OPTI-SCIENCES, INC.

CCM-200+ GPS Chlorophyll Content Meter

More than 900 publication citations

Applications

- **Nondestructive Chlorophyll Content Measurement**
- **Monitor Effects of Environmental Stress**
- **Evaluate and Determine Plant Nutrient Performance and Requirements**
- **Nitrogen Management**
- **Teaching**
- **Measure Algae blooms -New!**

Features

- **Lightweight, allows operation with a single hand for rapid field work**
- **Graphic Display of Chlorophyll Content Index with built-in optional *Sample Averaging* of from 2-30 measurements**
- **Built-in Data-Logging - for more than 100,000 measurements and GPS data**
- **USB output - comma delineated files**

The *proven* CCM-200+ GPS Chlorophyll Content Meter provides fast and reliable, chlorophyll content readings on the intact leaves of plants. The measurement is rapid and easy to make with single hand operation. As a result, researchers can gather and evaluate data faster than ever before. The instrument is especially useful for improving **Nitrogen** and **Fertilizer** management programs on crops such as corn, wheat, and a wide variety of both C_3 and C_4 plants.

The CCM-200+ GPS was designed to be the most repeatable portable chlorophyll content meter available. To accomplish this, it incorporates signal integration over a larger measuring area of the sample. This approach averages small structural variations in leaves that can affect repeatability and reliability when comparing results to systems with a smaller measuring area. Instrument measurement reliability has been determined by correlation with chemical tests. *More than 900 publishing citations*, on a great variety of different plant samples and applications, establish the credentials of the CCM-200 series meters.

The CCM-200+ GPS has the largest on-board memory of any chlorophyll meter, with the ability to store more than 100,000 measurements internally. No separate data logger is necessary. Researchers can record months of measurements without having to return to the lab to download data or worry about limiting memory.

Downloading of data is quick and easy through its USB port. The instrument connects to computers as a personal storage device and its comma delineated files open directly in standard spread sheet software.

Employing new MEDICAL grade strict tolerance LED sources increases accuracy and insures consistent meter to meter readings. Furthermore, built in temperature compensation insures reliable readings.

Nitrogen management - The instrument also allows averaging capability for nitrogen management and fertilizer application. Researchers can select from 2 - 30 measurements for averaging.

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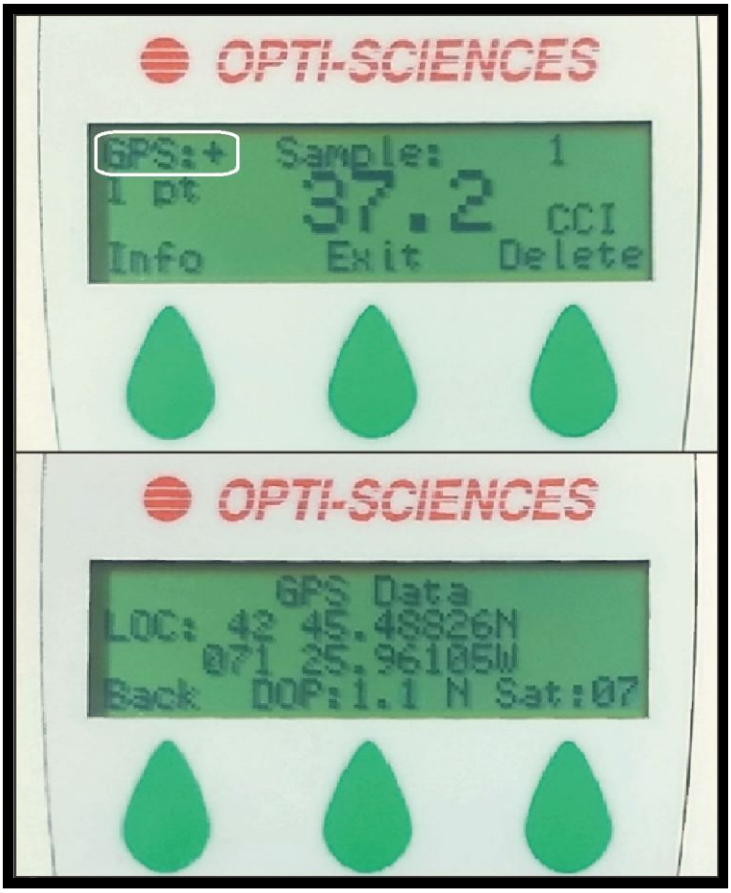
Nitrogen Status Agriculture Crop Production

