

# CCM200+ GPS

## Chlorophyll Content Meter



The *proven* **CCM-200plus** provides fast and reliable chlorophyll content readings on intact plant leaves. The measurement is rapid, and easy to make with single hand operation. The instrument is especially useful for improving **Nitrogen** and **fertilizer** management programs with various crops such as corn and wheat. The CCM-200plus is used on a wide variety of both C<sub>3</sub> and C<sub>4</sub> plants.

The CCM-200plus provides repeatable and reliable measurements. Signal averaging is incorporated over a large sample area. This approach takes into account small structural variations in leaves that can affect repeatability and reliability. Reliability of measurement has been determined by correlation with chemical tests.

The CCM-200plus 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

*More than 900 published citations*

### Applications

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- Chlorophyll Content *in situ*
- Monitor effects of abiotic stress
- Evaluate and determine Plant Nutrient Performance and Requirements
- Nitrogen Management
- Teaching
- Measure Algal Blooms

### Features

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- Graphic Display of Chlorophyll Content Index
- Optional averaging of 2 to 30 measurements
- Internal Data Logging
- USB output -comma delineated files
- 100,000 measurements and **GPS**

without having to repeatedly return to the lab to download data or worry about limited memory.

Downloading of data is quick and easy through its USB port. The instrument becomes a hard drive for computers and comma delineated files open directly in standard spread sheet software.

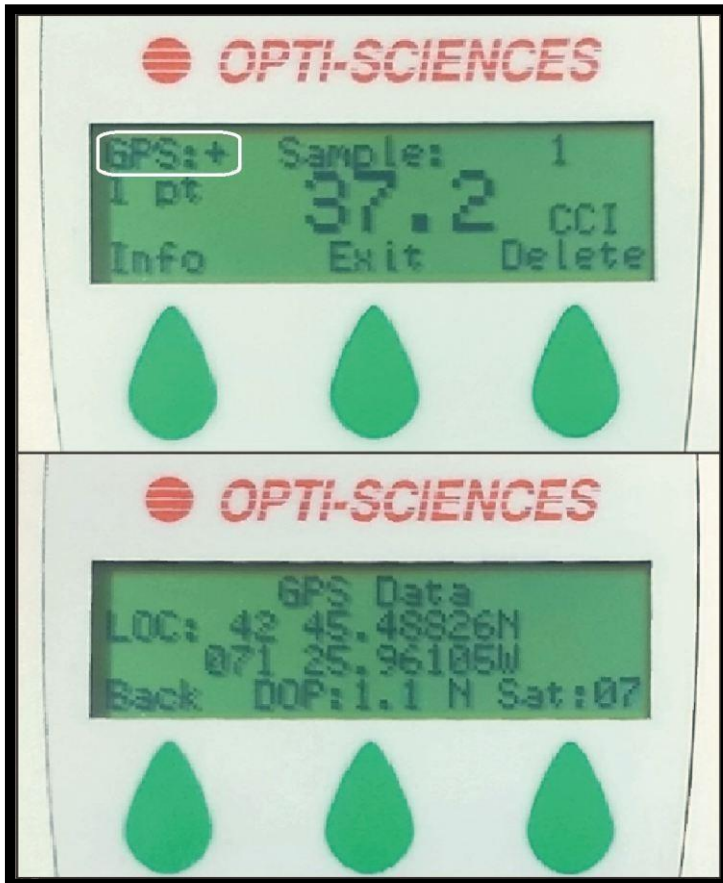
Employing medical grade strict tolerance LED sources increases accuracy and insures consistent meter to meter readings.

**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*



## Main instrument measuring screen image

In the upper left hand corner the **GPS: + or -** indicates whether GPS is active or not.

GPS data information

**GPS +:** GPS is active

**GPS-:** GPS is inactive.

## GPS data screen

Location, dilution, and satellite information, report to the data file 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. Satellite systems from countries around the world automatically respond.

## 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.

The GPS acts automatically. The accuracy range quoted is known as **CEP (circular error probable)**. A 2.5m CEP means that if you draw a 2.5m diameter circle around where the GPS says it is, the GPS is inside that circle.

## Other characteristics

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

Anti-jamming and spoofing systems

included Works one minute after turning on

## How it works:

For best location accuracy, the GPS system in the CCM-200plus chlorophyll content meter *automatically works with several GPS satellite systems around the world.* The 72-channel system includes: SBAS L1 C/A: WAAS (Wide Area Augmentation System) **US satellite system**, EGNOS (**European** Geostationary Overlay System), MSAS (**Japanese** MTSAT Satellite-based Augmentation System), GAGAN (**Indian** GPS Aided Geo Augmented Navigation), 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.

