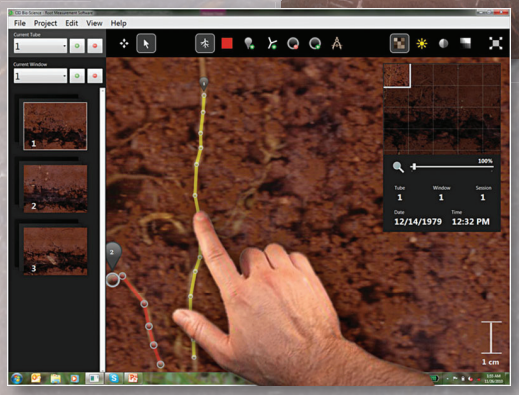
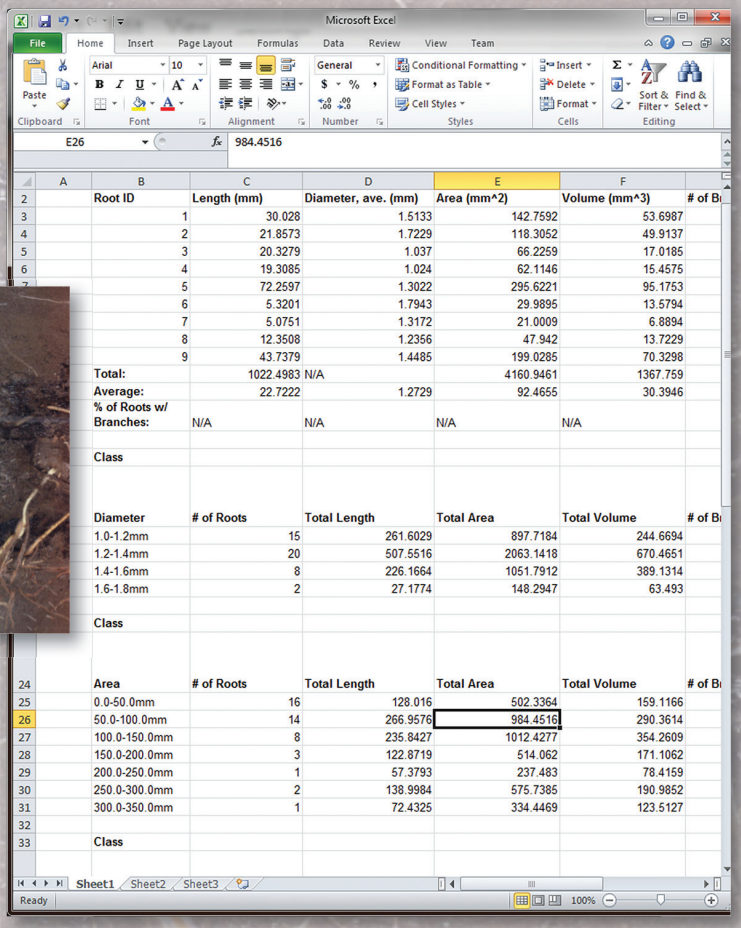
CID Bio-Science Inc.

Portable Instruments for Precision Plant Measurement

# RootSnap!

## Operations Manual



Microsoft Excel

File Home Insert Page Layout Formulas Data Review View Team

Paste Clipboard Font Alignment Number Styles Cells Editing

Arial 10 General Conditional Formatting Format as Table Cell Styles Insert Delete Format Sort & Filter Find & Select

E26 984.4516

| | A | B | C | D | E | F |
|---|---|---|---|---|---|---|
| 2 | | Root ID | Length (mm) | Diameter, ave. (mm) | Area (mm^2) | Volume (mm^3) |
| 3 | | 1 | 30.028 | 1.5133 | 142.7592 | 53.6987 |
| 4 | | 2 | 21.8573 | 1.7229 | 118.3052 | 49.9137 |
| 5 | | 3 | 20.3279 | 1.037 | 66.2259 | 17.0185 |
| 6 | | 4 | 19.3085 | 1.024 | 62.1146 | 15.4575 |
| 7 | | 5 | 72.2597 | 1.3022 | 295.6221 | 95.1753 |
| 8 | | 6 | 5.3201 | 1.7943 | 29.9895 | 13.5794 |
| 9 | | 7 | 5.0751 | 1.3172 | 21.0009 | 6.8894 |
| 10 | | 8 | 12.3508 | 1.2356 | 47.942 | 13.7229 |
| 11 | | 9 | 43.7379 | 1.4485 | 199.0285 | 70.3298 |
| 12 | | Total: | 1022.4983 | N/A | 4160.9461 | 1367.759 |
| 13 | | Average: | 22.7222 | 1.2729 | 92.4655 | 30.3946 |
| 14 | | % of Roots w/ Branches: | N/A | N/A | N/A | N/A |
| 15 | | | | | | |
| 16 | | Class | | | | |
| 17 | | | | | | |
| 18 | | Diameter | # of Roots | Total Length | Total Area | Total Volume |
| 19 | | 1.0-1.2mm | 15 | 261.6029 | 897.7184 | 244.6694 |
| 20 | | 1.2-1.4mm | 20 | 507.5516 | 2063.1418 | 670.4651 |
| 21 | | 1.4-1.6mm | 8 | 226.1664 | 1051.7912 | 389.1314 |
| 22 | | 1.6-1.8mm | 2 | 27.1774 | 148.2947 | 63.493 |
| 23 | | | | | | |
| 24 | | Class | | | | |
| 25 | | Area | # of Roots | Total Length | Total Area | Total Volume |
| 26 | | 0.0-50.0mm | 16 | 128.016 | 502.3364 | 159.1166 |
| 27 | | 50.0-100.0mm | 14 | 266.9576 | 984.4516 | 290.3614 |
| 28 | | 100.0-150.0mm | 8 | 235.8427 | 1012.4277 | 354.2609 |
| 29 | | 150.0-200.0mm | 3 | 122.8719 | 514.062 | 171.1062 |
| 30 | | 200.0-250.0mm | 1 | 57.3793 | 237.483 | 78.4159 |
| 31 | | 250.0-300.0mm | 2 | 138.9984 | 575.7385 | 190.9852 |
| 32 | | 300.0-350.0mm | 1 | 72.4325 | 334.4469 | 123.5127 |
| 33 | | | | | | |
| 34 | | Class | | | | |

Sheet1 Sheet2 Sheet3

Ready 100%


CID Bio-Science Inc.

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# DOCUMENT OVERVIEW

# INTRODUCTION TO ROOTSNAP!

## *What is RootSnap!?*

RootSnap! is a faster and more reliable method for analyzing root images. It includes a revolutionary user interface that employs a combination of advanced image analysis and a multi-touch LCD screen, which allows users to quickly and easily trace roots using their fingers. Root tracing enhancements, such as the "Snap-to-Root" feature that "snaps" root tracing points to the center of the root automatically, removes hours of tedious point-by-point outlining of roots.

## *What are the Design Intents of RootSnap!?*

RootSnap! features integrated image enhancement enabling users to optimize the scanned image for more accurate processing. Roots are mapped in a fraction of the time using the automated image analysis, the touch-screen interface, and the Snap-to-Root function. This software is designed to be user friendly, intuitive and time efficient. Files are stored as RootSnap! project (.rsp) files, and the application easily exports data to other software, such as Microsoft Excel.

## *What is RootSnap! Actually Used For?*

RootSnap!'s many features and the Snap-to-Root function can be used to monitor root growth, death and the occurrence of disease. More than a dozen parameters are calculated, including root length, area, volume, diameter, and angle of growth. A time-series root analysis feature allows for saving and reusing root trace information across images captured in multiple sessions.

## *What is the Snap-to-Root Function?*

The underlying function that makes RootSnap! user friendly and time efficient is the unique "Snap-to-Root" feature. When enabled, a root drawing that has just been traced will automatically "snap" to the center of the actual root. The center of the root is determined by the matching the identical color as the last root point, within the range of the tool, for the next root point.

# GETTING STARTED

After the RootSnap! software is installed on a touchscreen computer, the application can be accessed from the Start Menu or by double-clicking on the RootSnap! icon on the desktop.

## *Automatic Update Feature*

RootSnap! has an automatic update feature for downloading the latest version of RootSnap!. If the computer has an internet connection, RootSnap! users will automatically be notified that an update is available when starting the application. Each time the program is opened, the software will take a few seconds to verify that the proper system requirements are in place to run the software, as well as to search for any updates available if the computer is online. If an update is available, the user can choose to update (start the application and choose update when prompted) or revert to a previous version of software by using the add/remove programs feature in Windows. When an internet connection is not available while starting the software, the automatic update feature will be skipped and the last version downloaded onto the computer will be opened.

### Versioning

The version numbers for this application is defined numerically as: major.minor.build.revision (ex: Version 1.2.9.17). Major increments increase when a new version is released. Minor increments indicated when functionality changes are made. Build increments indicated that defects have been corrected. Lastly, the revision increment increases every time the software is changed in any way.

### Software Website

To install or update RootSnap! navigate to the CI-690 product software webpage (http://www.cid-inc.com/support/software-downloads). The software page will show the name of the application, current version and the publisher [CID Bio-Science, Inc.). Before installing the RootSnap! application, two Windows modules are required:

- Windows Installer 4.5
- Microsoft .NET Framework 4 (x86 and x64)

## *License Key Activation*

RootSnap! software incorporates a license key, which must be activated with CID Bio-Science, Inc. Any questions or problems with activating the license key should be directed to support@cid-inc.com. To activate the license key:

1. Install the RootSnap! software.
2. With the computer connected to the internet, open RootSnap!
3. Follow the instructions on the pop-up box to activate the license key.

After the license key has been activated, the <Help><About> screen will show the License key information. If the key is not activated, the number of days remaining in the trial version will be shown below the License key. There is a button to initiate a check for an update to the software. It is a good idea to check for updates every few months if the CI-690 computer is not usually connected to the internet. Make sure to connect the computer to the internet before attempting to update the software.


## *Hardware Requirements*

RootSnap! is designed to run at 1920 x 1080 (HD 1080p) on Windows 7 or Windows 8. Table 1 displays the minimum system requirements for running the RootSnap! application. The CI-690 RootSnap! software is designed to work with a touch-screen monitor. Using a touch-screen will increase the speed and ease of analysis, as well as eliminate repetitive point and click motions with the mouse. RootSnap! is compatible with both 32 bit and 64 bit PC's.

Table 1: Hardware requirements for running RootSnap! software.

| | |
|---|---|
| Operating System | Windows 7 or 8 |
| CPU | Dual Core or above |
| RAM | 2 GB |
| Video Card | 512 MB dedicated |

# OPERATING INSTRUCTIONS

To begin using RootSnap!, an image of a root or root system needs to be imported into the program or an already saved project or session can be opened. The Menu Bar displays File, Edit, View, and Help. Several specific terms are used to define some of the features and functions of RootSnap! Images, root maps, windows, sessions and projects are all defined and outlined in Table 2. The figure to the right shows the project data outline, listing root tubes and then each window, with the date and time (session). Here, Tube 2, Window 1 has two session images loaded into the project.

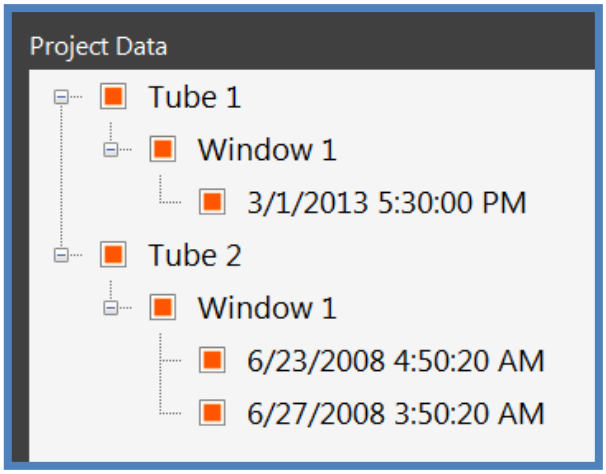
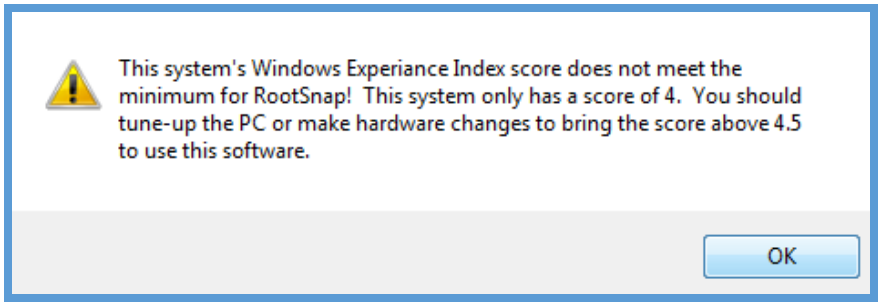



Table 2: Frequently used RootSnap! terms, definitions and details.

| Term | Definition | Important Details |
|---|---|---|
| **Image** | A picture file that is imported into RootSnap! | Use the CI-600 Digital Root Scanner to easily capture images for analysis. |
| **Root Map** | The lines (roots and branches) that are traced on the imported image | Use migrate roots feature to transfer root maps between sessions. |
| **Tube** | Clear plastic tube in ground that image was captured inside of. | Images can be imported from one tube or from multiple tubes |
| **Window** | Categorizes images by depth from the surface within an individual root tube | Import images into multiple windows in a tube in order to form a continuous image of a single tube from top to bottom. |
| **Session** | Categorizes images by the date the image was captured, from same tube. | Build sessions with multiple images from different dates and times to illustrate root behavior. |
| **Project** | A project file saves root maps, branches and points from all imported images. | Projects can be expanded to contain multiple tubes, windows and session images and their root maps. |

## *Windows Experience Index*

If an error message appears stating that the computer's Windows Experience Index (WEI) score does not meet the minimum 4.5 required for RootSnap!, click "ok". Computer's with WEI scores that are lower than the minimum will still run RootSnap!, but the system may hesitate briefly before some operations occur. The software will still function properly. This message only appears when the application is opened. If the WEI score is above 4.5, the message will not appear.

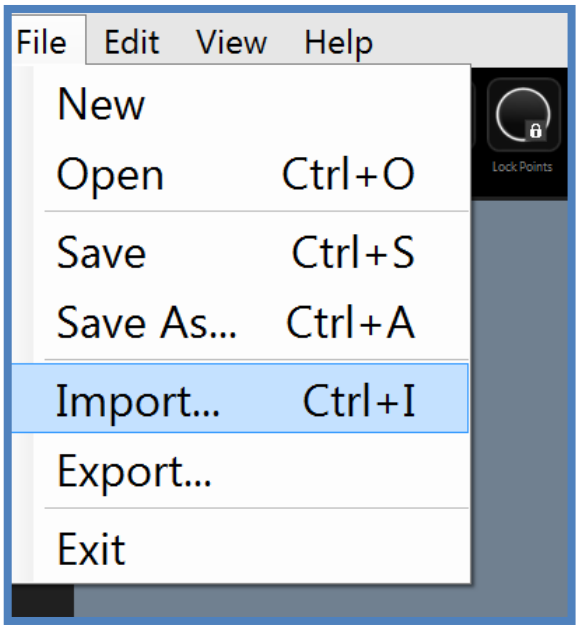



## *Import an Image*

The import feature gives the user the ability to import images and populate a RootSnap! project with multiple images naming them using the information in their ICAP (Internet Content Adaption Protocol) based file names.

During the import process, the user can preview images which are about to be imported. However, the user cannot zoom or pan around the preview images. The Pan & Zoom tool can be used once an image is imported into a project.

