CI-600 In-situ Root Imager

High Resolution Root Scanning

The study of fine root dynamics (production, turnover, and lifespan) and root system architecture (RSA) is at the forefront in the fields of ecology, agronomy, and plant breeding. Future gains in plant productivity will be driven by selection for traits that optimize acquisition of resources such as water and mineral nutrients under limiting conditions. The CI-600 leads the fine root-imaging field by offering researchers the ability to acquire high-resolution images of roots over time.

The CI-600 allows researchers the ability to scan multiple tubes in the field with one hand-held unit.

The CI-600:

- ✔ Provides a high-resolution underground color image of living roots in the soil
- ✔ Enables observation of root system architecture and soil profile over time

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✔ **Precise**

High-resolution images of root system architecture

✔ **Lightweight**

At 750 g the CI-600 is very easy to transport in the field

✔ **Versatile**

For use annual agricultural plants or in long-term ecological studies

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Features

- ✔ High-resolution image - up to 23.5 million pixels
- ✔ Quick image capture - 0.5-4 minutes
- ✔ Linear scanning with no distrotion
- ✔ Each scan generates a near 360° image (21.59 x 19.56cm) at up to 600dpi resolution
- ✔ Very portable and quick operation
- ✔ Enables observation of root system architecture and behavior during the entire growth season
- ✔ USB interface for laptop computer image storage

How to Use it

The CI-600 is designed for long-term root studies on living plants in the field. Install clear acrylic tubes within the study area prior to the growing season. When the root network begins to grow around the tubes, simply slide the CI-600 scanner head within the tube at the desired depth and take a scan using the tablet computer provided. The images collected by the CI-600 are saved for later analysis with RootSnap!© root image analysis software.

High-Resolution Images

▲ Fine roots: This image was scanned at 600 dpi and the original image size was 21.59 x 17.78 cm. Image provided courtesy of Dr. Dylan Fischer of The Evergreen State College. For more information and images please see his website: http://blogs.evergreen.edu/ecology/belowground-ecology

What's in the Box

- ✓ Root imaging unit
- ✓ Three 105cm clear tubes with end caps (custom length tubes available)
- ✓ Calibration tube
- ✓ Scanning software
- ✓ Operation manual
- ✓ Hardshell instrument case
- ✓ Tablet computer preloaded with RootSnap! image analysis software

Specifications

CI-600 Specifications

Scanner Resolution:	100, 300, & 600 DPI - up to 23.5 million pixels
Image Size:	21.6 W × 19.6 L cm (8.5 W × 7.7 L in)
Scan Speed:	0.5 - 4 minutes
Interface:	USB cable
Power Supply:	Tablet USB port
Scan Head Dimensions:	34.3 cm long × 6.4 cm diameter
Scanner Unit Weight:	750 g

Root Tube Dimensions

Inner diameter:	6.4 cm
Outer diameter:	7 cm
Wall thickness:	1.8 inch
Standard length:	105 cm
Power Supply:	Tablet USB port

Application References

The CI-600 In-Situ Root Imager has been proven to be an effective instrument creating useful data sets for researchers worldwide. For a more detailed view of relevant applications, please refer to the references below, or visit the publications section www.cid-inc.com/publications

Mahajan, G., Chauhan, B. S., Gill, M. S. (2011) Optimal Nitrogen Fertilization Timing and Rate in Dry-Seeded Rice in Northwest India. *Agronomy Journal* **103**: 1676–1682

Hotchkiss, E.E., DiTommaso, A, Brainard, D.C., Mohler, C.L. (2008) Survival and performance of the invasive vine Vincetoxicum rossicum (Apocynaceae) from seeds of different embryo number under two light environments. *America Journal of Botany* **95 (4)**: 447-453

Shi-Bao Zhang, Hong Hu, Kun Xu, Zhong-Rong Li, Yong-Ping Yang (2007) Flexible and reversible responses to different irradiance levels during photosynthetic acclimation of Cypripedium guttatum. *Journal of Plant Physiology* **164 (5)**: 611-620

Moser G, Leuschner C, Hertel D, Graefe S, Soethe N, Iost S (2012) Elevation effects on the carbon budget of tropical mountain forests (S Ecuador): the role of the belowground compartment   *Global Change Biol* **17 (6)**: 125-136 *2211–2226*