Accurate GPS module



Position accuracy:

The location accuracy is excellent. It can be accurate up to about 0.3 meters or in the worst case, up to 2.5 meters. This is dependent on the satellite systems available at the time of use.

How it works:

For best location accuracy, the GPS system in the CCM-200+ GPS chlorophyll content meter *automatically works with several GPS satellite systems around the world.* The 72-channel system includes: SBAS L1 C/A: WAAS (**US satellite system)**, EGNOS (**European** Geostationary Overlay System), MSAS (**Japanese** MTSAT satellite system), GAGAN (**Indian** GPS satellite system), GPS/QZSS L1 C/A **Japanese** satellite system, BeiDou B11 (**Chinese** satellite system), Galileo E1B/C (**European Union** satellite system) and the GLONASS L10F (**Russian** satellite system).

Main instrument measuring screen image

In the upper left hand corner the **GPS: + or -** indicates if GPS is working.

GPS data information -
GPS: + means that the GPS signal is good
GPS: - means that the GPS signal is too weak

GPS data screen

Location, dilution, and satellite information report to the data screen and the data file along with measuring data.

LOC: Location coordinates

DOP: - Dilution of precision-

Specifies the multiplying effect of navigation satellite geometry on positional measurement precision.

Sat: indicates the number of satellites that were used to determine GPS location.

Other characteristics

Operating temperature is -40°C to +85°C.

GPS works one minute after turning the system on.

Journal Citations for CCM-200 series:

Wheat

C.N. MISHRA, V. TIWARI, SATISH-KUMAR, V. GUPTA, A. KUMAR and I. SHARMA (2015) GENETIC DIVERSITY AND GENOTYPE BY TRAIT ANALYSIS FOR AGROMORPHOLOGICAL AND PHYSIOLOGICAL TRAITS OF WHEAT (Triticum aestivum L.) . SABRAO Journal of Breeding and Genetics 47 (1) 40-48, 2015, https://www.researchgate.net/profile/Chandra_Mishra6/publication/273122098_Genetic_diversity_and_genotype_by_trait_analysis_for_agromorphological_and_physiological_traits_of_wheat_Triticum_aestivum_L/links/559cd7c308ae0035df249e6d.pdf

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New - algae bloom measurement application

Journal Reference:

Trent T., Hendrickson J., Harwell M.C. (2017) A rapid, cost-effective screening tool for measuring Chl-a in water samples. Lake and Reservoir Management, Pages 1-6, Published online: 11 Jul 2017, http://dx.doi.org/10.1080/10402381.2017.1335360

Researchers from the Florida US environmental protection agency and St. Johns River Water Management District used the CCM-200plus chlorophyll content meter to quantify algae blooms.

"We believe this CCM provides a useful screening tool for rapid measurement of Chl-a concentrations in the lower St. Johns River and has the potential for being an algal bloom screening tool elsewhere. However, we emphasize that calibrations are required for applying our method in different water bodies."

