

MULTIPLIX RESEARCH™



UV-VISIBLE PORTABLE FLUOROMETER



- ▶ NON-DESTRUCTIVE / REAL-TIME
- ▶ GEOLOCATED MEASUREMENTS (GPS)
- ▶ LARGE SURFACE OF ANALYSIS (50 CM²)
- ▶ MULTI-WAVELENGTHS (UV-VIS)
- ▶ RECORDED & SORTED DATA
- ▶ ANY PLANT – LEAVES & FRUIT

MULTIPLEX RESEARCH™, A POWERFUL TOOL

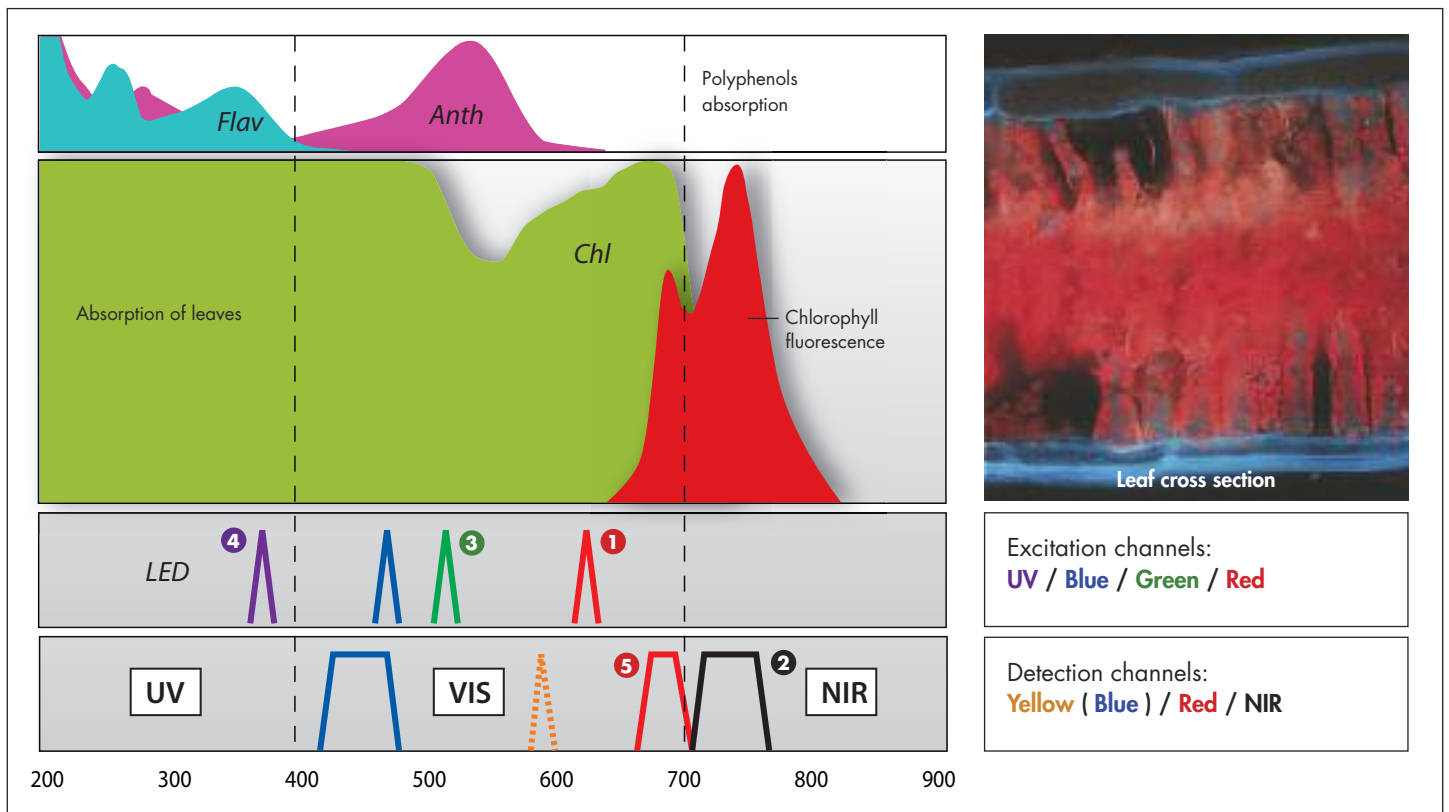
Based on research of the CNRS (National Center for Scientific Research) and the University of Paris-Sud Orsay, this new multiparametric portable optical sensor can perform real-time and non-destructive measurements of plant polyphenol and chlorophyll contents. By using two known properties of plant fluorescence, the screening effect of polyphenols and the reabsorption by chlorophyll, it can assess these compounds in vivo.