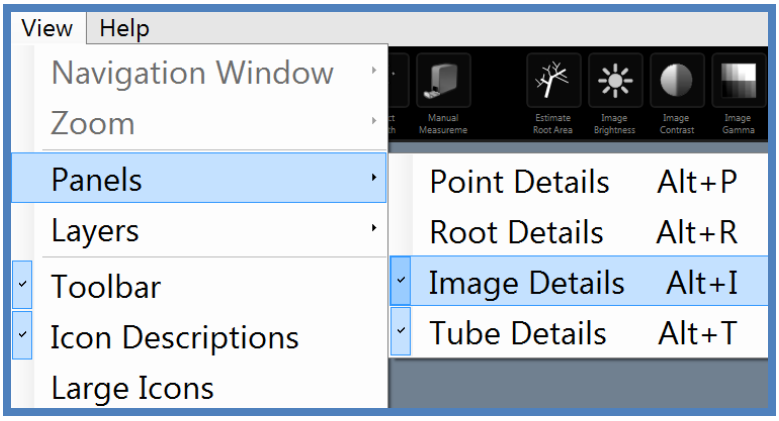
- To import an image, select <File> <Import > or press Control + I
- Browse the computer or enter the file name of the image you wish to import.



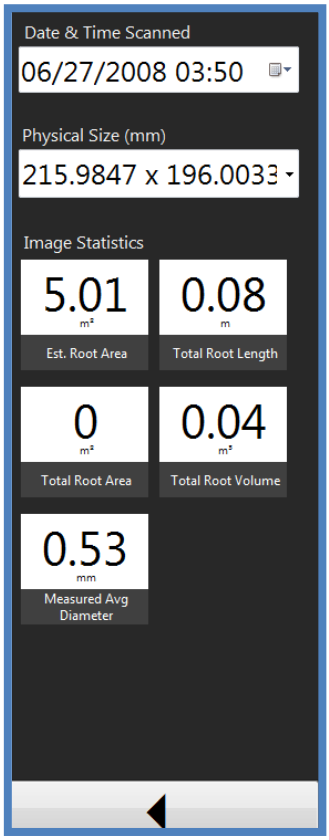

The application uses the DPI (dots per inch) of the image to determine the correct size and measurements of roots. For example, an image with a resolution of 1024 x 768 at 300 DPI has a physical area of 86.614 x 65.024 mm. Images of any DPI are supported by RootSnap!, however extremely high resolution images (+1200 DPI) may require a fast CPU to run smoothly. Various image file types can be imported and analyzed, such as JPEG, GIF, TIF, TIFF, PNG, BMP, etc.

Scanned images from the CI-600 Digital Root Scanner are 215.9 mm x 195.7 mm. The DPI and Pixel count are automatically adjusted to render this size. Typically the DPI, Pixels and Actual Size values do not need to be changed from the values automatically tagged with the image. The user should always check to ensure that the computed data conforms to what is expected.

To check if the actual size of the image is correct, or to change it to the correct size before starting to analyze roots, access the Image Details Panel by navigating to <View><Panels><Image Details>.



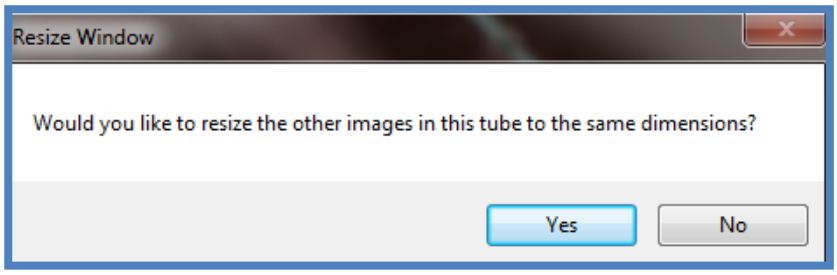

The Image Details panel will appear on the left side of the screen when enabled.

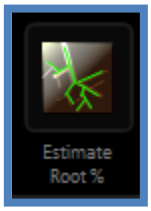



The "Physical Size" of the image is displayed in millimeters. Check that the image's Physical Size is correct. If the actual size of the image is not correct, change it to the correct size before starting to analyze roots.

CI-600 images are 215.9 mm x 195.7 mm. The DPI and Pixel count are automatically adjusted to render this size. Typically the DPI, Pixels and Actual Size values do not need to be changed from the values automatically tagged with the image.

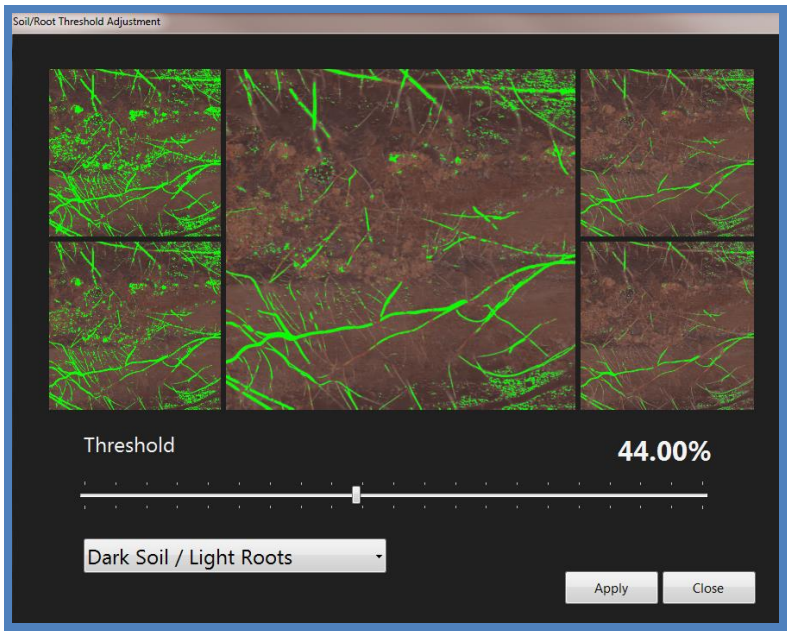
If there are multiple images in a project and the physical size is changed, a message will appear asking if you would like to resize all the images in the tube. The program can accommodate non-equal size images and windows in the same tube or session.

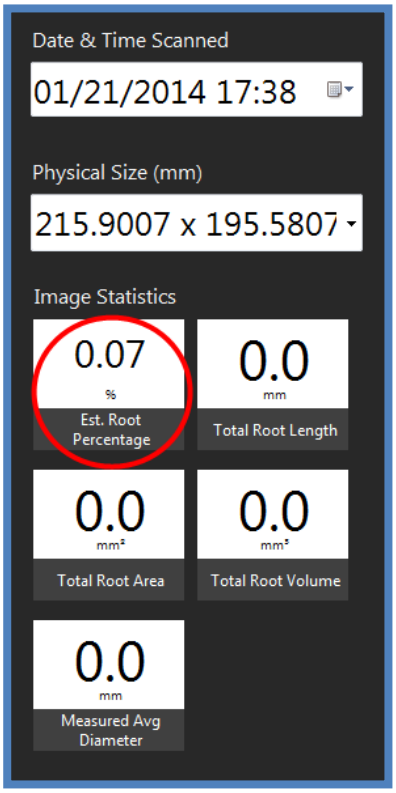





## *Estimate Root Percent*

After an image is imported and the actual size is correct, the image's root/soil separation threshold should be set. Click the Estimate Root Percent icon on the toolbar. Adjust the threshold level and select the best image. The best image has neon green overlaying only the roots and none of the soil. Choose from Dark Soil/Light Roots or Light Soil/Dark Roots to help set the best threshold.



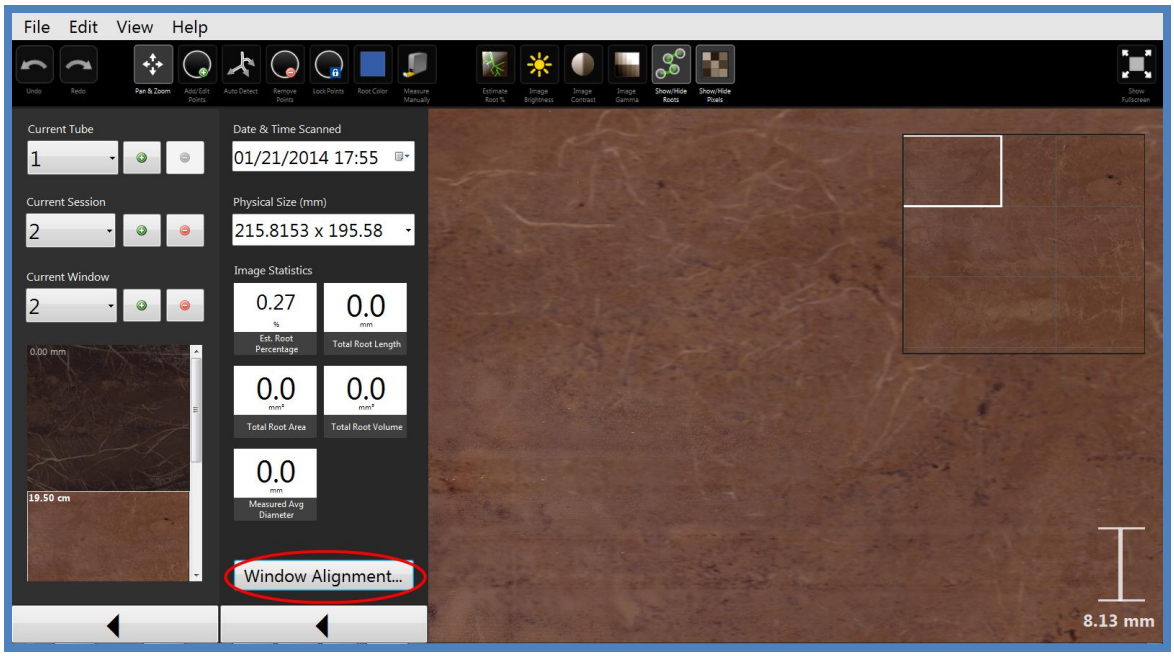

This tool estimates how much of the root system is shown in the image. After the threshold is set and you click "Apply", the estimated root percent statistic will appear in the Image Details Panel.

## *Window Alignment*

Images taken with the CI-600 Digital Root Imager typically have 1 cm of overlap in order to guarantee that the entire root area and all parts of the tube are scanned. Multiple images may be lined up and have the overlap removed using the Window Alignment tool on the Image Details panel. It is easy to accurately eliminate the overlap and make sure that all scanned roots are fully included in the analysis. Window images can be aligned using this feature. If root mappings from previous session images need to be aligned, please see the "Migrate Roots" section of this manual.

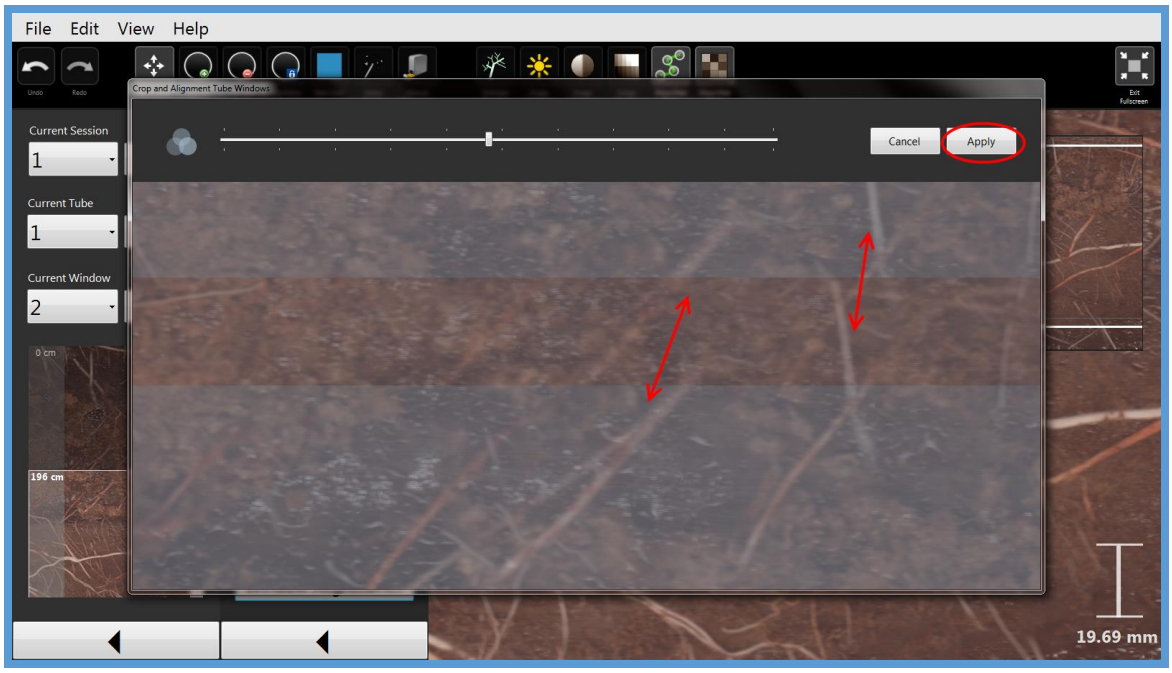
To align window images:

- Load the images into RootSnap!.
- Starting with the second window from the top (Window 2), the Window Alignment button is at the bottom of the Image Details Panel. If you cannot see the Window Alignment button, check that RootSnap! is in full-screen mode (show/exit full screen button on right of tool bar) and check that Window 2 or lower is selected.
- To see the Image Details Panel, select View<Panels<Image Details from the top menu bar.




- Pressing the Window Alignment button will initiate a pop-up window.
- Align the images from Window 1 and Window 2 using the mouse or fingers.
- The images will become transparent where overlapping. This is in order to help accurately line up the images and roots.

- Use the mouse or fingers to fine-tune the exact overlap in the transparent "ghost effect" area. Align the images by overlaying the roots.
- Click <Apply> at the top of the screen when images are aligned or click <Cancel> to exit the crop and align feature.




- The images will reflect the alignment in the preview on the Tube Details panel.
- The Window Alignment tool should be used for each window, starting with Window 2, before root mapping is started.

## *Beginning to Map Roots*

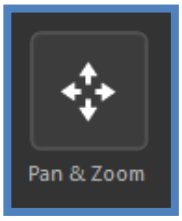
Once a root image is imported into RootSnap!, estimate the root area and align it with neighboring window images to be ready to begin mappings roots. Select a window image to start mapping.

1. Import image.
2. Rotate/flip the image.
3. Verify correct physical size in Image Details Panel.
4. Window alignment (if lower in tube then Window 1).
5. Adjust image Brightness, Contrast and Gamma
6. Estimate root percent.
7. Zoom in on root to map until it is at least as wide as your finger.
8. Place the first point in the center of the root. The first point is critical; it must be on the root!
9. Detect growth.
10. Check automatically mapped points for accuracy and diameter.
11. Move/place points past color change to keep automatically detecting growth.
12. Detect growth again.
13. Start mapping branches:
    a. Map a few points and detect growth.
    b. Dock branch to parent root.
14. Detect growth.
    a. Move points to end of branches.
15. Continue for rest of root system.

