Comparison of Chlorophyll Meter and Gun to Monitor N Status in Corn

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Introduction:

Over the past decade, the Minolta SPAD 502 chlorophyll meter has become recognized as a reliable substitute for total N determinations when assessing crop N status. The need to physically attach the SPAD meter to the leaf blade and the small sampling area are obvious limitations, but the fact that its operation is independent of external lighting conditions is an advantage. Within the past year, the CM1000 chlorophyll gun was introduced as a potential substitute for the SPAD meter in applications with small leaves and where measurements are difficult to make (i.e., turf).

Objective:

The objective of this project was to compare the performance of the CM1000 chlorophyll gun with the SPAD meter on corn.

Materials and Methods:

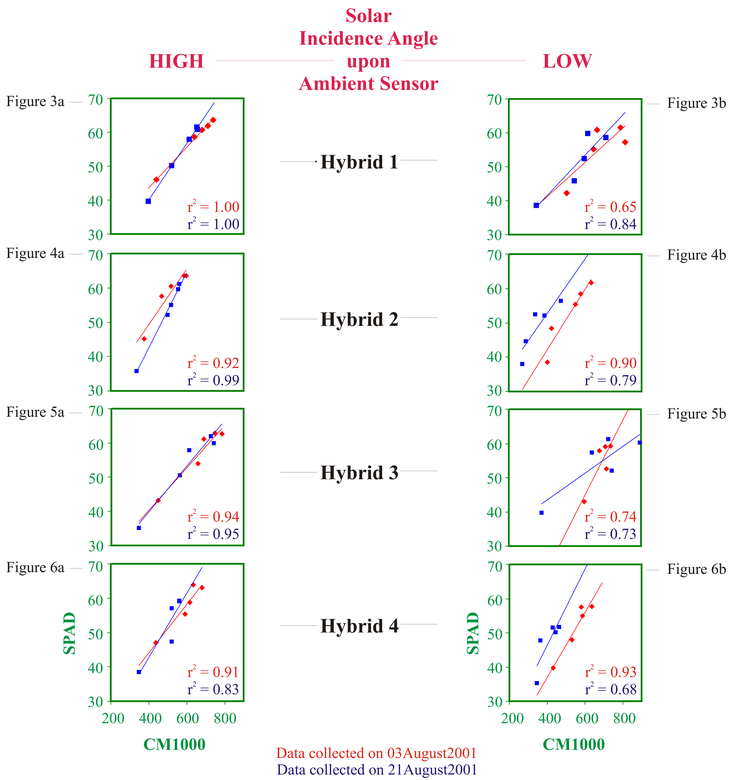
The SPAD and CM1000 meters were compared for irrigated corn (2 replications of 4 hybrids of corn at 5 N levels [0, 50, 100, 150, and 200 kg/ha]) on 2 dates after silking during the 2001 growing season.

The CM1000 measures were collected from a high clearance tractor moving through the plots at approximately 4.8-km/h (Figure 1). The average of 20-28 samples was used to estimate the relative leaf chlorophyll content in each plot.

The design of the CM1000 requires the sun to be behind the user such that the ambient light sensors on top of the instrument are illuminated. Therefore, orientation of the instrument was largely a compromise between the angle of the sun on the ambient light sensors and the angle of the sensor on the target.

The SPAD meter was utilized according to established procedures (Figure 2). An estimate of the relative leaf chlorophyll content for each 7.3 by 15.3-meter plot was made using the average of 30 SPAD meter readings.

Data were collected between the hours of 12:00 and 14:00 CST. The row orientation was E-W and the CM1000 was aimed down a single row at an oblique angle, avoiding both soil and tassels (see Figure 1).



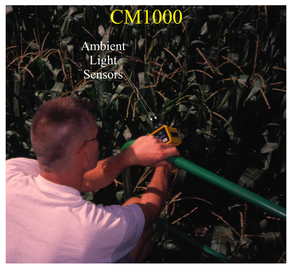


Figure 1

Figure 2

Results:

CM1000 data collected utilizing a higher solar incidence angle appears consistent from hybrid to hybrid (e.g., high r^2 values and the slopes of the lines of regression are similar) (Figures 3a, 4a, 5a, 6a).

At a relatively low solar incidence angle, the relationship between the meters is much more variable (e.g., lower r^2 values and the slopes of the lines of regression are less similar) (Figures 3b, 4b, 5b, 6b).

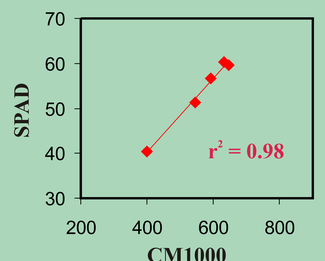
The relationship between SPAD and CM1000 meter readings is strong when the data are considered solely on the basis of nitrogen treatment (Figure 7).

Conclusions:

While this sensor is not recommended for canopies larger in scale than turf grass, the CM1000 chlorophyll meter recorded data that is highly correlated with SPAD meter data. The CM1000 allowed data collection without coming in contact with the plants and accomplished the goal in one fourth of the time taken using the SPAD meter..

The ambient light sensor located on the rear of the sensor has a restricted range of motion which limits the ease with which this sensor can be employed on larger canopies. Sensor modifications such as relocating or reorienting the ambient light sensors may eliminate or minimize this problem and provide more consistent results.

Figure 7



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