POLYPHENOL measurement

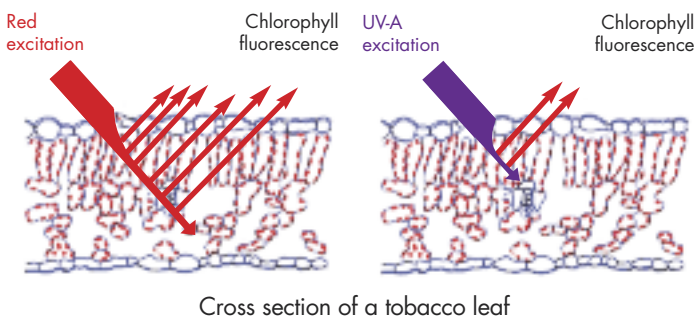
Near-infrared chlorophyll fluorescence ② is measured under a first reference excitation light ① not absorbed by polyphenols. It is compared to a second sampling light specific to a particular type of polyphenols (e.g. green ③ for anthocyanins or UV-A ④ for flavonols). Only a fraction of this light reaches the chlorophyll in the mesophyll and can generate near-infrared fluorescence.

CHLOROPHYLL measurement

The SFR (Simple Fluorescence Ratio) is directly related to the chlorophyll content of the sample. It is the ratio of chlorophyll fluorescence measured in the near-infrared ② to the chlorophyll fluorescence measured in the red ⑤, whatever the excitation in the visible. Because of the overlapping of the absorption and the emission spectrum of chlorophyll, re-absorption occurs at shorter wavelengths (red) but not at longer (near-infrared) wavelengths.

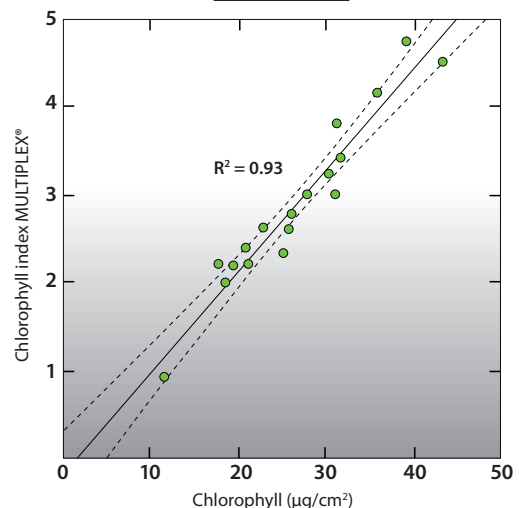


The comparison of these two excitations quantifies the screening effect due to polyphenols and therefore the content of the latter in the epidermis.



In the above example, the flavonol content in the epidermis of a tobacco leaf is measured.

Chlorophyll measurement
in kiwi leaves



Strengths

■ INNOVATIVE

Portable fluorometer with light-emitting diodes ranging from UV to visible. It is insensitive to ambient light thanks to its synchronised "PAM" detection. Non-contact measurements can be performed in single-shot or continuous mode on a 50 cm² surface (whole leaves and fruits) with a GPS positioning.

■ MULTI-WAVELENGTHS

With its 4 excitation channels (blue, green, red and UV) and its 3 detection channels (blue or yellow, red and near-infrared), the MULTIPLEX RESEARCH™ measures 12 individual signals for a multiparametric analysis.

■ MANY INDICATORS

Fluorescence ratios (related to flavonol, anthocyanin, chlorophyll contents, etc.) are calculated and recorded along with individual signals, as well as other fluorescence indices linked to nitrogen nutrition (NBI®), fruit quality (FERARI®) or different abiotic stresses (BRR).

■ INTERNAL GPS

The MULTIPLEX RESEARCH™ comes with an internal GPS which allows to geolocalize data.

■ 4 POWER CONFIGURATIONS

The MULTIPLEX® user can choose the configuration the best adapted to the sample type. This enables to avoid low signal or saturation.

■ PORTABLE AND AUTONOMOUS

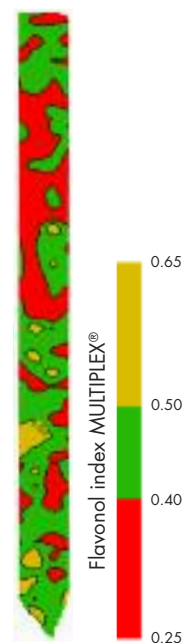
With its dual ergonomic handle, its 2.5 kg and its high capacity Li-ion battery, the MULTIPLEX RESEARCH™ can be used both in the field and the laboratory. Moreover, its processor and its internal memory as well as its real-time display make it totally autonomous (no computer is required).

■ EASILY MANAGEABLE DATA

The MULTIPLEX RESEARCH™ allows 4 levels of classification and can register more than 1 million data on an SD-card. They can then be exported. The data are in a format compatible with any data processing software.