# TOOL BAR OPTIONS


### Undo & Redo

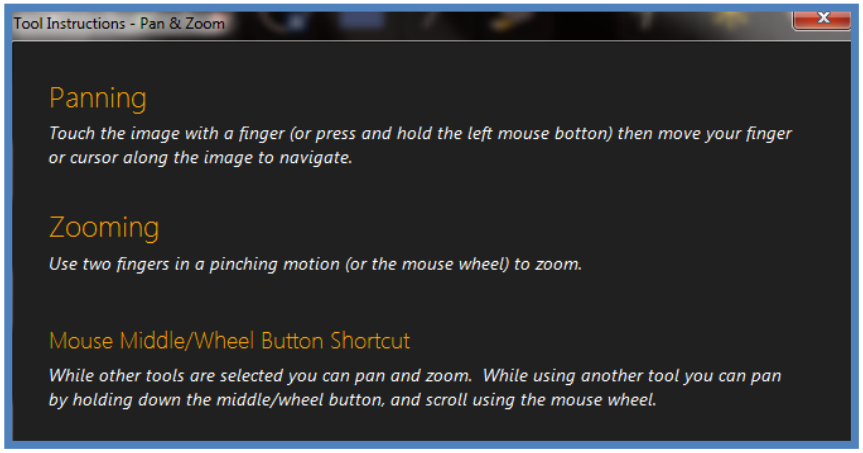
This tool allows users to undo or redo changing roots, adding points, moving points, deleting points, etc. It also allows the user to undo/redo changes to the root image. A current Session needs to be loaded to use these tools. Undo/redo can be used multiple times.

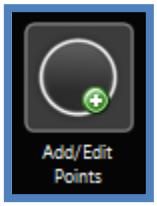



### Pan & Zoom

The Pan & Zoom tool functions so that the user can pan around the root image and zoom in or out on the image. Touching the icon twice will display a hidden menu with "Instructions" for the Pan & Zoom tool. These instructions are displayed in the Figure below.

- To activate the Pan & Zoom tool, select it from the Tool Bar by touching the icon or clicking it.
- Pinch in or out on the root image to zoom. This is done by touching the screen.
  - Place your index and thumb about three inches apart on screen over where you want to zoom in.
  - Touch the screen and start moving index and thumb towards each other. This should cause the image to zoom in on the center of where you touched.
- To pan, touch or click the <pan/zoom> tool and then touch the image, move your finger in the direction to pan and then lift your finger off the screen. Pan around the root image until finding the desired root to be mapped.
- The middle wheel of the mouse is enabled with a pan shortcut, to help when using other tools but needing to move around on the image.

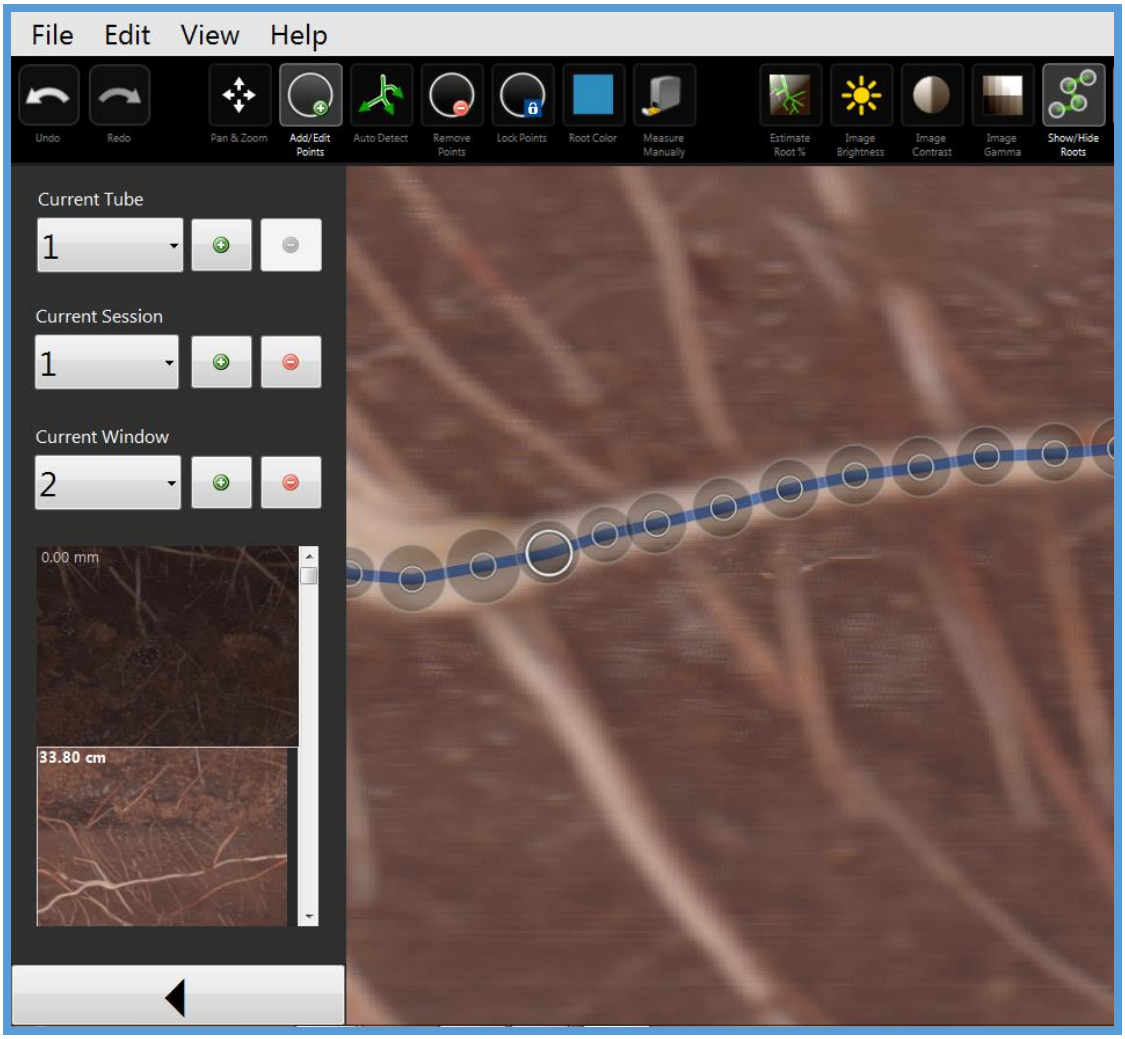




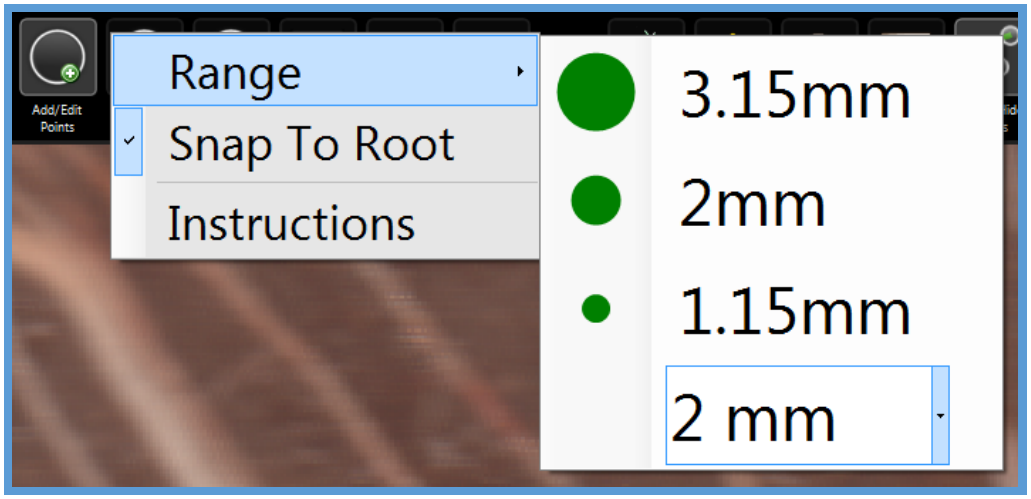

## Add/Edit Points

This tool functions to add new root points or move existing points. To add a new root point, touch or click the <Add/Edit Points> icon in the Tool Bar. Then, touch the desired place to add the root on the root image and trace your finger or cursor along the length of the root to add points. After you draw or move points they are analyzed and data for diameter, etc. is updated. First, the snap-to-root feature is applied, and then the trajectory is plotted and finally the point is measured.

- To add points to an existing root, zoom in to the root until it is as wide as your finger.
- Touch/click the <Add/Edit Points> icon on the Tool Bar.
- Touch the root directly in the center. Place the first root point in the middle of the root. The first point is critical; it must be on the root.
- Touch/click/drag the cursor up or down the root to continue adding points.



When the <Add/Edit Points> icon on the Tool Bar is clicked or touched, access to the Range, Snap To Root and the Instructions is seen.




### Range

The range around the finger touch or click that will select a currently mapped point to move it can be adjusted in the Move/Add points tool menu. There are 3 preset range sizes (large, medium and small) with corresponding circles that represent the range of the area that will be selected. The exact size will change depending on how zoomed in the image is. The range can also be set from 0.25 mm to 10 mm using the drop-down feature. Each range will have default point spacing.

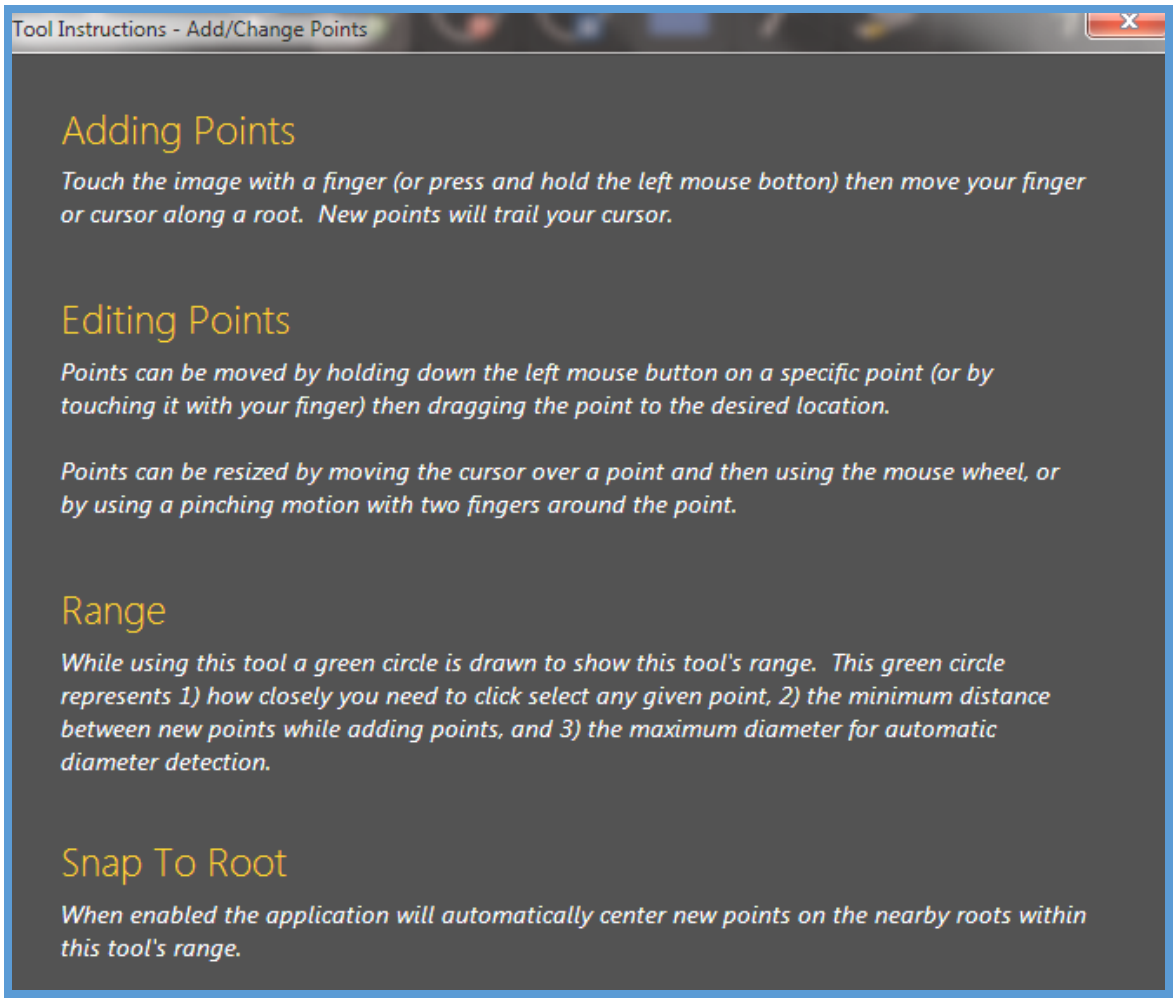
### Snap To Root

The Snap To Root feature, as explained in the Introduction section, will automatically "snap" all the points in a traced root path to the center of the root based on finding the identical color within the range of the tool. Adjusting the brightness, contrast and gamma, as discussed in later sections, can help the Snap To Root feature determine more accurately where the center of the root is in the image.

Sometimes mapping small or fine roots, or mapping areas where lots of roots are growing next to each other can be difficult if the Snap To Root feature is enabled. Snap To Root looks for the identical color in the gradient and identifies that as the center of the root and moves the root point to it.

If the application keeps moving your root point from where you would like it:

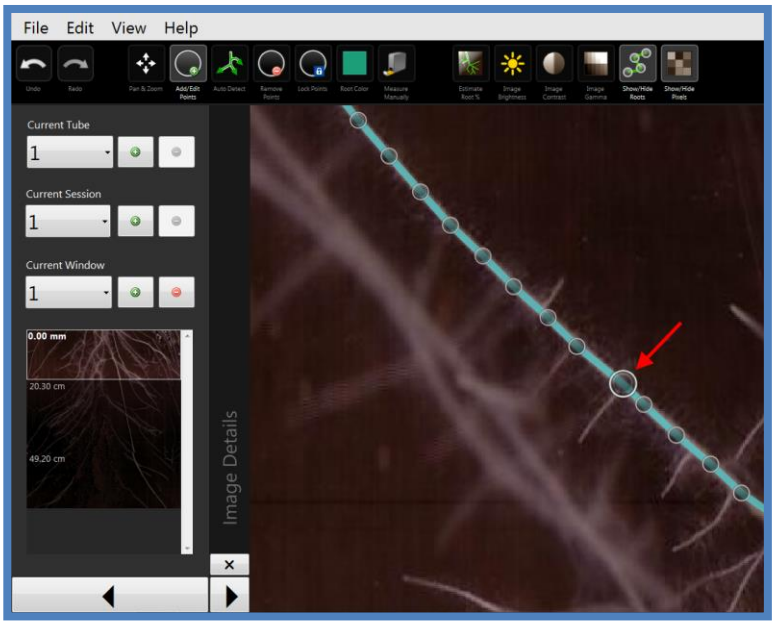
- Select the Move/Add Points tool pop-up menu
- If Snap To Root is enabled, it is visible with a check next to "Snap To Root "in the menu. If Snap To Root is disabled, there will be no checkmark.


Tool Instructions - Add/Change Points
Adding Points
Touch the image with a finger (or press and hold the left mouse botton) then move your finger or cursor along a root. New points will trail your cursor.
Editing Points
Points can be moved by holding down the left mouse button on a specific point (or by touching it with your finger) then dragging the point to the desired location.
Points can be resized by moving the cursor over a point and then using the mouse wheel, or by using a pinching motion with two fingers around the point.
Range
While using this tool a green circle is drawn to show this tool's range. This green circle represents 1) how closely you need to click select any given point, 2) the minimum distance between new points while adding points, and 3) the maximum diameter for automatic diameter detection.
Snap To Root
When enabled the application will automatically center new points on the nearby roots within this tool's range.