More Journal Citations:

Nitrogen Maize

Mashego S, Petja B.M., Moshi M.E. Mailula A.N., Shaker P., Lekalakala R.G. , Mushadu W.G., and Dikgwatlhe W.G. (2012) MAIZE GRAIN YIELD COMPARISON UNDER CONVENTIONAL AND SITE-SPECIFIC NITROGEN MANAGEMENT IN A DRYLAND FARMING SYSTEM BSc. Agric; Current MSc. Agric Soil Science at the University of Limpopo Work at the Limpopo Dept. of Agriculture, Directorate: Research Services

Nitrogen Maize

TORRES-DORANTE L., R. PAREDES-MELESIO R., A. LINK A., and J. LAMMEL J. (2015) A methodology to develop algorithms that predict nitrogen fertilizer needs in maize based on chlorophyll measurements: a case study in Central Mexico. The Journal of Agricultural Science, Cambridge University Press, DOI: https://doi.org/10.1017/S002185961500074X

New algae application

Nitrogen Rice

Saberioon M.M., Soom M.A.M. (2014) A Review of Optical Methods for Assessing Nitrogen Contents during Rice Growth. American Society of Agricultural and Biological Engineer. https://elibrary.asabe.org/abstract.asp?aid=45074

Nitrogen Potato

Lazarević B., Poljak M., Ćosić T., Horvat T., Karažija T. (2014) Evaluation of Soil and Plant Nitrogen Tests in Potato (Solanum tuberosum L.) Production. Agriculturae Conspectus Scientificus, Vol.79 No.1 Ožujak 2014. https://hrcak.srce.hr/120759

Nitorgen vinyard

D'Attilio D. (2014) Optimizing nitrogen fertilization practices under intensive vineyard cover cropping floor management systems. Virginia Tech,https://vtechworks.lib.vt.edu/handle/10919/5661

Nitrogen Maple tree

Van den Berg A. K., Perkins D. (2004) Evaluation of a portable chlorophyll meter to estimate chlorophyll and nitrogen contents in sugar maple (Acer saccharum Marsh.) leaves, Forest Ecology and Management 200 (2004) 113–117

Nitrogen Asian Pear

GHASEMI M., ARZANI K., YADOLLAHI A., GHASEMI S., KHORRAMI S.S. (2011) Estimate of Leaf Chlorophyll and Nitrogen Content in Asian Pear (Pyrus serotina Rehd.) by CCM-200. Available online at www.notulaebiologicae.roNotulae Scientia Biologicae Print ISSN 2067-3205; Electronic 2067-3264 Not Sci Biol, 2011, 3(1):91-94

Iron , sulfur

Christensen R. C., Hopkins B. G., Jolley V.D., Olson K. M., Haskell C. M., Chariton N. J. & Webb B. L. (2012) ELEMENTAL SULFUR IMPREGNATED WITH IRON AS A FERTILIZER SOURCE FOR KENTUCKY BLUEGRASS, Journal of Plant Nutrition DOI: 10.1080/01904167.2012.706684 pages 1878-1895

Molyibdenum

Biscaro G.A.; Goulart Junior S.A.R.; Soratto R.P.; Freitas Júnior N.A.F.; Motomiya A.V.A.; Filho G.C.C. (2009) Molybdenum applied to seeds and side dressing nitrogen on irrigated common bean in cerrado soil. Ciência e Agrotecnologia Print version ISSN 1413-7054 Ciênc. agrotec. vol.33 no.5 Lavras Sept./Oct. 2009 http://dx.doi.org/10.1590/S1413-70542009000500012 CIÊNCIAS AGRÁRIAS

