

THE POTENTIAL OF MULTISPECTRAL/HYPERSPECTRAL TECHNOLOGIES FOR EARLY DETECTION OF “FLAVESCENCE DORÉE” IN A PORTUGUESE VINEYARD

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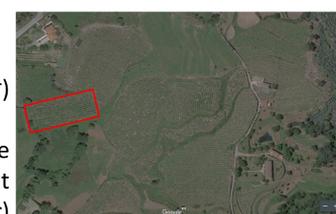


INTRODUCTION

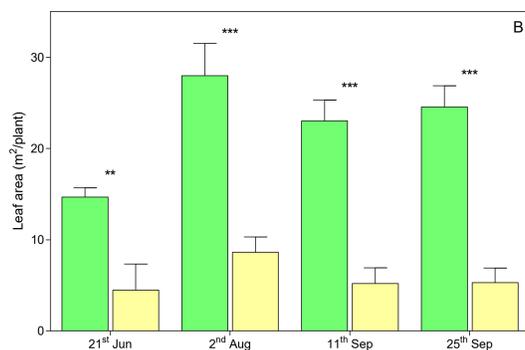
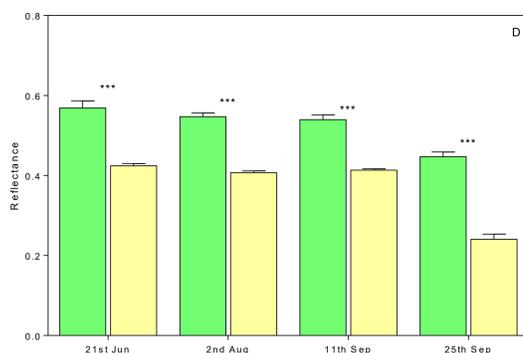
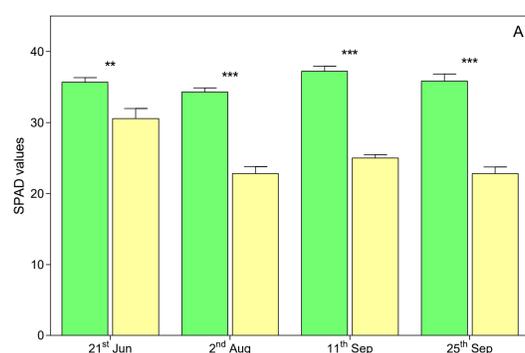
- “Flavescence dorée” (FD) is a grapevine quarantine disease caused by phytoplasmas. It is transmitted by insects (*Scaphoideus titanus* and *Orientalus ishidae*) and by the commercialization of infected vegetative propagation material. FD symptoms are characterized by plant decline, stunted growth and abnormal lignification, flower abortion, leaf rolling and discoloration, unripened shoots and shriveled grapes.
- FD is a serious problem to the sustainability of “Vinhos Verdes” region, where it is present since 2008 leading to severe harvest losses or even the death of the infected plants.
- The current management strategies for FD control are costly, difficult to implement and have a high environmental impact. Recently, several developments in imaging technologies (multispectral, hyperspectral or thermal imaging) have been carried out to support vineyard management, which may be used to enhance water use efficiency, access optimal harvest time and improve disease detection.
- This study, conducted in ‘Vinhos Verdes’ region, aimed to evaluate the potential drone imaging on previous detection of FD infection and its relationship with agronomical parameters measured during the season of 2018.

MATERIALS AND METHODS

- **Plant material:** 20-year-old vineyard (Fafe; Portugal)
- **Treatments (n = 8):**
 - **Plant material:** Healthy (FD-) and FD infected (FD+) grapevines cv. Loureiro
 - **Timepoints:** before the development of disease symptoms (21st June), after symptoms appearance, at veraison (2nd August), at post-veraison (11th September) and at harvest (25th September).
- **Measurements:**
 - Chlorophyll content (SPAD values)
 - Leaf area
 - Photosynthetic rate
 - NIR apparatus
 - Drone imaging

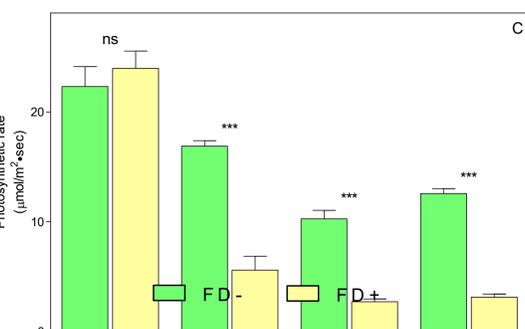


RESULTS AND DISCUSSION



➤ At all timepoints, FD infected plants revealed a significant decrease in the studied physiological parameters (except on 21st June in photosynthetic rate).

➤ NIR reflectance values showed more significant differences between healthy and FD-infected grapevines on 21st June (first observation) ⇒ easier than physiological parameters.



➤ NIR reflectance values presented good correlations with physiological parameters from the second timepoint – 2nd August (after symptoms appearance).



Table 1. Correlation between physiological measurements and NIR measures.

	21 st Jun	2 nd Aug	11 th Sep	25 th Sep
SPAD-NIR	0.67	0.91	0.94	0.88
LA-NIR	0.22	0.84	0.76	0.83
Photo-NIR	-0.05	0.87	0.89	0.97

SPAD values (A), leaf area (B), photosynthetic rate (C) and NIR reflectance measured in 21st June, 2nd August, 11th September and 25th September of 2018 in healthy (FD-) and “flavescence dorée” infected (FD+) grapevine cv. Loureiro. Data are means ± SEM of 8 biological replicates. Mean differences between FD- and FD+ plants according to the two-way ANOVA have been denoted as *** ($P < 0.001$), ** ($P < 0.01$) and ns - non significant.

ACKNOWLEDGEMENTS

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CONCLUSIONS

- FD infection decreased physiologic parameters (SPAD values, LA and photosynthesis) of grapevines;
- Both physiologic measurements and imaging techniques discriminated healthy and FD-infected plants;
- NIR spectroscopy and physiologic measurements showed good correlations (especially from August).

The good correlations between in situ measures and spectral imaging seem to be promising in terms of disease detection before symptoms manifestation