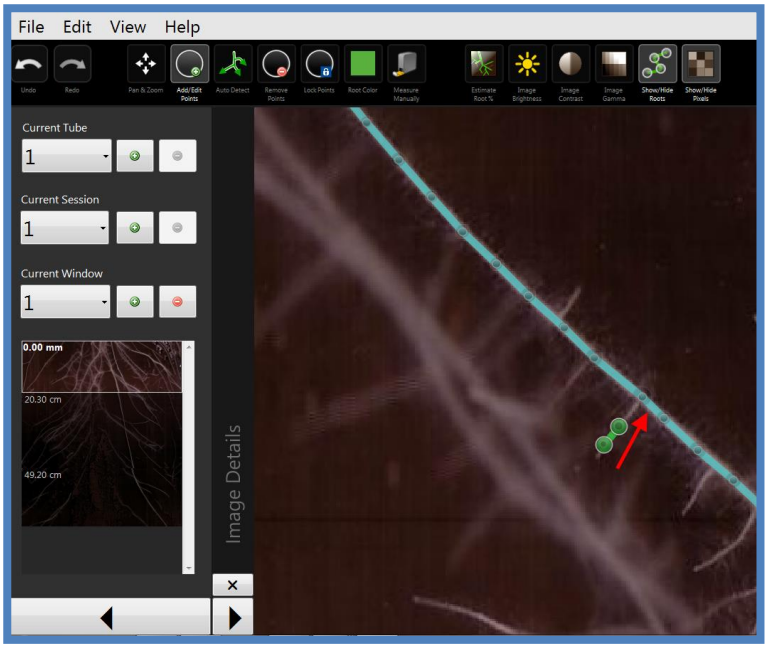
## How to Add a Branch

To add a branch:

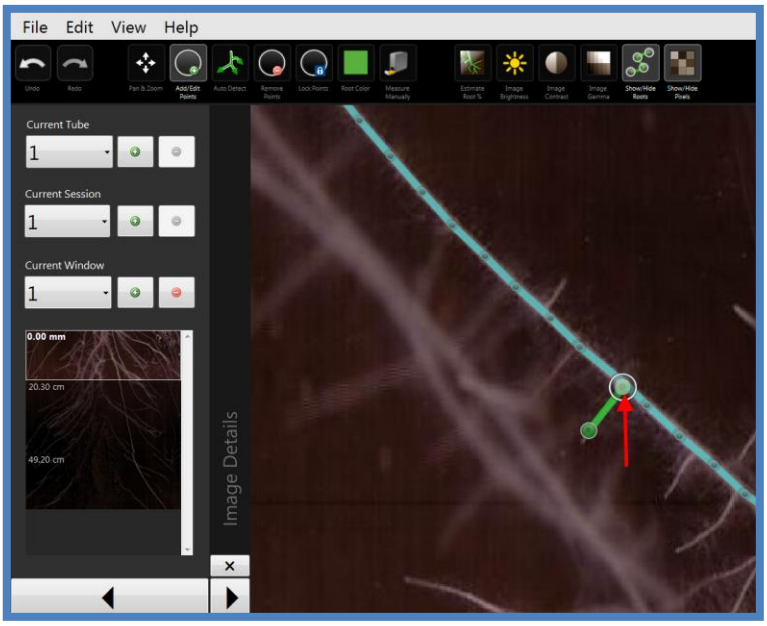
1. Touch or click the <Add/Edit Points> icon in the Tool Bar.
2. Select the point on the parent root that has the branch. Move this point to the base of the branch.



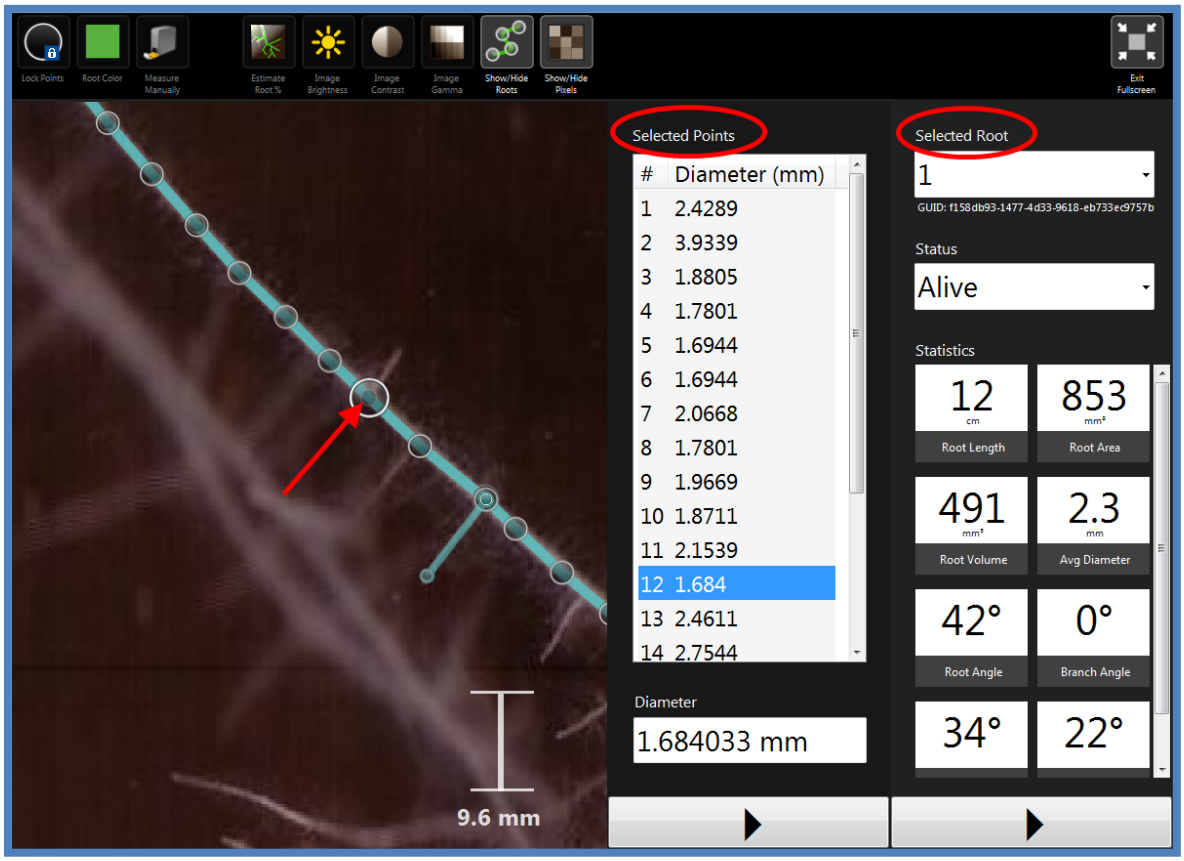

3. Start at the tip of the branch and using the Add/Edit Points tool, add points towards the parent root.



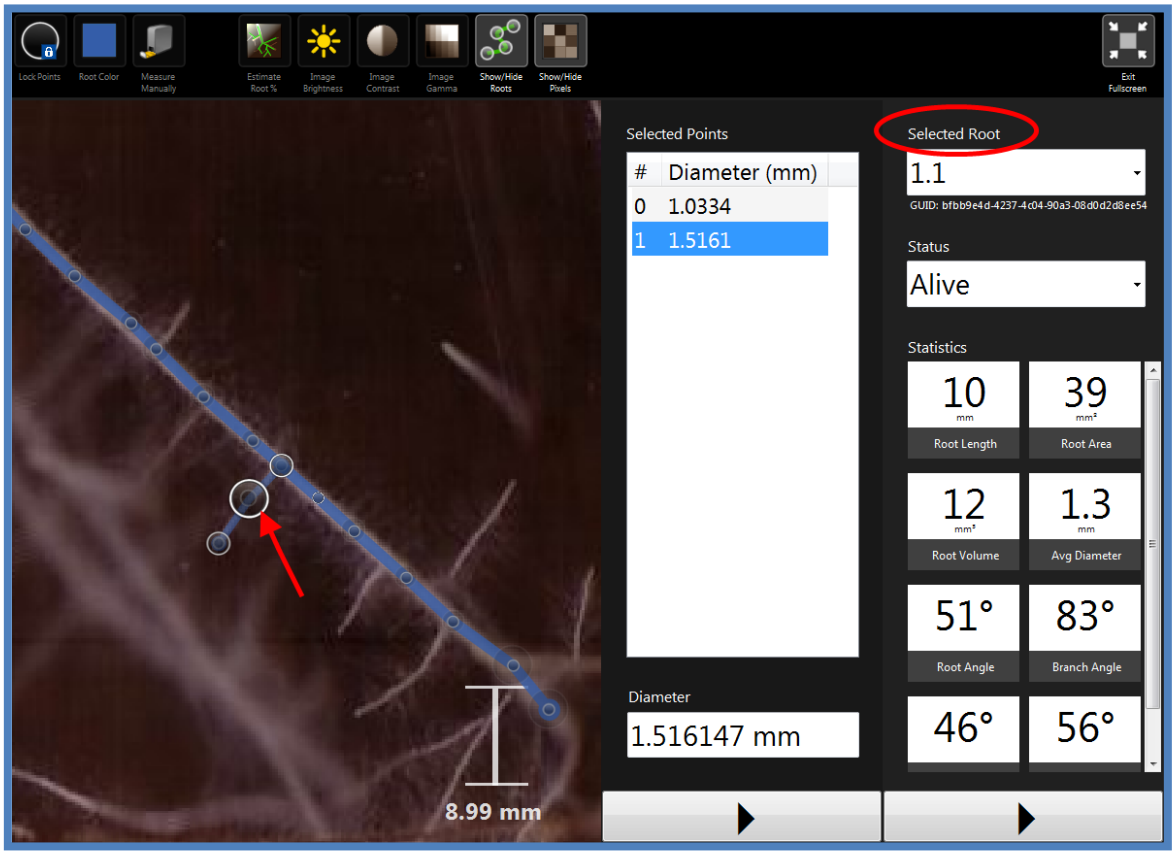
4. Hover over the root point on the parent root to dock the branch. This will add the branch to the parent root.

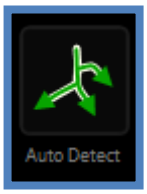



5. View data about the parent root in the Root Details and the Point Details panel: <View><Panels><Point Details> or <Root Details>. Use the Add/Edit Points tool to select a point on the parent root.



6. View data about the branch by selecting a branch point. A branch will have a current root with a decimal place. To change the name of the root, click the box and type a new name. The branch angle will also appear for points along a branch segment. The branch angle will be 0º for a point on a parent root.





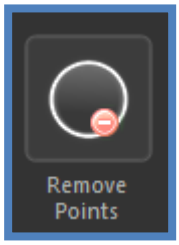

### Auto Detect

The Auto Detect tool will automatically find roots using the Snap To Root application of RootSnap! In order for this feature to run effectively, the user should adjust the brightness, contrast and gamma of the image. Test the Snap To Root feature by creating a new root path and determining if the root points are "snapped" acceptably to the center of the root. The Auto Detect tool takes time to work and many images need to have brightness, contrast and/or gamma adjustments prior to running the Auto Detect tool.

To automatically map a root:

- Touch or click the <Auto Detect> button.
- The root will grow from each end as the application searches for points to map.

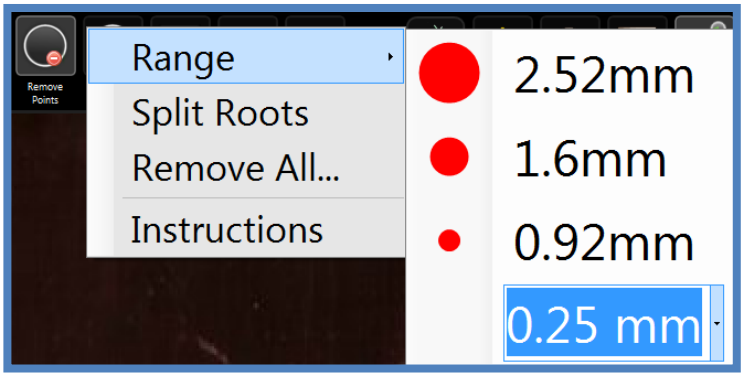
- When you are satisfied with the root points mapped or would like to stop the Auto Detect feature from working, press the <Esc> key on the keyboard.
- Remove any points that are not correct and double-check what was mapped automatically.
- Use the <Split Roots> tool to divide the root in half it the automatic mapping jumped between two neighboring roots.




### Remove Points

The Remove Points tool allows users to delete or remove points from a root. Removing the first point in a root path will delete the entire root path and connected branches. If you double-click the <Remove Points> icon on the Tool Bar, there is an option on the drop-down menu. Selecting <Remove All…> will remove all the points in the current window. If this is accidentally selected, use the Undo tool to bring back all the root points. Clicking the right mouse button will enable the Remove Points tool when the Add/Edit Points tool is selected.

### Range

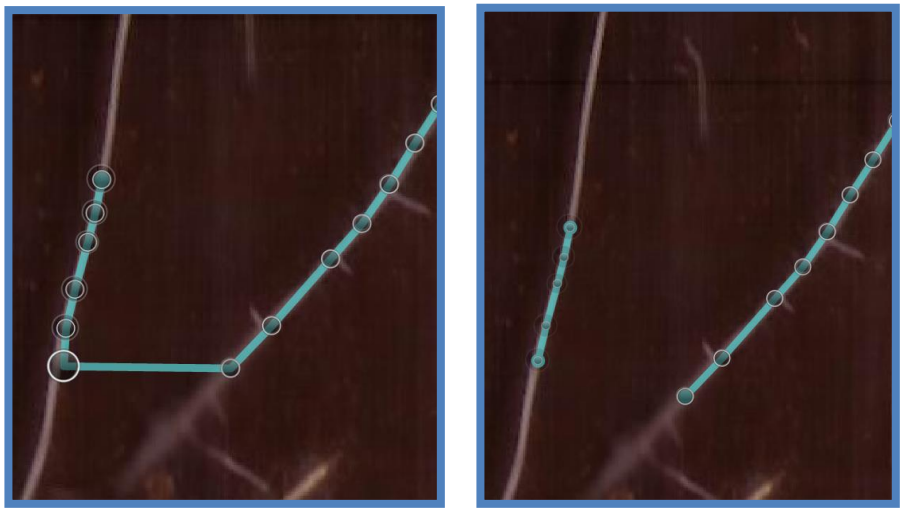



The range around the finger touch or click that will be erased can be adjusted in the Remove Points tool menu. There are 3 preset range sizes (large, medium and small) with corresponding circles that represent the range of the area that will be selected. The exact size will change depending on how zoomed in the image is. The range can also be set from 0.25 mm to 10 mm using the drop-down feature.

- When points are spaced close together, it is recommended to use a smaller range to select or delete intended points efficiently.