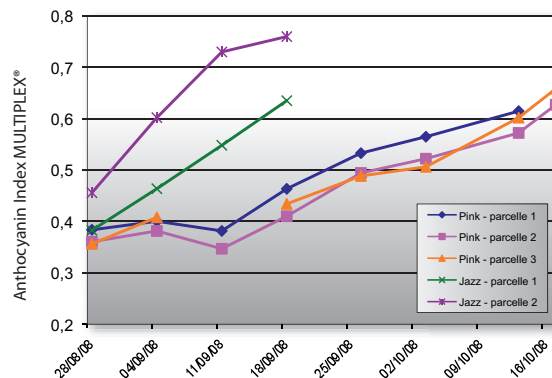
Flavonol mapping of lettuce in greenhouse



EXAMPLES OF APPLICATIONS

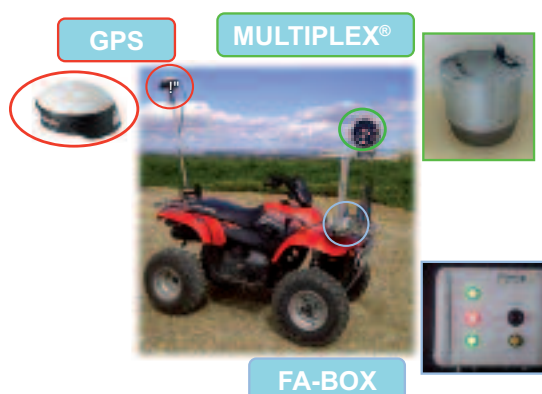
Measurements of anthocyanin content on several apple plots (Pink and Jazz varieties)

Pink is a late variety that turns pink during maturation. On the contrary, Jazz is an early variety that turns red. This graph shows obvious differences in coloring of these two varieties: higher anthocyanin content for Jazz. This graph shows also a faster blushing for Jazz compared to Pink. Jazz is harvested in mid-September and pink in mid-October.



The **NBI® (Nitrogen Balance Index)** is the Chlorophyll/Flavonols ratio. When a plant is in optimal conditions, it favours its primary metabolism and synthesises proteins (nitrogen-containing molecules) containing chlorophyll, and few flavonols (carbon-based secondary compounds). On the contrary, in case of nitrogen deficiency, it directs its metabolism towards the production of flavonols. Thanks to this new index, an earlier and more pertinent information about the nitrogen status of cultures is obtained (see references).

Mounted MULTIPLEX® system in a vineyard

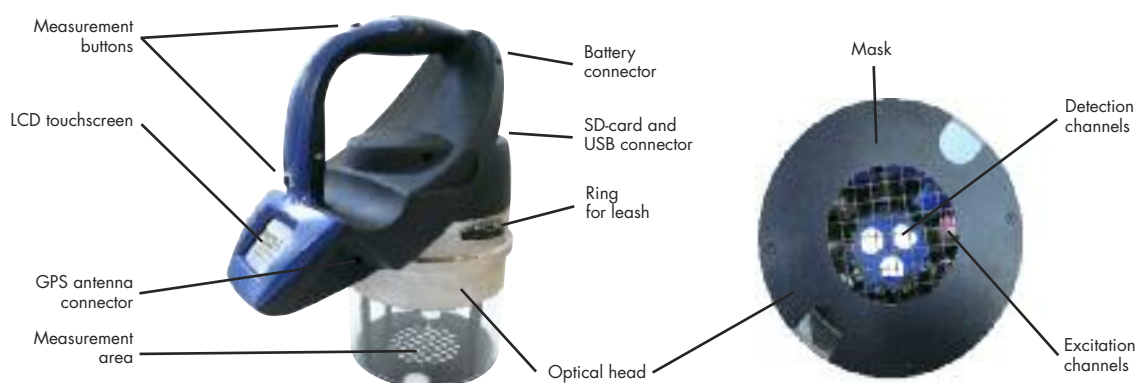


On-the-go model of the MULTIPLEX RESEARCH™



TECHNICAL SPECIFICATIONS – MULTIPLEX RESEARCH™

Measured material	Any plant material: leaves, needles, berries, fruits and seeds
Measured parameters	12 fluorescence signals SFR_R and SFR_G: chlorophyll indices FLAV: flavonol index NBI®: nitrogen status, SFR/FLAV ratio ANTH: anthocyanin index It is possible to customize the signals measured by the fluorimeter, upon request.
Measurement process	Pressure on one of the two main buttons
Measured area	50 cm ² (8 cm diameter), 28 cm ² (6 cm diameter), or 12.5 cm ² (4 cm diameter) as an option
Acquisition time	1 measurement < 1 s
Storage capacity	1 million of multiparametric measurements (512 Mo SD card)
Measurement modes	One shot or continuous mode
Data classification	4 levels (file, group, sample and measurement numbers)
Temperature range	From 5 to 45°C
Light sources	LED (pulsed operation) 4 excitation channels: UV, blue, green and red
Detectors	Silicon photodiodes 3 detection channels: yellow or blue, red and near-infrared
User interface	3.2" graphic LCD panel with touchscreen Sound warning
Data downloading	SD-card / USB connection for data transfer in continuous mode Data compatible with any data processing software
Battery	External Li-ion rechargeable battery
Battery life	10 hours
Charge time	3 hours
Total weight	2.5 kg (without battery)
Size	340 mm x 280 mm x 170 mm
Positioning	Internal GPS
Relative accuracy	< 2.5 m (CEP, 50%, 24 h static)
Languages	English, French, Spanish and German
Safety	Strap



REFERENCES

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