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BY PESSL INSTRUMENTS

Decoding Plant Stress: How METOS STREMO Empowers Researchers to Quantify the Invisible

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Understanding the Hidden Signals of Water and Heat Stress

Every plant speaks a language. A silent conversation of signals that reveal how it feels, adapts, and survives. For decades, researchers have relied on indirect indicators like soil moisture, temperature, or visual assessment to estimate plant stress. **But these methods leave a critical gap: they measure the environment, not the plant itself. The METOS STREMO system bridges that gap.**

By directly measuring transpiration and irradiance at the leaf level, METOS STREMO allows scientists to see how plants respond to their environment in real time, providing an unprecedented window into the physiology of stress, adaptation, and resilience.

THE SCIENCE BEHIND METOS STREMO

Developed by Pessl Instruments, METOS STREMO combines decades of ag-tech expertise with plant physiology research.

At the heart of the system lies the PI FylloClip sensor, an ultra-light, leaf-mounted sensor that detects transpiration activity and irradiance without harming the plant.

How it Works

1. **FylloClip sensors attach directly to leaves.** Concentric electrodes detect subtle changes in leaf capacitance, reflecting water movement and stomatal behavior.
2. **Integrated air sensors** measure temperature and relative humidity, from which VPD is calculated
3. **Combined data streams** in the FieldClimate platform provide a complete picture of plant-water-environment interaction.
4. **Researchers visualize and export** high-resolution physiological data for modeling, statistical analysis, or publication.

By correlating the plant's transpiration response with environmental variables, METOS STREMO allows precise identification of drought onset, heat stress, and recovery events long before visual symptoms appear.

WHY IT MATTERS FOR RESEARCH

Scientific progress in agronomy, crop physiology, and climate adaptation depends on measurable, repeatable, and scalable data.
METOS STREMO provides exactly that: translating complex plant processes into clean datasets that can be analyzed, modeled, and published.

Key Research Benefits

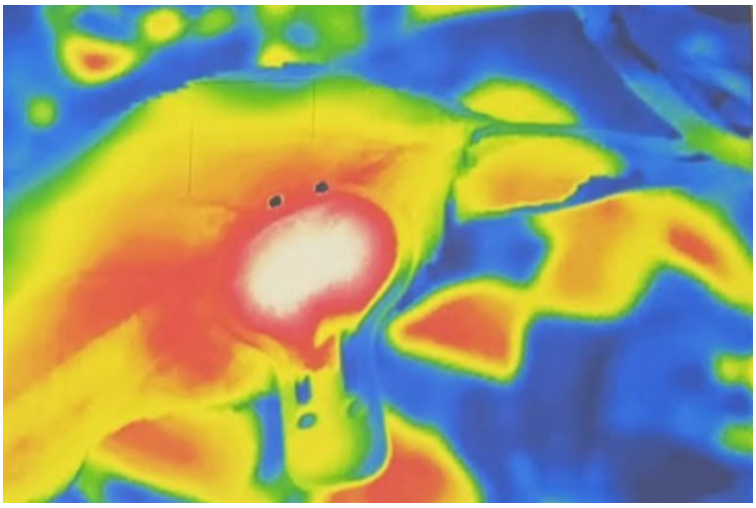
- **Direct physiological data:** Capture stomatal response and transpiration dynamics in real time.
- **Non-invasive method:** Continuous measurement without affecting plant integrity.
- **Reproducible results:** Standardized across environments, crops, and trials.
- **Cross-platform integration:** Use FieldClimate or connect through open API for custom analytics.
- **Scalable design:** Deploy single sensors or bundles across multiple treatments or sites.