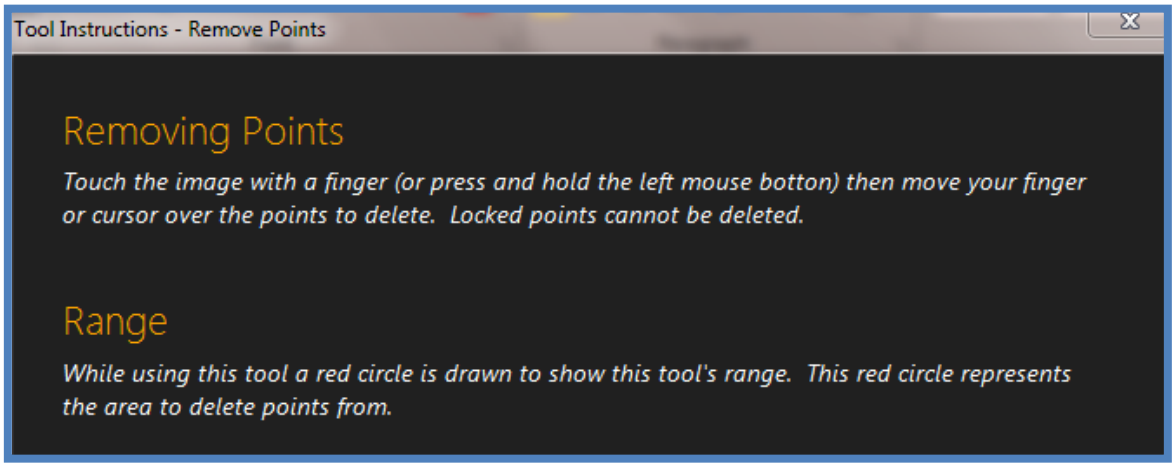
### Split Roots

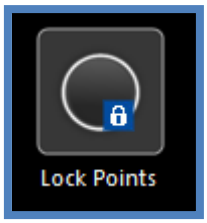
Enabling <Split Roots> will split the root in half when erasing a root point. If two roots are accidentally docked together, or a branch is combined at the wrong point, the split roots tool should be used.



To delete points:

1. Touch or click the <Remove Points> tool in the Tool Bar.
2. Touch or click on or near the point(s) to be deleted.
3. Right-click the mouse button to enable the Remove Points tool.

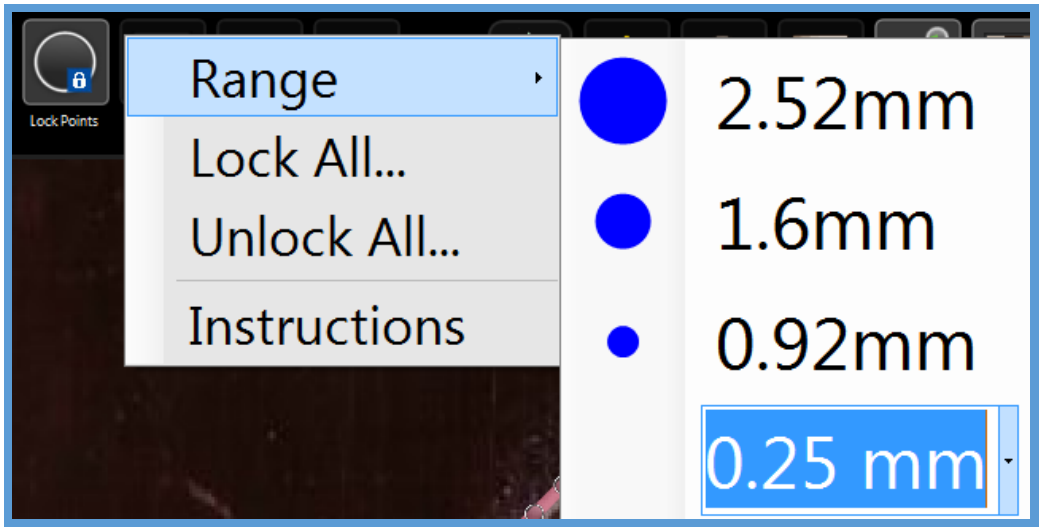




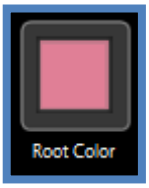

### Lock Points

This tool allows the user to lock points in place. Once a point is locked, it cannot be moved from its location or be modified in any way. A locked point has a padlock icon in the middle of the point. It is often useful to lock points near other points that are being changed to avoid mistakes.

The Lock Points tool menu has options to adjust the range of the lock tool to large, medium or small. The exact size will change depending on how zoomed in the image is. The range can also be set from 0.25 mm to 10 mm using the drop-down feature. The "Lock All" or Unlock All" tools can be selected to either lock or unlock all the points in the current window.




- To lock or unlock points in a current session, touch or click the <Lock Points> icon in the Tool Bar. Then, click/touch and move the blue circle over the point(s) to Lock. Points that are locked have a padlock icon appear as in the figure to the right.
- The points on the green root to the left are locked, while the empty points of the yellow root on the right remain unlocked.

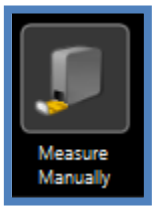



### Root Color

The Root Color tool changes the color of a selected root. When selected, the Root Color tool has a drop down panel with many shades of colors to choose for roots. Branches are given a more transparent color than that of the main root. Root Color will automatically change after completing a root, cycling through the spectrum of available root colors. Clicking the Left button on the mouse will quickly cycle through the colors.

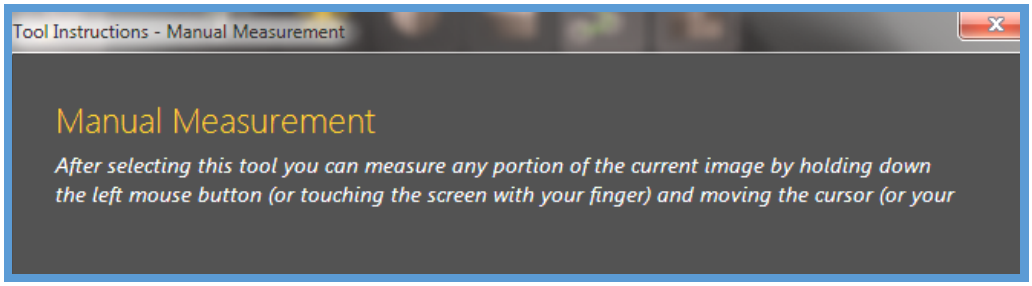
To change the color of a root:

- Touch or click the <Root Color> button on the Tool Bar
- Touch or click the desired color on the drop down color panel.



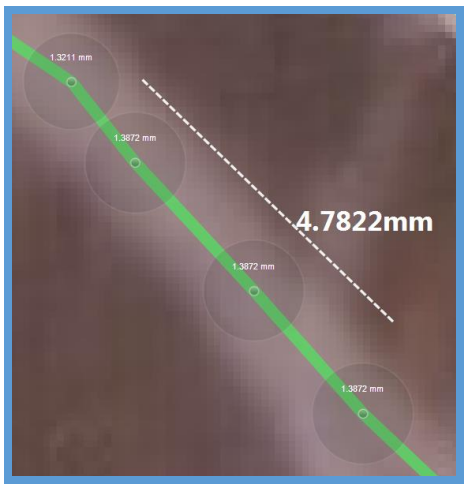

### Measure Manually

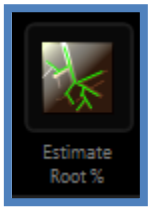
The Measure Manually tool allows the user to measure a specific section of roots by drawing a dashed line on the workspace. The line will disappear with the next click/touch.




To use the Measure Manually tool:

- Select the Measure Manually tool.
- Trace a line next to the root or branch segment to be measured.
- Trace a line through the root to estimate diameter.




### Estimate Root Percent

The estimate root percent tool is explained in a separate section, on page 7 of this User Manual.


## Image Brightness

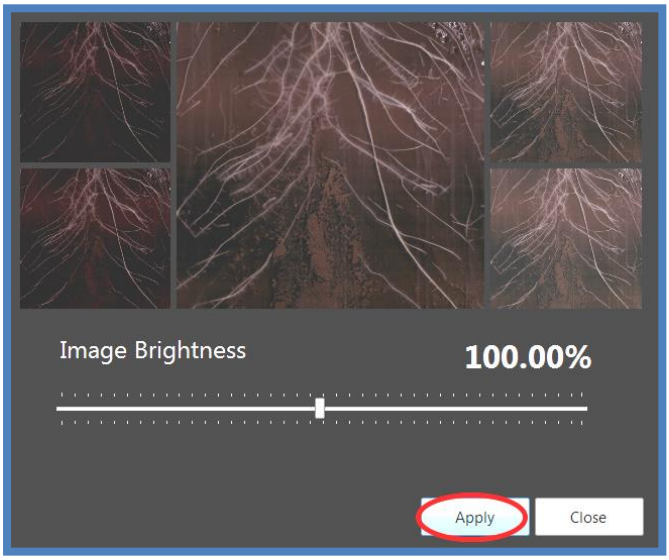
This tool allows the adjustment of the brightness of the root image and evenly makes pixels brighter or darker. Brightness should be changed until it is just above the point where all roots are distinguishable from the surrounding soil.

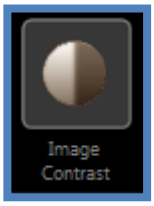
To adjust the root image brightness:

1. Touch or click the <Adjust Brightness> icon in the Tool Bar.
2. Select an image with the desired brightness or adjust the brightness using the trackbar.
3. Click <Apply> or <Close> to save the changes or dismiss the buttons.

The Adjust Brightness, Contrast and Gamma tools are great for dark roots in light soil or similar situations; they can also help to illuminate smaller roots or roots deeper in the soil.

As image brightness increases, small differences in the contrast become visible. Contrast is the difference in light intensity between white and black. Gamma is a measurement of contrast that affects the mid-tones of an image.



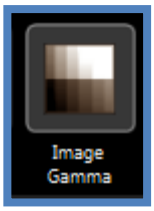



### Image Contrast

The Image Contrast tool gives the user the ability to adjust the contrast of the image. Contrast changes the shades of the images and can be used to make more dominant colors more intense. Correctly adjusted contrast should make the distinction between root and soil clearer.

To adjust the contrast:

- Touch or click the <Image Contrast> icon in the Tool Bar.
- Select an image with the desired contrast or use the trackbar.
- Click <Apply> or <Close> to save or dismiss the changes.




### Image Gamma

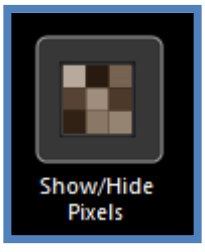
The Image Gamma tool allows the gamma setting of the image to be adjusted. The gamma is calculated according to a formula based on brightness and contrast and serves to help specific artifacts (roots) in the image stand out more. A correctly adjusted gamma will make the roots "pop" from the soil and clearly stand out.

To adjust the gamma of the image:

- Touch/click the <Image Gamma> icon in the Tool Bar.
- Select an image with the desired gamma or use the trackbar.
- Click <Apply> or <Close>.


### Show/Hide Roots

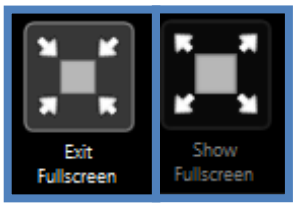
This tool allows the user to show or hide root paths, points or other markup in an open session. To use this tool, touch or click the <Show/Hide Roots> button to toggle between views.




### Show/Hide Pixels

This tool allows users to show or hide images pixels or a smoothed average rendering in an open session. This tool does not have an effect on RootSnap!'s calculations and is available for user preference. To use this tool:

- Touch or click the <Show/Hide Pixels> button to toggle between views.

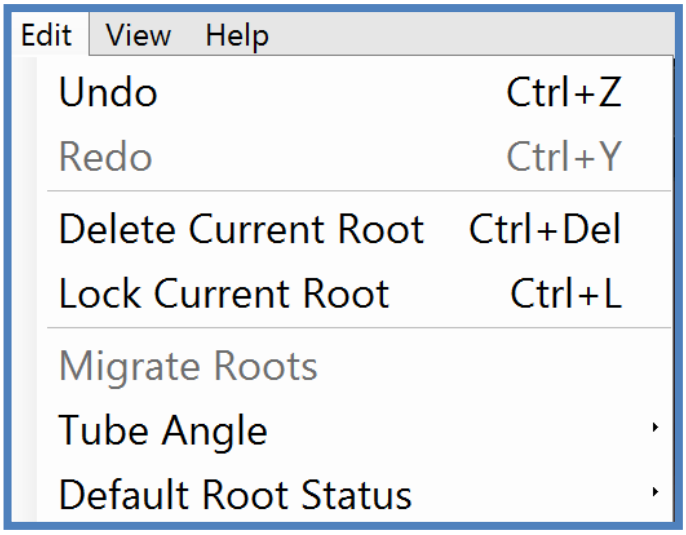



### Fullscreen Tool

This feature allows user to toggle from fullscreen mode to regular-view mode.

- Touch or click the full-screen button on the tool bar to switch between fullscreen and regular-view.
- Press F11 to switch between the two.

# EDIT MENU




The Edit Menu has access to the Undo and Redo tools, (page 11 of this instruction manual) as well as the Migrate Roots tools.

Selecting the Undo (or Redo) tool on the tool bar, in the Edit<Undo menu or by using the keyboard shortcut Ctrl + Z will result in the last action being undone. The keyboard shortcut for the redo tool is Ctrl + Y.

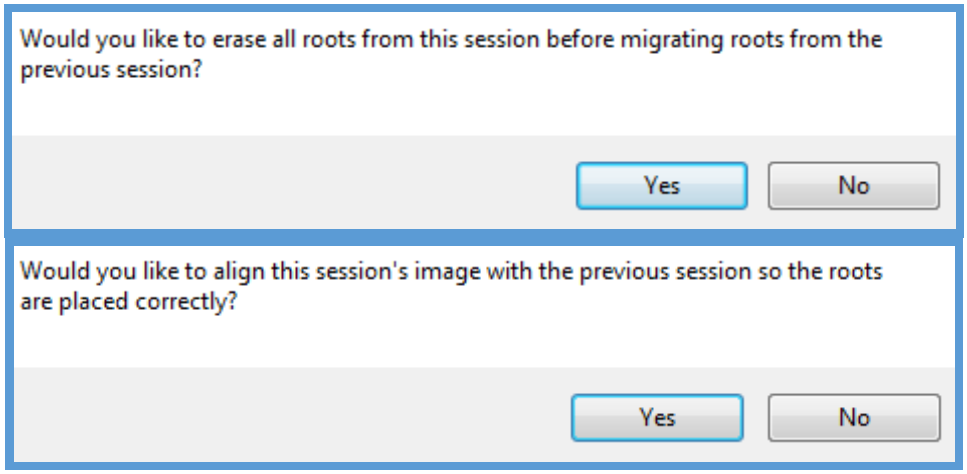
Selecting "Delete Current Root" will erase the currently selected root in the project. The keyboard shortcut for this tool is Ctrl + Del. The "Lock Current Root" option in the Edit menu will lock all the root points for the currently selected root. The keyboard shortcut for this tool is Ctrl + L.

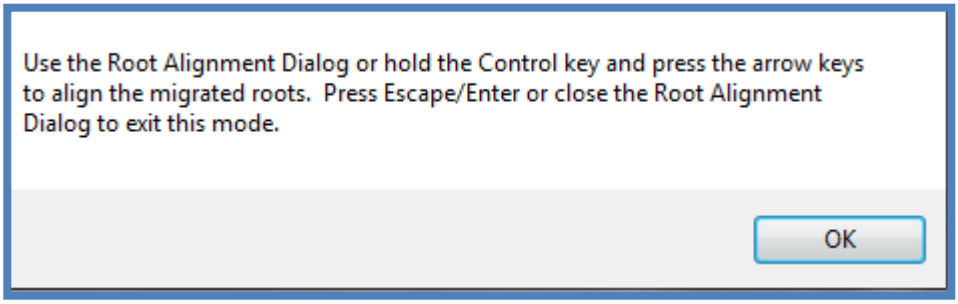
## *Migrate Roots*

The Migrate Roots tool should be used to copy root mappings from Session 1 to Session 2 or later sessions. Roots should be fully mapped in the first session before migrating to later sessions.

