



## PANAMA DISEASE TROPICAL RACE 4 RESEARCH UPDATE

### Proximal sensing tools for early, quantifiable stress and disease detection

#### Why?

- If detection of TR4 was possible before notable visual symptoms appeared, isolation and plant destruction could occur earlier to reduce the increase in inoculum and minimise potential spread through soil movement.
- Quantification of stress severity in plants can offer objective measurements of leaf function.
- Potential use in 'ground-truthing' data from remote sensing technology (e.g. satellite imagery), and in rapid screening programs for new variety assessments.

#### How?

##### Chlorophyll fluorescence

Chlorophyll fluorescence is light energy which is 're-emitted' by a leaf because it has not been used for photosynthesis. Stress can reduce photosynthetic efficiency and result in an increase in chlorophyll fluorescence and emitted heat.

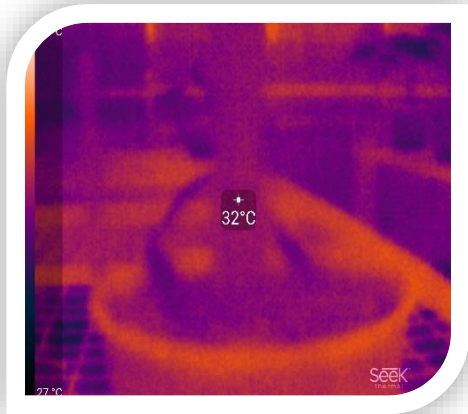


##### Leaf pigment concentration

The concentration of certain leaf pigments (chlorophyll, anthocyanins, flavonols) are influenced by stress. They can be measured by examining how light is interacting with the leaf tissue through the use of optical-sensing devices.

### Stomatal conductance

Pores on the underside of the leaf (stomata) facilitate gas exchange and adjust their size in response to environmental conditions. A porometer can measure stomatal conductance (uptake of CO<sub>2</sub>) and provide information on the stress-status of a plant.



### Plant temperature (thermal imagery)

Stressors which interfere with transpiration (movement of water from roots to leaves) will consequently affect a plant's ability to regulate its temperature. Abnormal temperature increases may be detected through thermal imaging (infrared radiation).

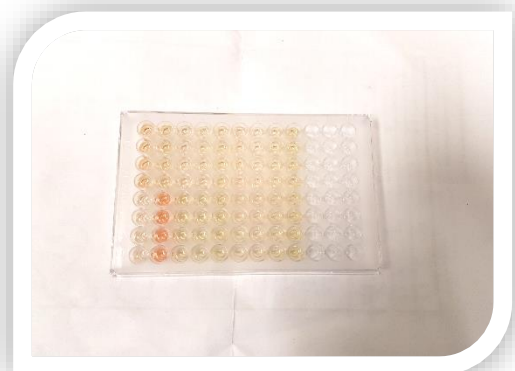


### Sap flow

Vascular clogging diseases (e.g. Panama disease) will interrupt normal transpiration. Changes to the rate and amount of water moving through a plant can be monitored using a sap flow meter.

### Stress-indicative amino acids

Proline (an amino acid) has been found to accumulate in plants upon exposure to stress. Destructive sampling and lab-based analysis can be done to assess the concentration of proline in leaf tissue and use it as an indicator of a plant's physiological condition.



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