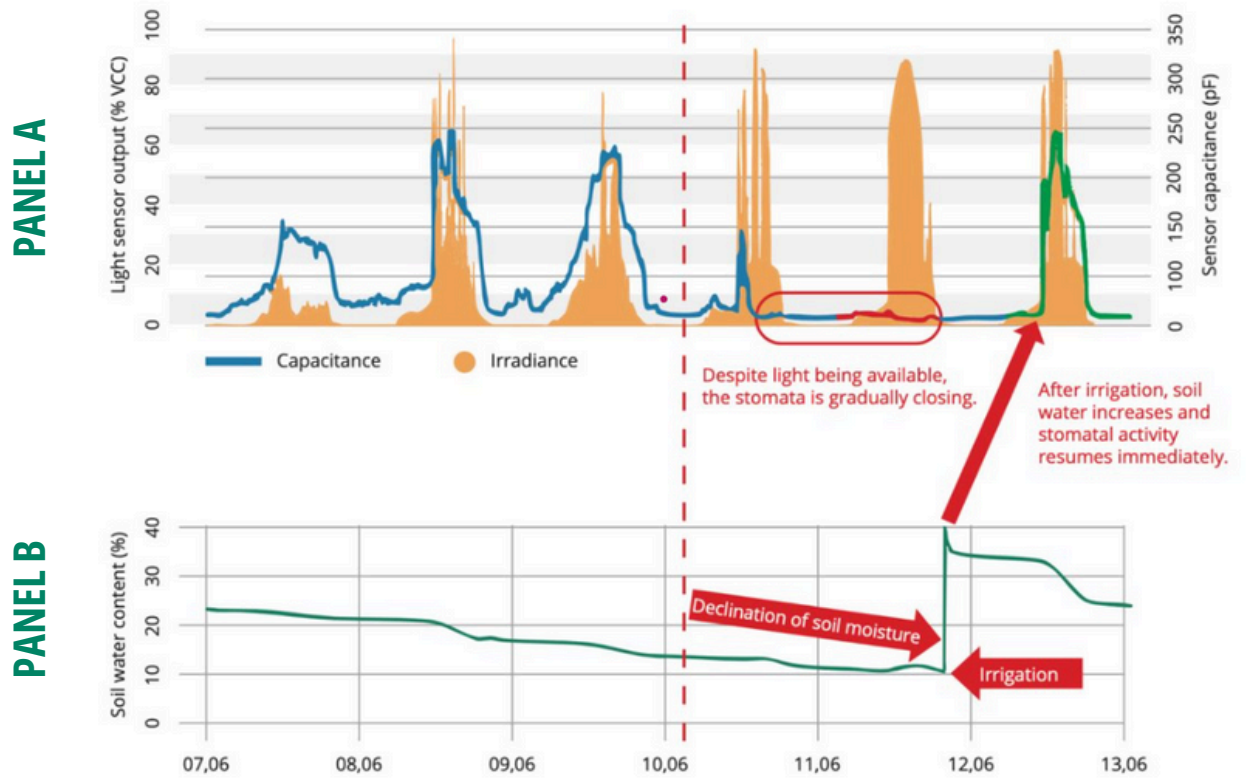
This makes METOS STREMO ideal for:

- **Peer-reviewed studies** requiring high-resolution physiological data
- **Long-term field trials**
- **Greenhouse and open-field experiments** under variable conditions
- **Climate resilience research** focused on drought, heat, and evapotranspiration modeling

COMPARISON: SOIL MOISTURE AND STRESS INDICATED BY STOMATA READINGS

At the Laimburg Research Center, METOS STREMO was used to monitor grapevine plants under controlled drought conditions. The system recorded a decline in capacitance (a proxy for transpiration) as soil moisture decreased, indicating stomatal closure and stress, even while irradiance remained constant.
When irrigation was applied, both soil moisture and leaf transpiration rapidly recovered.





Panel (A) shows the relationship between light irradiance (yellow area) and capacitance (blue line), which reflects stomatal activity. Under sufficient soil moisture conditions, stomatal transpiration closely follows irradiance patterns.

As shown in panel (B), declining soil water content over time leads to water stress. The decreasing of the capacitance in panel (A) detects the stomatal closure under water stress, despite continued light availability.

Following the irrigation event on June 11th (marked by the arrow), there is a rapid increase in soil moisture and a corresponding recovery in stomatal activity and transpiration (blue line), confirming that the plant resumes physiological function once water becomes available.

WHY METOS STREMO IS A RESEARCH ESSENTIAL

CHALLENGE	TRADITIONAL METHOD	STREMO SOLUTION
Early stress detection	Late visual observation, indirect soil moisture or environmental data	Direct leaf transpiration data
Integration with environmental data	Separate systems	Unified FieldClimate platform
Field scalability	Limited by cost/lab setup	Affordable, wireless, multi-site bundle
Data export & analysis	Manual / disconnected	Seamless API and CSV integration

CONCLUSION

GIVING PLANTS A VOICE

For the first time, researchers can observe plant stress as it happens, not after it leaves a mark on yield or appearance.

METOS STREMO makes it possible to understand how plants respond to water, heat, and light in ways that were previously invisible outside a laboratory.

By integrating direct physiological sensing with environmental data, **STREMO bridges the gap between plant science and precision agriculture**, empowering the next generation of research into sustainable food production and climate resilience.

METOS STREMO RESEARCH BUNDLE

SPECIAL OFFER

To make this technology accessible for research institutions, Pessl Instruments offers a special **5-unit Research Bundle**, tailored to universities and experimental stations.

Bundle Includes

- 5× METOS STREMOs (each with air temperature, humidity, and 2 PI FylloClip sensors)
- SIM cards and communication for 1 year
- Data storage, analysis, and API access for all five devices for 1 year
- Technical support and integration guidance

~~$3,990~~ **$1,990**

Special conditions:

- **Maximum 2 packages** per research facility/university
- **Bundle offer valid until 31 December 2025 only**

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