To Migrate Roots between sessions:

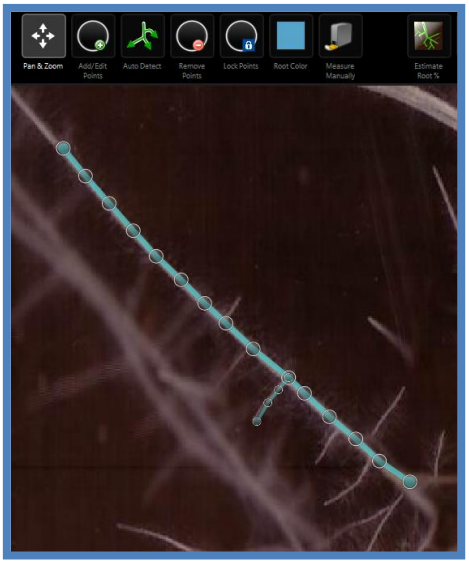
- Select the <Migrate Roots> tool from the Edit menu.
- Select "Yes" when the following pop-up boxes appear:






- Press the <Ctrl> key on the keyboard and use the arrows to move the root mapping into place, overlaying the root. Alternatively, use the Root Alignment Dialog to move the root mapping into place.


- Press <Enter> to end the alignment mode or touch the "X" in the upper left corner of the Root Alignment

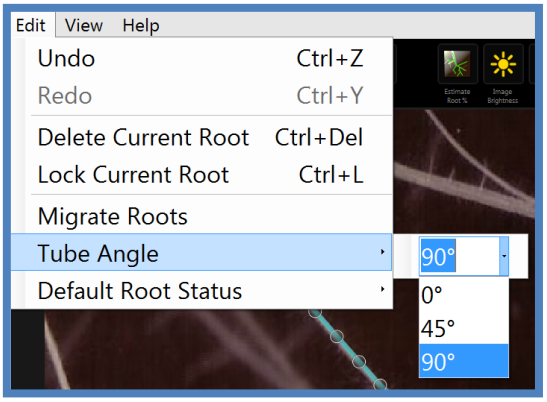


- Select a root and select the Auto Detect tool.
- Next, use the Add/Edit Points tool to move the end point of the root or add new points to map growth.

- Map the root to the new tip.

## *Tube Angle*

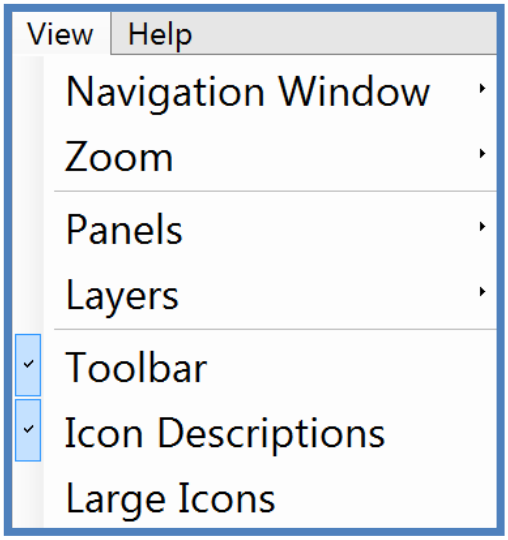
The <Edit><Tube Angle> option allows the user to adjust the angle of the root tube. This is dependent on how the physical root tube is installed in the field. If the tube is installed vertically, the user should select the 90$^{0}$ option. For horizontal tubes, select the 0$^{0}$ option. For tubes installed at an angle, choose the 45$^{0}$ option.




## *Default Root Status*

The default root status, appearing in the Root Details Panel, can be changed in the Edit Menu. There are three available options for root status: New, Alive and Dead. The default root status will be used for any new images imported into the project.

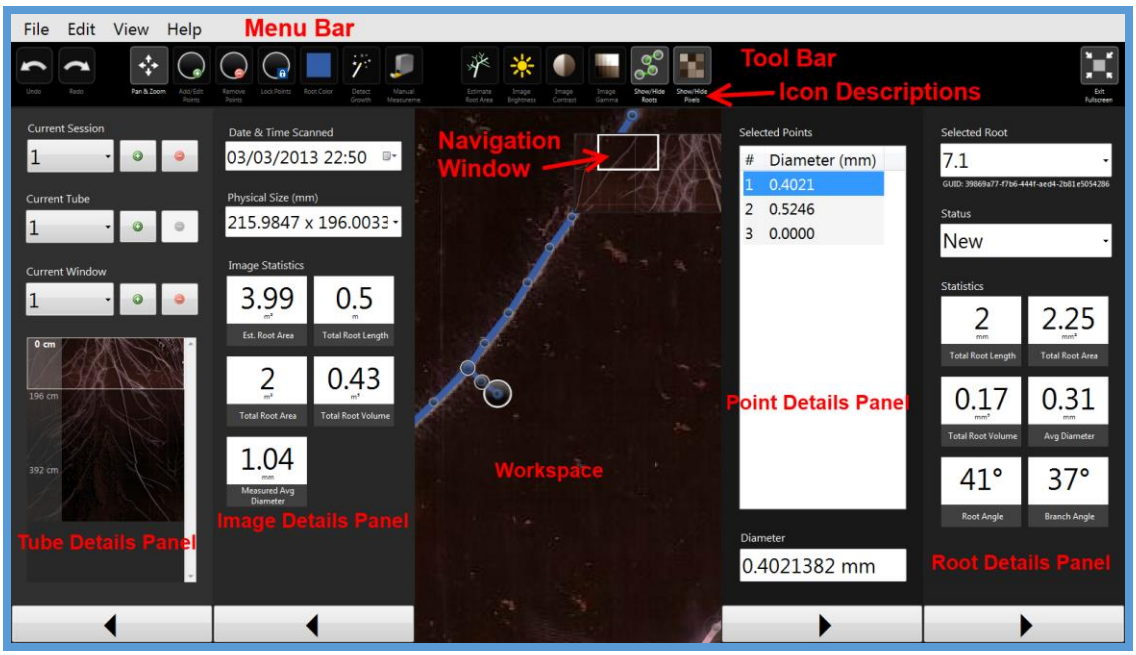
# VIEW MENU




The View Menu accesses various options and features of RootSnap!. The View Menu allows the user to show or hide the Navigation Window, zoom in/out on the image, access the 4 detail panels, show the previous root mappings layer, and show or hide the toolbar, icon descriptions or make the icons larger.

The Navigation Window is the small pop up box in the RootSnap workspace. Touching the Navigation Window will jump to that section of the root image. The Navigation Window menu allows the user to make the Navigation Window Visible, enable Snap to Grid or Show the Grid. Right-clicking on the Navigation Window will also bring up the Navigation Window menu.

- To change the current viewable area, click or touch a specific area on the Navigation Window.
- To view the Navigation Window, select <View>< Navigation Window><Visible>.
- To show a grid over the Navigation Window, press Control+G or select <View><Navigation Window><Show Grid>.
- To snap to the grid when using the Navigation Window, press Control+Shift+G or select <View><Navigation Window><Snap to Grid>.

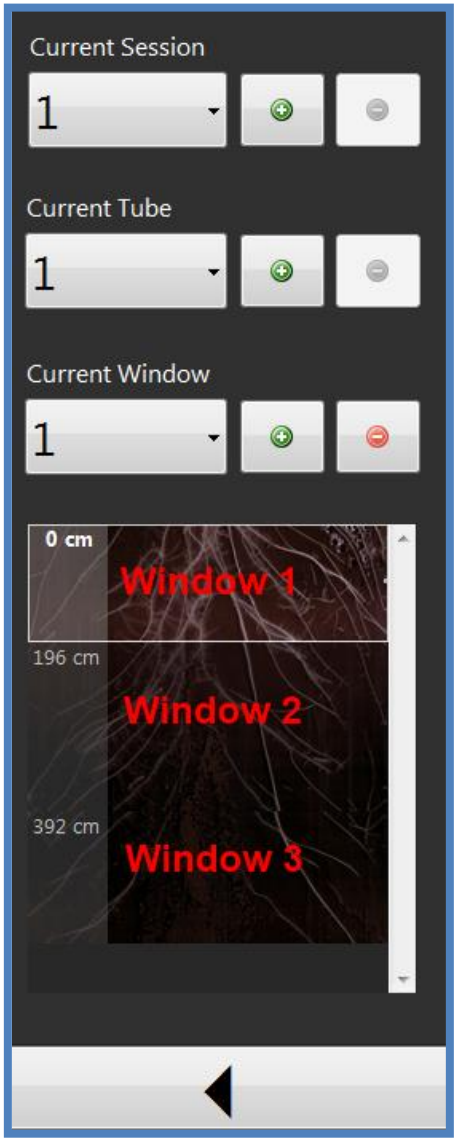


- Selecting “Zoom” from the View menu allows for adjustment to the zoom of the image.
    - Select “Zoom Out” or press Control and – on the keyboard to zoom out on the image.
    - Select “Zoom In” or press Control and + on the keyboard to zoom in on the image.
    - Select “100%” or press Control + 0 on the keyboard to reset the zoom to 100% or full size.
- Selecting <Layers><Previous Root Mappings> will either show or hide root mappings from the previous session.
- The Details Panels that pop out on the left and right sides of the RootSnap! workspace can be accessed by navigating to View<Panels
    - Select <View><Panels><Tube Details> or press Alt + T to show the Tube Details panel.
    - Select <View><Panels><Image Details> or press Alt + I to show the Image Details panel.
    - Select <View><Panels><Point Details> or press Alt + P to show the Point Details panel.
    - Select <View><Panels><Root Details> or press Alt + R to show the Root Details panel.

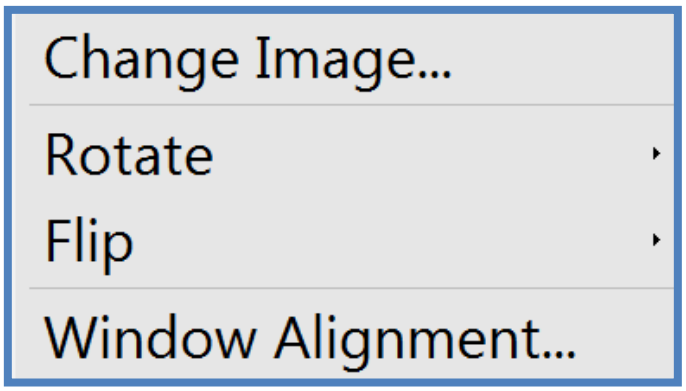
## *Detail Panel Descriptions*

### Tube Details Panel

The Tube Details panel allows the user to easily navigate and manage the current project by jumping to different sessions, tubes or windows. The Tube Details panel can also be used to expand projects, adding new windows, tubes and sessions using the green "+" button.




1. To view the Tube Details panel, enable it from the <View><Panels><Tube Details> on the menu bar
2. Use the black arrow at the bottom of the panel to expand or hide the tube details panel.
    a. The Tube Details panel appears on the left side of the RootSnap! workspace.
3. The depth of each window from the top of the imaged area can be seen on the left side of the window preview section. Window 1 is the window closest to the surface of the soil with a depth of 0 cm. Window 2 has a depth of 196 cm and Window 3 begins at 392 cm below ground.
4. Right-click on a window in the Tube Details Panel to enable the Tube Details Menu, shown below.
    a. The tube Details Menu includes options to change the image by importing another image and to rotating or flipping the image.
    b. If the Window Alignment feature is available, it is also shown as an option.



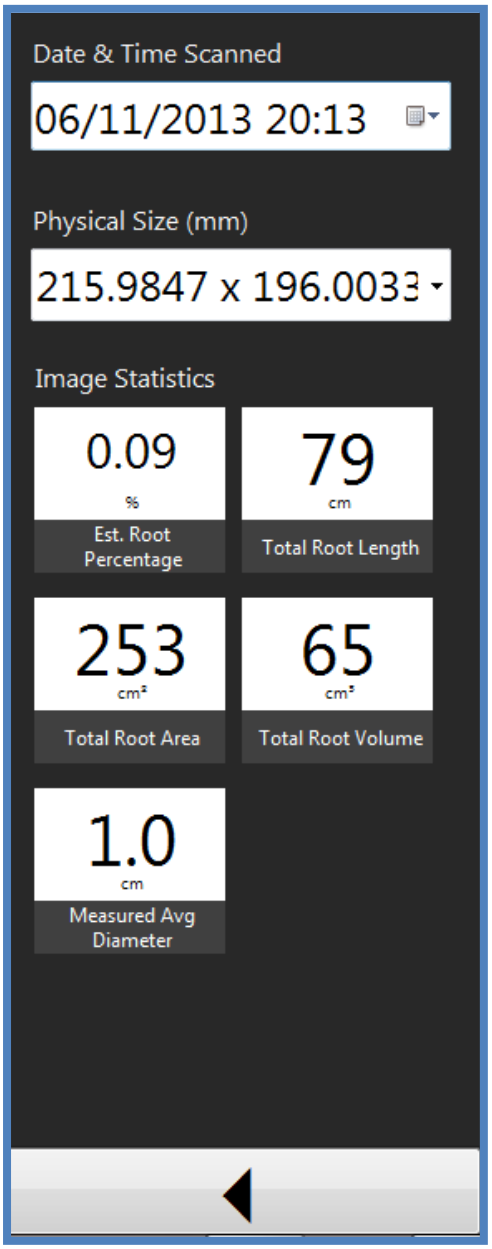
### Image Details Panel

The Image Details panel displays information about the image currently active in RootSnap!. The top of the Image Details panel shows the "Date & Time Scanned." This is the date and time that the image was created. If the image was acquired with a CI-600, the timestamp should import properly. If the image was taken with a flat-bed scanner or digital camera, the timestamp may need to be adjusted to the actual date/time the root image was taken. The time is on a 24-hour clock to eliminate confusion.

The "Physical Size" of the image is displayed in millimeters. Check that the image's Physical Size is correct. If the actual size of the image is not correct, change it to the correct size before starting to analyze roots. CI-600 images are 215.9 mm x 195.7 mm. The DPI and Pixel count are automatically adjusted to render this size. Typically the DPI, Pixels and Actual Size values do not need to be changed from the values automatically tagged with the image.

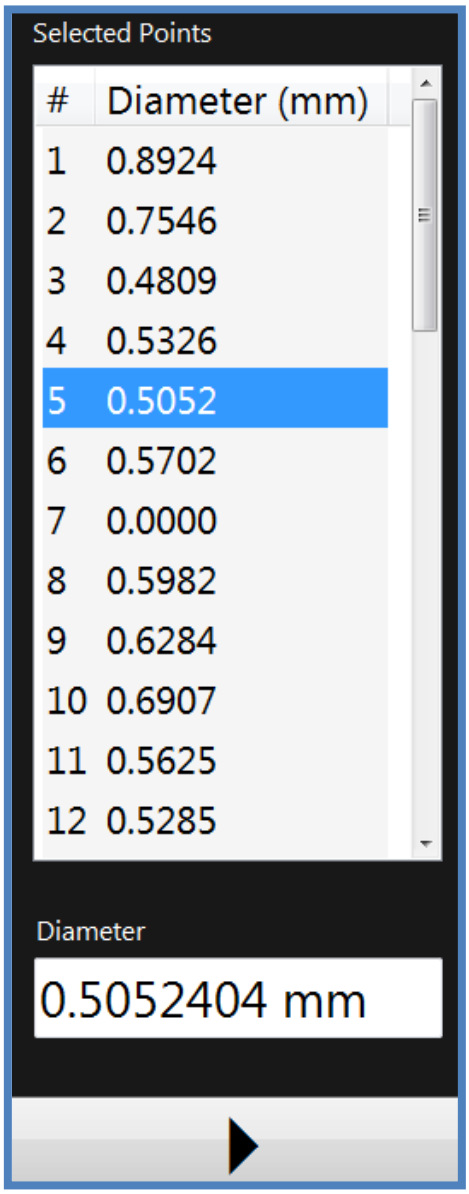
The units that the data is reported in are automatically chosen by the program, determined by what fits the data set the best. The data can be reported in millimeters, centimeters or meters.

