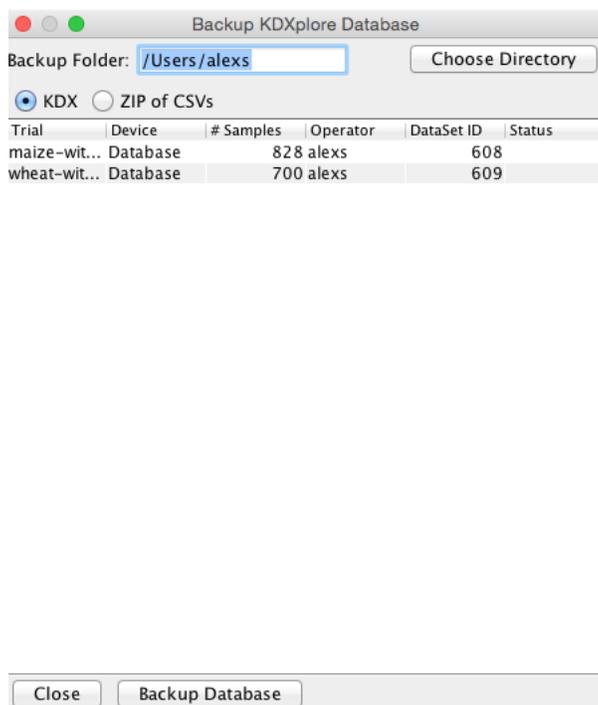


Fig. 7.9: Backing up the offline databases in KDXplore

KDXPLORE SEED PREPARATION

Note: This Module Is In Alpha

Topics covered in this section:

- *KDXplore Seed Preparation*
 - *Introduction*
 - * *Wizard*
 - * *Step 1 - Item Retrieval*
 - * *Step 2 - Item Transferral*
 - * *Step 3 - Item Validation Step*
 - * *Step 4 - KDDart Upload Step*

To start Seed Preparation, from the KDXplore Trial Manager window, select a Trial to work with then the Seed



Preparation button. This will display the Seed Preparation Wizard.

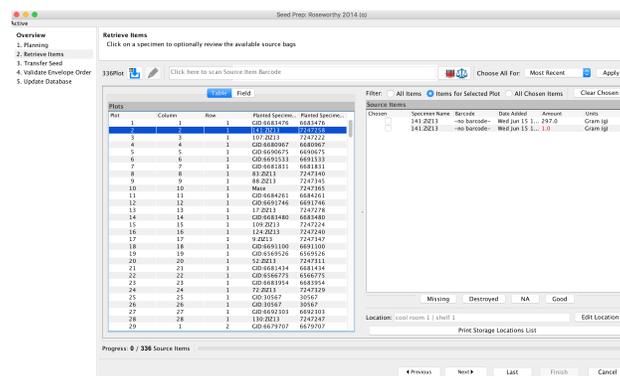


Fig. 8.1: Item Retrieval Step in Seed Preparation

8.1 Introduction

Seed Preparation functionality contained within KDXplore has the following main design features:

- Agnostic in regards to the units of measurement;
- Designed to be a generic tool sitting above your existing organisation work flows for planting trials/experiments;
- Provide a flexible structure to assist, not hinder, in reducing errors when preparing for planting;
- Designed for use with devices such as barcode scanners and weighing tools (i.e. bluetooth scales);
- Provide a wizard for preparing planting materials for trials/experiments; and
- Facilitate less experienced operators by reducing the reliance on memory of the process.

The Seed Preparation workflow in KDXplore is divided into four main steps which are:

1. Item Retrieval;
2. Item Transferral;
3. Item Validation; and
4. KDDart Upload.

These are described in detail in following sections.

8.1.1 Wizard



To display the wizard, in Trial Manager select a Trial, then select the Seed Preparation button

The wizard displays the four steps of Seed Preparation which can be displayed or hidden by selecting each step heading. These provide a brief description and basic example for each step.

Navigation through the wizard is performed by the Next and Previous buttons

located at the foot of the window.



Wizard Preferences are displayed above these buttons which include:

- Warn if Item amount below nn (i.e. '20' which could be grams, seeds, kernels, etc.);
- Display Progress: Step/Total/None;
- Automatically allocate Destination Items to Plots;
- Barcodes are available for Source Items;
- Barcodes are available for Destination Items; and
- Skip this step next time.