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Nitrogen Status

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Crop Production

## New algal 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 algal 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>

### 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>

### Nitrogen, Vineyard

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

GHA SEMI M., ARZANI K., YADOLLAHI A., GHA SEMI 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.roNotulaeScientiaBiologicaePrintISSN2067-3205;Electronic2067-3264NotSciBiol,2011,3\(1\):91-94](http://www.notulaebiologicae.roNotulaeScientiaBiologicaePrintISSN2067-3205;Electronic2067-3264NotSciBiol,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

### Molybdenum

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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## Why quantify chlorophyll with CCM200+?

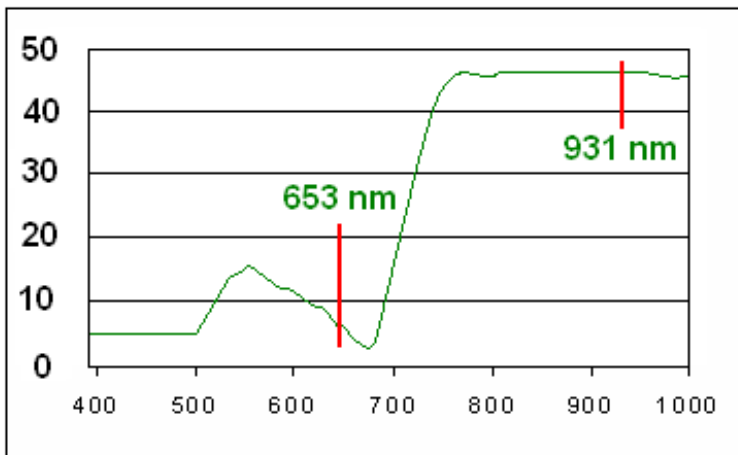
Changes in chlorophyll content can occur as a result of nutrient deficiencies, exposure to environmental stress and to certain herbicides, and differences in the light environment during growth.

Chlorophyll content can be used to manage nutrient optimization programs that both improve crop yield and help protect the environment.

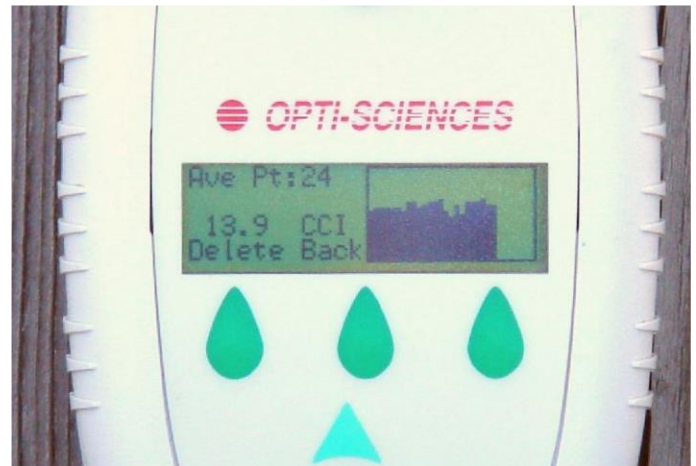
Laboratory methods for determination of chlorophyll content are both time consuming and destructive.

Typically, a sample must be detached, ground up in a solvent, and assayed only once with a spectrophotometer.

The CCM-200*plus* provides non-destructive, rapid and repeatable measurements with an option for auto averaging of measurements.



The CCM-200*plus* accounts for both chlorophyll transmittance and leaf thickness.



## Technical Specifications

**Measured Parameters:** Optical absorbance at 653 nm and 931 nm. Chlorophyll content as CCI (Chlorophyll Content Index unit).

**Measurement Area:** 3/8" diameter circle, or 9.53 mm  
Area 71.22 mm<sup>2</sup>

**Resolution** +/- 1 CCI Unit

**Repeatability** +/- 1%

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

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

**Storage Capacity:** 1 GB non-volatile 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, 6 keys for control and data manipulation, beep signal for status and warnings.

**Output:** USB 1.1 interface for data transfer. Either entire measuring files, or single measurements can be output by selection.

**Temperature Range:** 0 to 50 °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 of inactivity

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

**Weight (with battery):** 162g