1. To access the Image Details Panel, navigate to <View<Panels><Image Details>.
2. The panel will appear on the right side of the screen when enabled.



### Point Details Panel

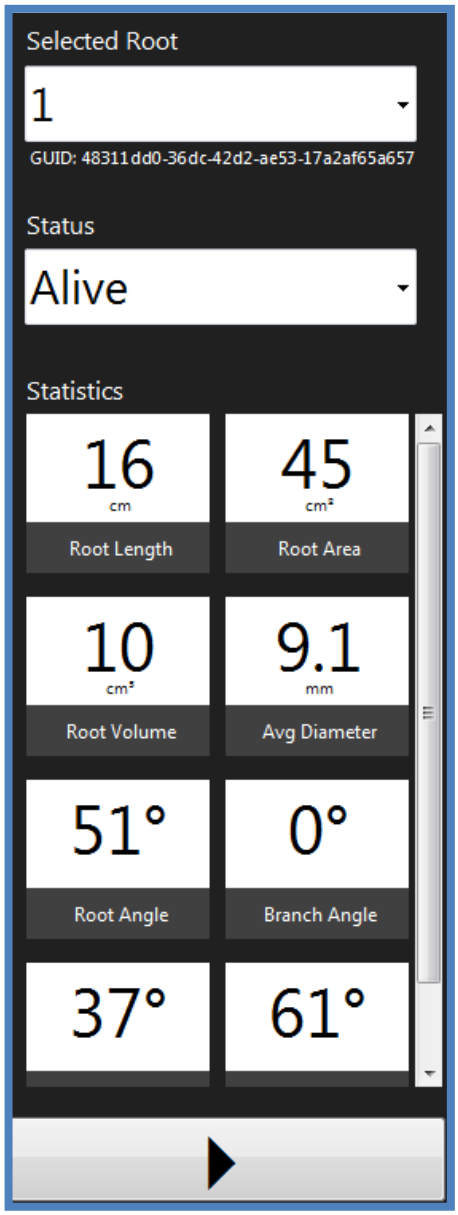
The Point Details panel displays the diameter details of the currently selected root point, and other points on the root, as shown in the example to the right.



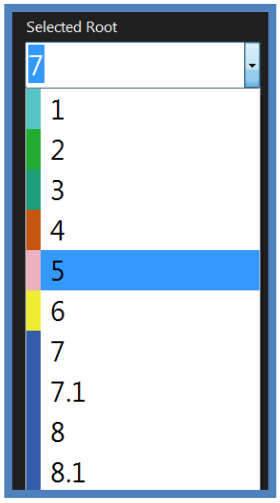

1. Click <View><Panels><Point Details> option to show or hide this feature.
2. To expand/hide the Point Details panel, press the arrow at the bottom of the bar. The Point Details will appear on the right side of the workspace.
3. To change the Current Point displayed in the Point Details panel, select any point using the Add/Edit Points tool or choose a point from the list.
4. To change the diameter of a point, select the point on the root map. Use the mouse wheel or pinch the point in/out until the gray circle is as large as the root. The correct diameter can also be entered numerically into the Point Details panel.

## Root Details Panel

This feature allows the user to view the morphological details of the current root including numerical data such as root area, volume, diameter and length, as seen in the example Root panel to the right. Also reported in the root details panel is the root angle, branch angle (only reported if segment is a branch), and the start and end tip angles of the root.




1. To hide or show this feature: select <View><Panel><Root Details>.
2. To expand or minimize the Root Details panel off to the side, press the small arrow at the bottom of the panel.
3. To change the current root displayed in the Root Details panel:
    a. Select any point on the root using the <Add/Edit Points> tool.
4. The "Selected Root" drop-down list at the top of the Root Details panel. The drop-down list in the Root Bar is organized so that branches (sub-roots) are with their parent root and are color-coded.




The Root Details panel contains the statistics for total root length, total area of the selected root, root volume, average diameter of root points on the root, root angle, and if applicable, branch angle. The start and end tip angles of the root are also reported. RootSnap! calculates root volume by assuming a cylindrical shape for the roots. The application uses this assumption to extrapolate point diameter and root length into root volume data in $mm^3$, $cm^3$, or $m^3$ (whichever unit fits the data best).

# HELP MENU

The Help Menu contains the Release Notes and the "About" information pop-up box. The Release Notes are the fixes, corrections or additions made to the software in the latest release or version. The "About" pop-up screen contains information about the license key of the application, checking for updated versions, and requesting license key activation.

# EXPORTING DATA

Data from RootSnap! projects, tubes, windows or sessions can be exported to be opened as a spreadsheet. Exported data is saved as .csv (comma separated value) files which can be opened using Microsoft Excel or similar programs and saved as various other file types. The user has a choice of which data is exported and can select individual sessions to the entire project to be exported as a single .csv file. After selecting which sessions to export, the user then has a choice of what data fields to include in the exported data file. By default, several data fields will not be exported. Desired data fields can be set before exporting.

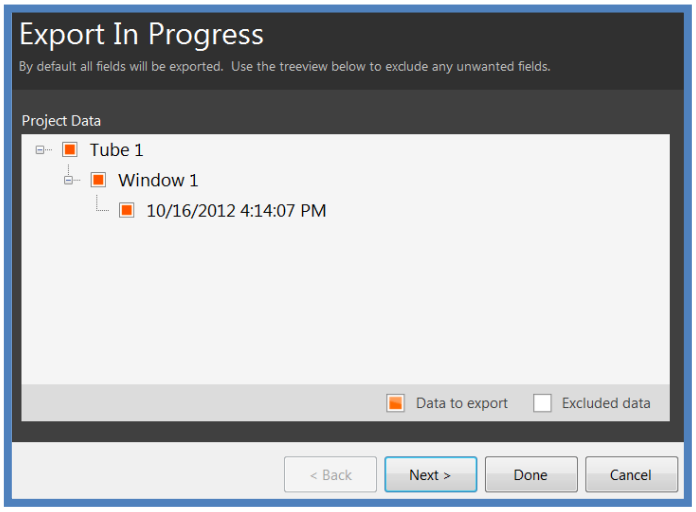
The data fields that are available to export are broken down into 5 levels: tube data, window data, session data, root data and point data. The individual data fields available for each are shown in Table 3.

Table 3: Date fields that can be exported in a .csv file from a RootSnap! project.

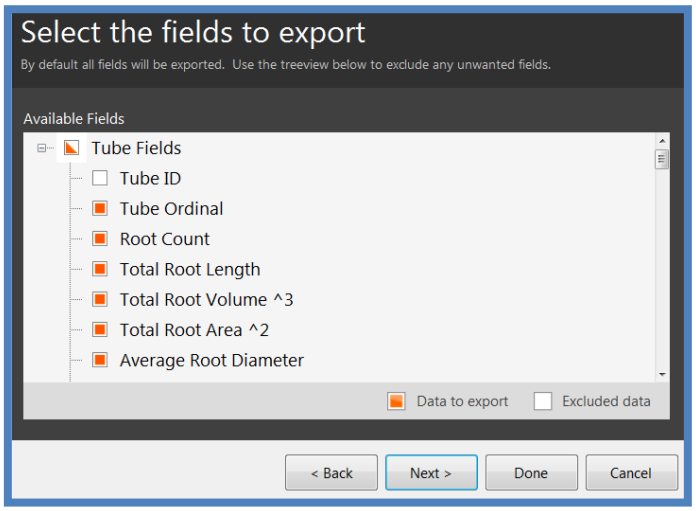
| TUBE | WINDOW | SESSION | ROOT | POINT |
|---|---|---|---|---|
| Tube ID | Tube ID | Tube ID | Tube ID | Tube ID |
| Tube Ordinal | Tube Ordinal | Tube Ordinal | Tube Ordinal | Tube Ordinal |
| Root Count | Window Ordinal | Window Ordinal | Window Ordinal | Window Ordinal |
| Total Root Length | Depth | Session ID | Session ID | Session ID |
| Total Root Volume | Root Count | Session Ordinal | Session Ordinal | Session Ordinal |
| Total Root Area | Total Root Length | Date and Time | Session Date | Session Date |
| Average Root Diameter | Total Root Volume | Physical Size | Parent Root ID | Root ID |
| Average Root Length | Total Root Area | Image Size | Root ID | Location |
| Average Root Area | Average Root Diameter | Root Count | Root Ordinal | Point Ordinal |
| Average Root Volume | Average Root Length | Total Root Length | Root Alias | Diameter |
| | Average Root Area | Total Root Volume | Status | |
| | Average Root Volume | Total Root Area | Length | |
| | | Average Root Diameter | Average Diameter | |
| | | Average Root Length | Area | |
| | | Average Root Area | Volume | |
| | | Average Root Volume | Root Angle | |
| | | | Branching Angle | |
| | | | Branch Count | |
| | | | Start Tip Angle | |
| | | | End Tip Angle | |

Root data is displayed at the top of the file including the root id, length, average diameter, area, volume, mean angle, branch count, branch ids and point count. Below the root data is the point data, such as the sample location (X, Y axis values for point), diameter, angle and mapping method (manual or automatic from Find Roots feature). Also shown is the brightness distribution score, gradient detection score and root behavior score for each point.

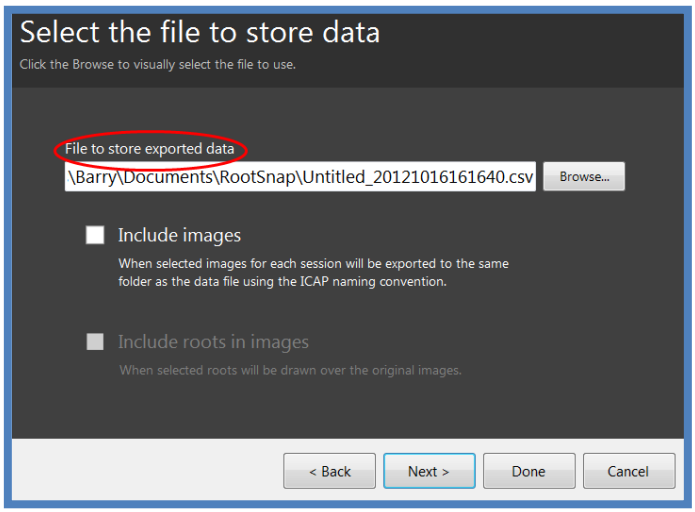
1. To export data from a Project, select File <Export>.
2. Choose which Tubes, Windows or Sessions to export data from. Data to export will have an orange square next to it.

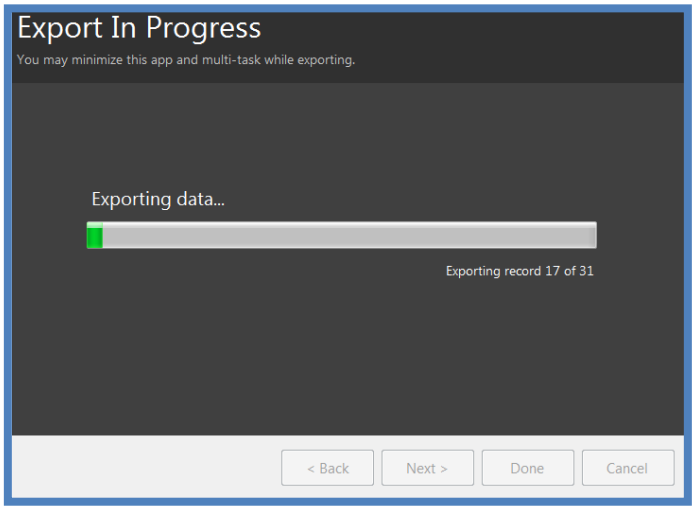



3. Choose which data fields to include in the exported data file.
4. The "point" fields are disabled by default to eliminate excess data. The default export setting will provide the average diameter of the root or branch. If individual point diameter is needed, select this data field to export.

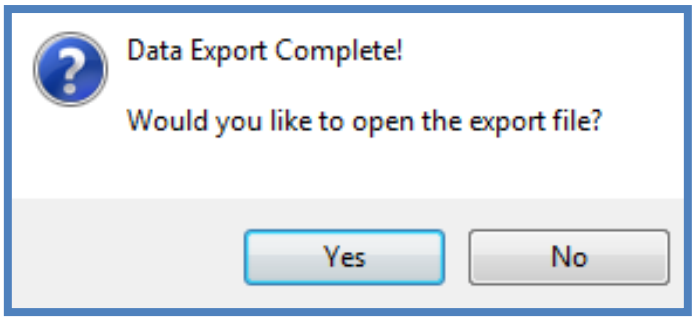


5. To save the exported data, type the desired file name and press save it as .csv.
6. The .csv file will be saved in the "Document<RootSnap!" folder.
7. Choose "Include Images" to save a copy of the original root image (without mappings) with the .csv.
8. The feature to "Include roots in images" will be available in a later version.
9. Click "Next" or "Done" to begin exporting the data. During the export process, you can minimize the RootSnap! application.