8.1.2 Step 1 - Item Retrieval

The Item Retrieval Step is where known Source Items are chosen for the specimens in your Trial. In this step you can see the currently selected Specimens for planting in each plot. The available Items and Item amounts for each of these Specimens can also be seen. Items can be refreshed and Specimens changed at any point in this step if required.

Source items chosen for each Specimen in this step will be transferred in the next step for planting. A potential guide to follow is:

1. Review Plot Specimens
2. Review Source Items for each Specimen
3. Select Source Items for each Specimen
4. Proceed to the next step

To complete: Choose a Source Item for each Specimen shown in the left Table.

8.1.3 Step 2 - Item Transferral

Item Transferral Step is where the Source Items selected Previously are Weighed into more manageable amounts and placed in new containers for Planting (e.g. Envelopes)

These Resulting new Items are referred to as *Destination Items*

Destination Items can be created by Merging, Splitting, or just simply Transferring Source Items chosen in the previous step.”

Destination Items created for each Specimen in this step will be Validated to their Plot in the next step for planting.

A potential guide to follow in this process is:

- Review Source Items (These should have been retrieved from storage);
- Transfer some amount of Source Items to new Container;
- Weight new container (Destination Item);
- Repeat for each Source Item selected in previous step
- Proceed to the next step;

To Complete: Create a new *Destination Item* for planting for each *Specimen* from Source Items previously chosen.

8.1.4 Step 3 - Item Validation Step

The *Item Validation Step* is where the barcodes for the destination item created in step two are printed and placed with their respective Planting container and the Trial unit’s barcode.

When this is completed the Barcodes for the destination item and respective Trial units are scanned in sequence to validate the container for planting. Barcoded containers are packaged and validated in this step for planting.

A potential guide to follow in this process is:

1. Choose how your Trial is traversed (This will change the planting order);
2. Scan the destination item’s barcode for the first destination item in the list;
3. Scan that destination items respective barcode;
4. Place both barcodes with the destination items;
5. Repeat for each Trial unit in your Trial; and
6. Proceed to the next step.

To complete: Scan the destination item barcodes followed by respective Trial unit Barcodes in the chosen order for all Trial units.

8.1.5 Step 4 - KDDart Upload Step

In this workflow step the changes or actions performed in previous steps are visible for review before being uploaded to your KDDart database. These are the:

- Items chosen for planting;
- Items created;
- Item amounts remaining; and
- Item location or item status.

Changes that occurred in previous steps can be double checked before they are pushed to KDDart for planting.

A potential guide to follow in this process is:

- Review Trial unit Specimens were planted correctly;
- Review that the Source item amounts remaining for each Specimen are correct; and
- Review any Location or status changes to Items are correct (missing/destroyed/NA).

Review all changes made and update/upload changes to Kddart by selecting the update button.

KDXPLORE TRIAL AND NURSERY DESIGN

Note: This Module Is In Alpha

Topics covered in this section:

- *KDXplore Trial and Nursery Design*
 - *Overview*
 - * *Aims*
 - * *Advantages*
 - * *General Workflow*
 - *Manual Design*
 - *Algorithmic Driven Design*

9.1 Overview

9.1.1 Aims

The KDXplore's Trial Design module assists users with designing the physical layout and placement of germplasm within a field.

It was specifically designed to cater for multiplicity between Site, Trial and Trial Replicates.

The outcome of using Trial Design will be designs that encompass multiple experiments, with multiple replicates and each or all of which can be at multiple locations.

9.1.2 Advantages

Trial/Nursery Design functionality within KDXplore has the following main design features:

- An easy to use single interface for the placement of multiple experiments, with N replicates at multiple, different Sites
- Agnostic to Organism type

- Germplasm lists can be imported and combined from file or KDDart. They can then be edited allowing better visibility and control over what will be planted in what experiments
- The Trial Design module in KDXplore offers two ways of designing your trial; 1. Algorithmic Driven design or 2. Manual design
- Algorithmic driven design, allows the user to select from range of experimental design methods (Randomised Complete Block, Latin Square etc.) and process the design with one click, using the provided list of germplasm
- Algorithms presented are of a plugin format, easily replicated and the list presented by KDXplore is designed to be appended or edited by users
- Manual design allows the user to have more control over a field, built for breeders and scientists that have non-generic layouts designs in mind or are unable to apply a standard algorithmic design.
- Can be used to allocate plots around field obstructions according to the users wishes.
- Customisable placement of spatial variation checks.
- Overlays for easy visualisation of Trial components, e.g. the different replicates
- Customisable randomisation option.
- Easily user extendable plot types allowing easy distinction between what is planted (Field Variation Check, Genetic check, Filler plot, Do-not-plant etc.)