Kunstler, G., Curt, T., Bouchaud, M. and Lepart, J. (2006) Indirect facilitation and competition in tree species colonization of sub-Mediterranean grasslands. *Journal of Vegetation Science* **17 (3)**: 379–388

H. Wallander, A. Ekblad, D.L. Godbold, D. Johnson, A. Bahra, P. Baldrian, R.G. Bjork, B. Kieliszewska-Rokicka, R. Kjoller, H. Kraigher, C. Plassard, M. Rudawska (2012) TEvaluation of methods to estimate production, biomass and turnover of ectomycorrhizal mycelium in forests soils - A review , *Soil Biology and Biochemistry*
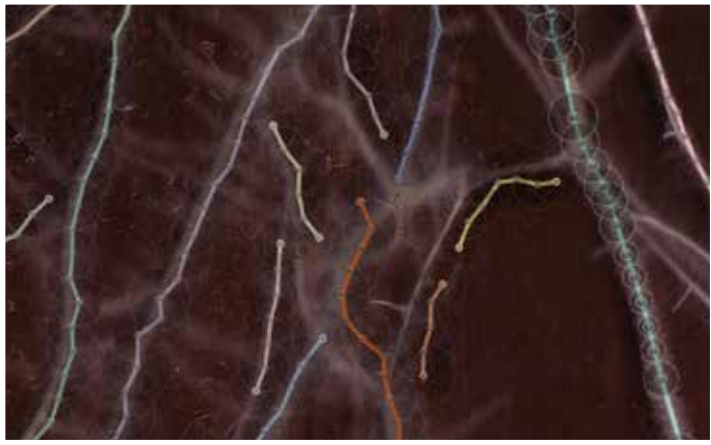
RootSnap!© removes hours of tedious tracing by offering a revolutionary user interface that employs a multi-touch screen to easily trace roots using a finger. The software enables users to move quickly through root images to quantify root length, area, volume and diameter. The software has tracing enhancements like the "Snap-to-Root" function which automatically moves root tracing points to the center of the root. Additionally, RootSnap!© has integrated image enhancement features which enables users to optimize each scanned image for more accurate processing.

Monitor root growth, dynamics, taxonomy, morphology, and behavior over time with RootSnap!© Simplify root mapping using the multi-touch screen and our proprietary "Snap-to-Root" functionality. The superior RootSnap!© user interface is intuitive and efficient. It uses familiar commands to manipulate images and files and stores information in common file formats (XML) and supports exporting data to Excel.
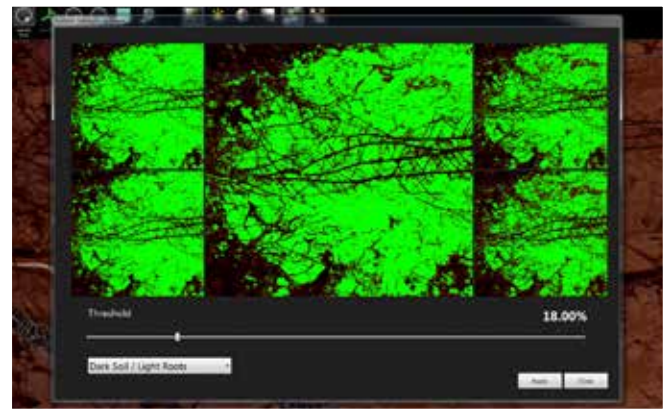
	C Length (mm)	D Diameter, ave. (mm)	E Area (mm^2)
1	30.028	1.5133	142.75
2	21.8573	1.7229	118.30
3	20.3279	1.037	66.22
4	19.3085	1.024	62.11
5	72.2597	1.3022	295.62
6	5.3201	1.7943	29.98
7	5.0751	1.3172	21.00
8	12.3508	1.2356	47.9
9	43.7379	1.4485	199.02
	1022.4983	N/A	4160.94
	22.7222	1.2729	92.46

Benefits

- ✓ **Easy to use**
- ✓ **Map roots quickly and efficiently**
- ✓ **Trace roots with a finger**
- ✓ **Easily manipulate images (colors, sharpness, contrast, etc.)**
- ✓ **Designed to work with Excel**
- ✓ **Monitor root growth, disease and behavior over time**