10. When the export is complete, there will be the option to open the file and view the data immediately.




The next page of this manual is an example spreadsheet of the data that is exported by default. The spreadsheet is split in two so that it can be viewed on a single page. All values are in millimeters and Project, Tube and Window totals reflect the current totals for the latest session.

| | A | B | C | D | E | F | G | H | I | J |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | * | * | * | * | * | * | * | * | * | * |
| 2 | * | * | * | * | * | * | * | * | * | * |
| 3 | Date Created | Software Name | Software Version | | | | | | | |
| 4 | 3/8/2013 14:36 | RootSnap! | 1.2.6.78 | | | | | | | |
| 5 | | | | | | | | | | |
| 6 | | | | | | | | | | |
| 7 | Tube Ordinal | Root Count | Total Root Length | Total Root Volume ^3 | Total Root Area ^2 | Average Root Diameter | Average Root Length | Average Root Area ^2 | | |
| 8 | 1 | 35 | 1393.446 | 1276004 | 139132.4 | 565.0153 | 1393.446 | 139132.4 | | |
| 9 | 2 | 5 | 108.8863 | 31658.03 | 6272.086 | 36.21402 | 54.44315 | 3136.043 | | |
| 10 | | | | | | | | | | |
| 11 | | | | | | | | | | |
| 12 | Tube Ordinal | Window Ordinal | Depth | Root Count | Total Root Length | Total Root Volume ^3 | Total Root Area ^2 | Average Root Diameter | Average Root Length | Average Root Area ^2 |
| 13 | 1 | 1 | 0 | 21 | 596.9333 | 573994.7 | 62130.05 | 133.6734 | 298.4666 | 31065.02 |
| 14 | 1 | 2 | 0 | 11 | 614.4612 | 602081.5 | 62656.81 | 112.2307 | 307.2306 | 31328.4 |
| 15 | 1 | 3 | 0 | 3 | 182.0514 | 99927.25 | 14345.5 | 36.60356 | 91.02569 | 7172.749 |
| 16 | 2 | 1 | 0 | 5 | 108.8863 | 31658.03 | 6272.086 | 72.42804 | 108.8863 | 6272.086 |
| 17 | | | | | | | | | | |

| | A | B | C | D | E | F | G | H | I | J | K | L | M | N |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | | | | | | | | | | | | | | |
| 19 | Tube Ordinal | Window Ordinal | Session Ordinal | Date & Time | Physical Size | Image Size | Root Count | Total Root Length | Total Root Volume ^3 | Total Root Area ^2 | Average Root Diameter | Average Root Length | Average Root Area ^2 | |
| 20 | 1 | 1 | bcfe4ba2781b40a | 3/8/2013 14:24 | 196.0033,215.9847 | 768.2312px | 0 | 270.812 | 280990.8 | 29694.84 | 13.63993 | 30.09022 | 3299.426 | |
| 21 | 1 | 1 | ad70fcd523ab40( | 3/8/2013 14:25 | 196.0033,215.9847 | 768.2312px | 0 | 326.1214 | 293003.8 | 32435.21 | 12.04895 | 27.17678 | 2702.934 | |
| 22 | 1 | 2 | cd24a9ae1d3146 | 3/8/2013 14:24 | 196.0033,215.9847 | 1093.2315px | 0 | 234.4304 | 230627.6 | 23644.43 | 22.27312 | 58.6076 | 5911.107 | |
| 23 | 1 | 2 | 55af2030274f32 | 3/8/2013 14:25 | 196.0033,215.9847 | 1093.2315px | 0 | 380.0307 | 371453.8 | 39012.38 | 19.33843 | 54.2901 | 5573.198 | |
| 24 | 1 | 3 | 4cc945e2074b47 | 3/8/2013 14:24 | 196.0033,215.9847 | 861.2314px | 0 | 119.0048 | 44189.18 | 7700.243 | 19.82826 | 59.50241 | 3850.122 | |
| 25 | 1 | 3 | 57eca1d779ce49 | 3/8/2013 14:25 | 196.0033,215.9847 | 861.2314px | 0 | 63.04656 | 55738.07 | 6645.254 | 33.5506 | 63.04656 | 6645.254 | |
| 26 | 2 | 1 | b4f525eff1af4ecc | 3/8/2013 14:32 | 196.0033,215.9847 | 2315.2551px | 0 | 108.8863 | 31658.03 | 6272.086 | 14.48661 | 21.77726 | 1254.417 | |
| 27 | | | | | | | | | | | | | | |
| 28 | | | | | | | | | | | | | | |
| 29 | Tube Ordinal | Window Ordinal | Session Ordinal | Parent Root ID | Root ID | Ordinal | Alias | Status | Length | Average Diameter | Area ^2 | Volume ^3 | Mean Angle (degrees) | Branching Angle |
| 30 | 1 | 1 | 1 null | b6931bb836c0408ba | b6931bb836c0408ba | 1 | Untitled | New | 73.03908 | 45.53242 | 10447.82 | 118928.7 | 103.1243 | 0 |
| 31 | 1 | 1 | 1 null | 3751c94c8b0e4991a | 3751c94c8b0e4991a | 2 | Smaller root | New | 106.8398 | 35.36225 | 11866.88 | 104871.4 | 53.71975 | 0 |
| 32 | 1 | 1 | 1 3751c94c8b0e4f2d65b630aa4508a | | 3751c94c8b0e4f2d65b630aa4508a | 2 | Untitled | New | 3.249947 | 2.739407 | 27.96937 | 19.15487 | 149.3227 | 95.60297 |
| 33 | 1 | 1 | 1 3751c94c8b0e44dccbd87e8974017b | | 3751c94c8b0e44dccbd87e8974017b | 2 | Untitled | New | 2.062965 | 1.386002 | 8.982675 | 3.112502 | 142.3524 | 88.63263 |
| 34 | 1 | 1 | 1 3751c94c8b0e4d97af4c155e4475cb | | 3751c94c8b0e4d97af4c155e4475cb | 2 | Untitled | New | 2.877635 | 1.386002 | 12.52995 | 4.341636 | 351.6071 | 297.8873 |
| 35 | 1 | 1 | 1 3751c94c8b0e422656bd8b8a24649a | | 3751c94c8b0e422656bd8b8a24649a | 2 | Untitled | New | 2.650707 | 1.386002 | 11.54185 | 3.999259 | 153.8861 | 100.1664 |
| 36 | 1 | 1 | 1 3751c94c8b0e42cd5ebd9e40848b79 | | 3751c94c8b0e42cd5ebd9e40848b79 | 2 | Untitled | New | 2.799487 | 1.928493 | 16.96081 | 8.177199 | 126.6744 | 72.95461 |
| 37 | 1 | 1 | 1 3751c94c8b0e4b155c3fbcce2649259 | | 3751c94c8b0e4b155c3fbcce2649259 | 2 | Untitled | New | 3.379554 | 1.673842 | 17.77149 | 7.436665 | 132.7643 | 79.03452 |
| 38 | 1 | 1 | 1 null | 656a4f058ed343c98 | 656a4f058ed343c98 | 3 | Untitled | New | 73.91278 | 31.37493 | 7285.378 | 57144.55 | 70.22855 | 0 |
| 39 | 1 | 1 | 2 null | b6931bb836c0408ba | b6931bb836c0408ba | 1 | Untitled | Alive | 73.03908 | 45.53242 | 10447.82 | 118928.7 | 103.1243 | 0 |
| 40 | 1 | 1 | 2 null | 3751c94c8b0e4991a | 3751c94c8b0e4991a | 2 | Untitled | Alive | 106.8398 | 35.36225 | 11866.88 | 104871.4 | 53.71975 | 0 |
| 41 | 1 | 1 | 2 3751c94c8b0e4f2d65b630aa4508a | | 3751c94c8b0e4f2d65b630aa4508a | 2 | Untitled | New | 3.249947 | 2.739407 | 27.96937 | 19.15487 | 149.3227 | 95.60297 |
| 42 | 1 | 1 | 2 3751c94c8b0e44dccbd87e8974017b | | 3751c94c8b0e44dccbd87e8974017b | 2 | Untitled | New | 2.062965 | 1.386002 | 8.982675 | 3.112502 | 142.3524 | 88.63263 |
| 43 | 1 | 1 | 2 3751c94c8b0e4d97af4c155e4475cb | | 3751c94c8b0e4d97af4c155e4475cb | 2 | Untitled | New | 2.877635 | 1.386002 | 12.52995 | 4.341636 | 351.6071 | 297.8873 |
| 44 | 1 | 1 | 2 3751c94c8b0e422656bd8b8a24649a | | 3751c94c8b0e422656bd8b8a24649a | 2 | Untitled | New | 2.650707 | 1.386002 | 11.54185 | 3.999259 | 153.8861 | 100.1664 |
| 45 | 1 | 1 | 2 3751c94c8b0e42cd5ebd9e40848b79 | | 3751c94c8b0e42cd5ebd9e40848b79 | 2 | Untitled | New | 2.799487 | 1.928493 | 16.96081 | 8.177199 | 126.6744 | 72.95461 |
| 46 | 1 | 1 | 2 3751c94c8b0e4b155c3fbcce2649259 | | 3751c94c8b0e4b155c3fbcce2649259 | 2 | Untitled | New | 3.379554 | 1.673842 | 17.77149 | 7.436665 | 132.7643 | 79.03452 |
| 47 | 1 | 1 | 2 null | 656a4f058ed343c98 | 656a4f058ed343c98 | 3 | Untitled | Alive | 73.91278 | 31.37493 | 7285.378 | 57144.55 | 70.22855 | 0 |
| 48 | 1 | 1 | 2 null | fcf64241a93b411c98 | fcf64241a93b411c98 | 4 | Untitled | New | 48.17985 | 17.79923 | 2694.118 | 11988.3 | 44.44564 | 0 |
| 49 | 1 | 1 | 2 fcf64241a93b411 | 16bb8840abab4b6b | 16bb8840abab4b6b | 4 | Untitled | New | 3.078202 | 1.644054 | 15.89875 | 6.534602 | 306.3475 | 261.9019 |
| 50 | 1 | 1 | 2 fcf64241a93b411 | 03020c56a56f49d8a | 03020c56a56f49d8a | 4 | Untitled | New | 4.051363 | 2.384766 | 30.35265 | 18.09598 | 302.692 | 258.2465 |
| 51 | 1 | 2 | 1 null | 74f5a162c87945 4fbd | 74f5a162c87945 4fbd | 1 | Big Root | New | 68.74068 | 23.22958 | 5016.548 | 29133.07 | 320.0089 | 0 |
| 52 | 1 | 2 | 1 74f5a162c87941 768d7871cbce4eecb | | 74f5a162c87941 768d7871cbce4eecb | 1 | Untitled | New | 5.18369 | 0.933825 | 15.20017 | 3.546894 | 227.9737 | 92.03514 |
| 53 | 1 | 2 | 1 null | 80b79569e7144274 8 | 80b79569e7144274 8 | 2 | Untitled | New | 57.93081 | 16.47598 | 2998.546 | 12351 | 130.7361 | 0 |
| 54 | 1 | 2 | 1 null | 0b06b01af48443 0eb | 0b06b01af48443 0eb | 3 | Untitled | New | 102.5752 | 48.45364 | 15614.13 | 189140 | 78.33178 | 0 |
| 55 | 1 | 2 | 2 null | 74f5a162c87945 4fbd | 74f5a162c87945 4fbd | 1 | Untitled | New | 81.35246 | 27.34705 | 6989.257 | 477883.88 | 320.0089 | 0 |
| 56 | 1 | 2 | 2 74f5a162c87941 768d7871cbce4eecb | | 74f5a162c87941 768d7871cbce4eecb | 1 | Untitled | New | 5.18369 | 0.933825 | 15.20017 | 3.546894 | 227.9737 | 92.03514 |

# TROUBLESHOOTING

## *Technical Support*

If you have a question about the CI-690 software features and functions, first look in the CI-690 Help Menu or User Guide. If you cannot find the answer, you can access troubleshooting information and the CI-690 Product Support Forum at:

http://www.cid-inc.com/support/9-product-support/29-product-support-root-image-analysis-system-ci-690

Questions can also be directed to a Technical Support Representative located in your country. CID Bio-Science, Inc. is committed to provide customers with high quality, timely technical support. Technical support representatives are to answer your technical questions by phone or by e-mail at:

support@cid-inc.com.

CID Bio-Science, Inc.'s contact information:

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1554 NE 3rd Ave.
Camas, WA 98607 USA

Phone: 800-767-0119 (U.S. and Canada)
360-833-8835
Fax: 360-833-1914

Internet: http://www.cid-inc.com
E-mail: support@cid-inc.com

## *Customer Service*

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## *Tips*

### Keyboard Shortcuts

The following keyboard shortcuts can be used with RootSnap!:

- Control + O: open a project
- Control + S: save a project
- Control + A: save a project as
- Control + I: import an image
- Control + Z: undo the previous action
- Control + Y: redo
- Control + LEFT: next session in the project
- Control + RIGHT: previous session in the project
- Control + -: zoom out
- Control + +: zoom in
- Control + 0: zoom 100%
- Alt + T: view the Tube Details panel
- Alt + I: view the Image Details panel
- Alt +R: view the Root Details panel
- Alt +P: view the Point Details panel
- Control+G: show grid over Navigation Window
- Control+Shift+G: snap to grid for Navigation Window

### Mouse Shortcuts

The following keyboard shortcuts can be used with RootSnap!:

- Use center wheel to zoom in/out when Pan & Zoom is enabled.
- With Add/Edit Points selected, draw with the left mouse click and remove points with the right mouse click
- Push the center wheel to pan or move around.
- Click on a point and then scroll the mouse wheel to adjust the diameter of the point.
- Push and scroll the wheel to jump between sessions when the tube details panel is selected.

## *Frequently Asked Questions*

1. Where do I download the most current version of CI-690 RootSnap! software?
    - The latest version of software can be downloaded at http://www.cid-inc.com/support/software-downloads. Click the "Install" button at the bottom of the page to begin the download. Windows Installer 4.5 and Microsoft .NET Framework 4 (x86 and x64) are required.
2. How does the click-once automatic update work?
    - If the computer has an internet connection when the RootSnap! software is opened, the click-once application will check if there is an update available. If an update has been released, there will be an option to download the update or to skip the download. It is recommended to download the update. Information on the changes in each new version can be found in the "Release Notes" in the "Help" menu.
3. How can I change the size of the image, if it is not imported properly?
    - To check if the actual size of the image is correct, or to change it to the correct size before starting to analyze roots, access the Image Details Panel by navigating to <View><Panels><Image Details>.
    - The "Physical Size" of the image is displayed in millimeters. Check that the image's Physical Size is correct. If the actual size of the image is not correct, change it to the correct size before starting to analyze roots.

# PUBLISHED LITERATURE

**Towards the discovery of novel genetic component involved in stress resistance in Arabidopsis thaliana.**
*New Phytologist, Volume 201, Issue 3, pages 810–824, February 2014*
Juraniec, M., Lequeux, H., Hermans, C., Willems, G., Nordborg, M., Schneeberger, K., Salis, P., Vromant, M., Lutts, S. and Verbruggen, N.
DOI: 10.1111/nph.12554

**Ecology and invasive properties of musk thistle (*Carduus nutans*) in the Central Prairies of Nebraska.**
*Theses, Dissertations, and Student Research in Agronomy and Horticulture. Paper 61, 2012.*
Han, Chengchou.
http://digitalcommons.unl.edu/agronhortdiss/61

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**7. DISCLAIMER OF LIABILITY.** Customer expressly acknowledges and agrees that any testing or experimenting that it performs with respect to the Software is entirely at Customer's own risk and expense. CID BIO-SCIENCE, INC. WILL NOT BE LIABLE FOR ANY DIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES, WHETHER ARISING IN TORT (INCLUDING NEGLIGENCE), CONTRACT OR OTHERWISE, THAT STEM FROM ANY USE OF CONFIDENTIAL INFORMATION OR THE SOFTWARE OR CID BIO-SCIENCE, INC.'S PERFORMANCE OR FAILURE TO PERFORM UNDER THIS AGREEMENT.

**8. Export Restrictions and Reservation of Rights.** Customer certifies that neither the Software nor the Confidential Information nor any portion thereof will be exported to any country in violation of any applicable laws including, without limitation, the United States Export Administration Act and regulations there under, as applicable.

**9. Term and Termination**. This Agreement will continue in effect for so long as Customer is engaged in using as specified above. Customer agrees to discontinue the use as specified above upon request by an authorized representative of CID Bio-Science, Inc. Following termination of this Agreement for any reason, the provisions of this Agreement with respect to non-disclosure and limited use of the Software, indemnification, and warranty and liability disclaimers, will survive. Upon termination of this Agreement, Customer shall cease using, and upon request, return to CID Bio-Science, Inc. all materials, data, documentation and information constituting or relating to the Software, including all copies and regardless of the form or media on which same is contained. At the request of CID Bio-Science, Inc., Customer shall certify that the terms of this Section have been complied with.

**10. Entire Agreement and Governing Law.** This Agreement: (a) constitutes the entire Agreement with respect to the Software. It supersedes all prior or contemporaneous oral or written agreements concerning the Software and; (b) may not be amended except by the written agreement signed by authorized representatives of both parties; (c) will be governed by and in accordance with the laws of the State of Washington as applied to agreements and to be performed entirely within Washington with Washington residents, and is not governed by the United Nations Convention on Contracts for the International Sale of Goods, the application of which is expressly excluded. The parties agree that any litigation relating in any way to this Agreement shall be filed and initiated in and only in Camas, Washington and the parties consent to personal jurisdiction and venue in the Federal and State Courts in Camas, Washington.