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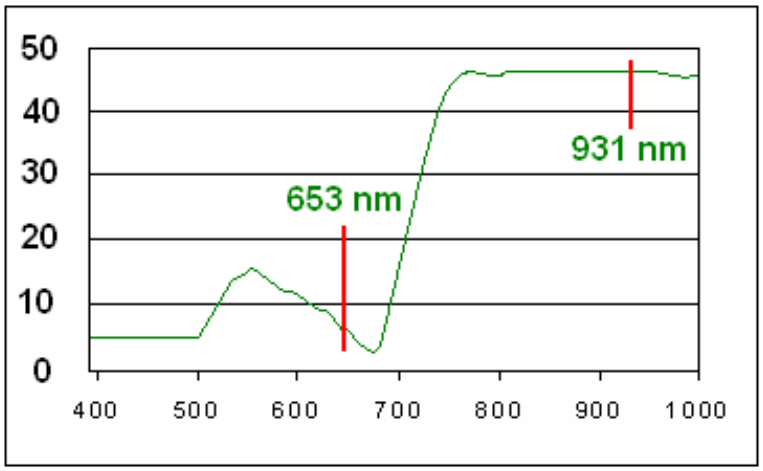
Changes in chlorophyll content can occur as a result of nutrient deficiencies, exposure to environmental stress, exposure to certain herbicides, and differences in the light environment during growth (shading). Chlorophyll content meters are instrumental in nutrient optimization programs that both improve crop yield and help protect the environment. Testing for herbicide damage can indicate the need for a change in herbicide selection, amount or application method. The instrument is valuable for ensuring good weed control, while having minimum impact on crop health.

Laboratory methods for determination of chlorophyll content are both time consuming and destructive to the sample. Typically, a sample must be detached, ground up in a solvent and then assayed with a spectrophotometer. With chemical assays, a sample measurement only happens once, precluding the monitoring of trends in chlorophyll content over the growing cycle on the same sample.The CCM-200+GPS provides non-destructive, rapid measurements. It reduces the need for time consuming and costly chemical testing.



CCM-200+ GPS measurements measure chlorophyll content and compensate for leaf thickness using leaf transmittance at two wavelengths.

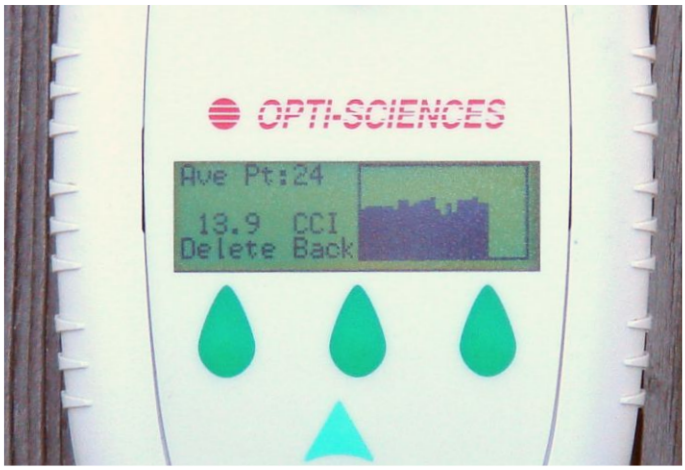


Image of averaging graph screen.
Averaging is possible for from 2-30 measurements

Technical Specifications

Measured Parameters: Optical absorptance in two different wavebands (653 nm and 931 nm). Designed to measure chlorophyll content and compensate for leaf thickness

Measurement Area: 3/8" diameter circle, or 9.53 mm area is 0.11in^2, or 71.22 mm^2

Resolution +/- 1 CCI Unit

Repeatability +/- 1%

Source: (1) Medical grade LED (peak at 653nm)
(1) Infrared LED (peak at 931 nm)

Detector: Silicon photodiode with integral amplifier for absorptance measurement and source power monitoring for temperature compensation

Storage Capacity: 8 MB of non-volitile memory allows between 94,000 and 160,000 measurements.

Modes: Single point measurement, or selectable averaging from 2 to 30 samples. Standard deviation is available for 10 samples or more.

User Interface: 128 x 32 pixel display, 8 keys for control and data manipulation, beep signal for status and warnings

Output: USB 1.1 interface for data transfer.

Temperature Range: 0-50 Deg C

Temperature Drift: Temperature compensated source and detector circuitry for minimum drift over full range.

Power Source: 9V Alkaline Battery

Auto Off Interval: 4 minutes (no key press or download)

Size: 152(L) x 82(W) x 25(D)mm

Weight (with battery): 162g

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