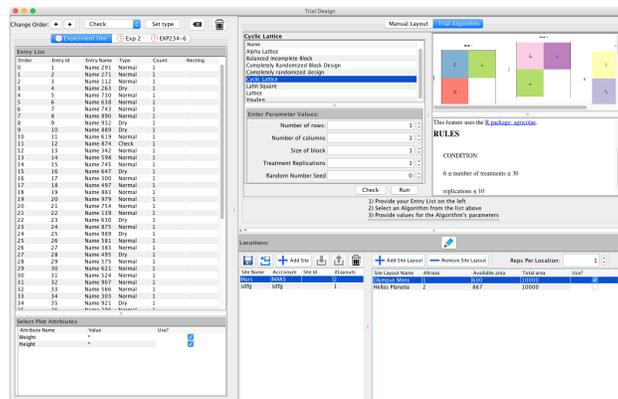


Fig. 9.1: Algorithmic Driven Design

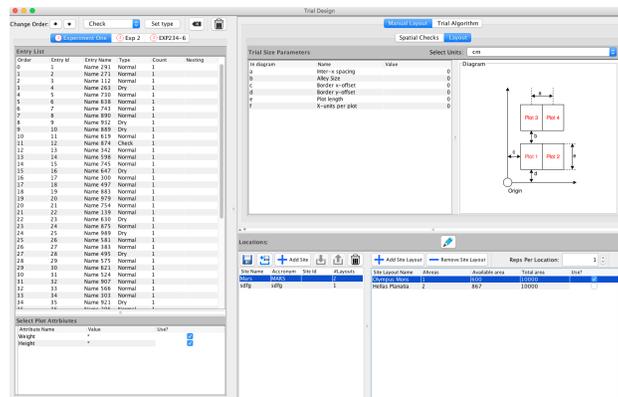


Fig. 9.2: Manual Control Design

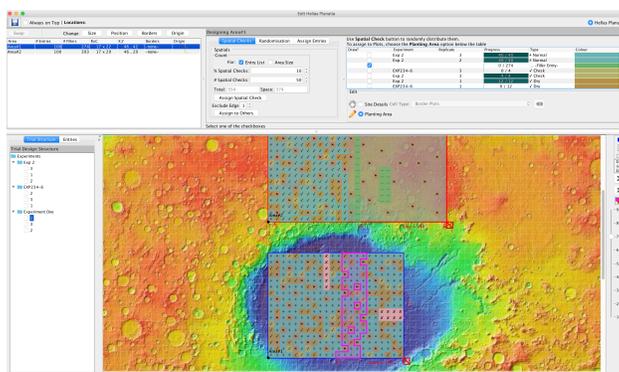


Fig. 9.3: Building the Field Layout

9.1.3 General Workflow

Manual Design

Table 9.1: Manual Design

Step	Description
1.	Defining Trial Size layout parameters (e.g. plot length, Alley length...) so calculate available plots inside of available fields.
2.	Importing from file and KDDart germplasm lists and defining them as individual experiments.
3.	Selecting the number of replicates for each experiment. For the selected Sites or all at once (Fields where the experiments will be placed):
4.	Place spatial variation checks (optional).
5.	Customise block options.
6.	Customise randomisation options.
7.	Place filler or do-not-plant plots (optional).
8.	Allocate germplasm with single click according to parameters.
9.	Edit the resultant Trial layout (optional).
10.	Save the Trial and export to CSV for planting.

Algorithmic Driven Design

Table 9.2: Algorithmic Driven Design

Step	Description
1.	Importing from file and KDDart germplasm lists and defining them as individual experiments.
2.	Select algorithm from list in KDXplore, potentially reading the also available documentation (in KDXplore).
3.	Install any dependencies (instructions given through KDXplore - only if using for the first time)
4.	Enter parameters for the algorithm.
5.	Save the resultant layout or export to CSV for planting.