IECAG 2021
The 1st International Electronic Conference on Agronomy
03–17 MAY 2021 | ONLINE
Chaired by PROF. DR. YOUSSEF ROUPHAEL
agronomy
MDPI

Application of Multispectral Images to Monitor the Productive Cicle of Vines Fortified with Zinc

Diana Daccak [1,2,*], Cláudia Campos Pessoa [1,2], Ana Rita F. Coelho [1,2], Ana C. Marques [1,2], Inês C. Luís [1,2], João Caleiro [1,2], Maria Manuela Silva [2,3], Manuela Simões [1,2], Fernando Reboredo [1,2], Maria Fernanda Pessoa [1,2], Paulo Legoinha [1,2], Maria Graça Brito [1,2], José Carlos Kullberg [1,2], José António Almeida [1,2], Paula Scotti Campos [2,4], José C. Ramalho [2,5] and Fernando C. Lidon [1,2]

[1] Earth Sciences Department, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal;
[2] GeoBioTec Research Center, Faculdade de Ciências e Tecnologia, Universidade Nova de Lisboa, Caparica, Portugal;
[3] ESEAG / Grupo Universidade Lusófona, Lisboa, Portugal;
[4] INIAV, Instituto Nacional de Investigação Agrária e Veterinária, Oeiras, Portugal
[5] PlantStress & Biodiversity Lab, Centro de Estudos Florestais, Instituto Superior Agronomia, Universidade de Lisboa, Oeiras, Portugal;

* Correspondence: d.daccak@campus.fct.unl.pt

NOVA SCHOOL OF SCIENCE & TECHNOLOGY
geobiotec Geobiociências, Geoengenharias e Geotecnologias
Almeida Garrett ESCOLA SUPERIOR DE EDUCAÇÃO
iniav Instituto Nacional de Investigação Agrária e Veterinária, I.P.
cef Centro de Estudos Florestais
INSTITUTO SUPERIOR D AGRONOMIA Universidade de Lisboa

Abstract: In a context of an exponential growing population and resource limitations, precision agriculture techniques can improve efficiency in the agricultural sector. This can be achieved by monitorization and quick detection of changes in crops, resulting in smart resource use, waste reduction and maximization of production. In a field located in Palmela (Portugal), three foliar sprays of ZnO and $ZnSO_4$ were performed in *Vitis vinifera* variety Fernão Pires, for production of biofortified single-vine wine. Field characterization was performed with soil sampling and UAVs (with altimetric measurement sensors), synchronized by GPS. Vegetations indexes, and characterization of drainage capacity and slopes were then interpolated with mineral content, monitored with X-Ray Fluorescence analysis. Morphologically, the experimental parcel had a slight slope (maximum of 1.10 m) with irrigation and nutrient availability in soil requiring special attention (i.e., just 1/3 of the parcel had higher capacity to water drainage). NDVI values reflected better physiological values in N-NE region. Zinc increases in leaf's were directly proportional with the applied concentrations in vines sprayed with $ZnSO_4$ and ZnO, in the concentration of 60% (900 g ha^{-1}) revealed a greater vigor. In conclusion, the use of smart farm techniques and its crossing with analytical procedures, allows the characterization and vines, and a higher potential for optimization of wine production.

Keywords: Biofortification; Grapes; NDVI; Precision Agriculture; Remote Sensing; *Vitis Vinifera*; Zinc

IECAG 2021

Materials and Methods

Experimental Field

Fernão Pires variety-
foliar application with $ZnSO_4$ and ZnO
(0%, 10%, 30% and 60%- 0, 150, 450 and 900 g ha^{-1})

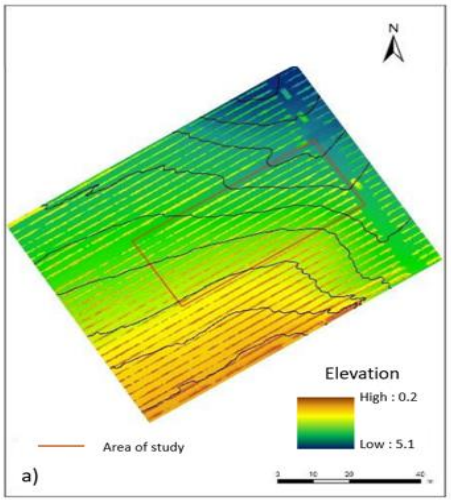
Field Morphology and vigor

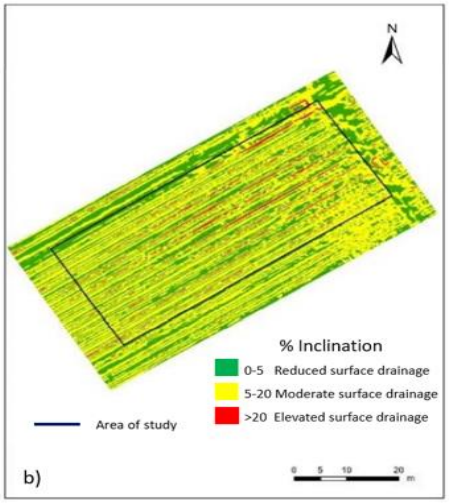
UAV's images

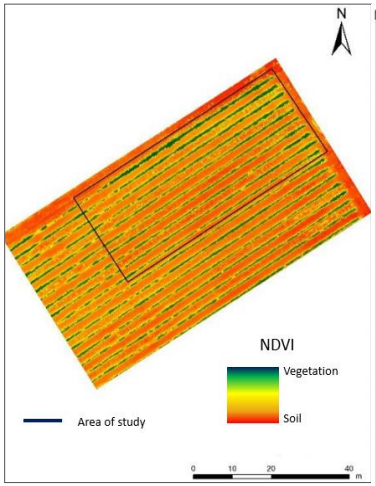
Quantification of Zn

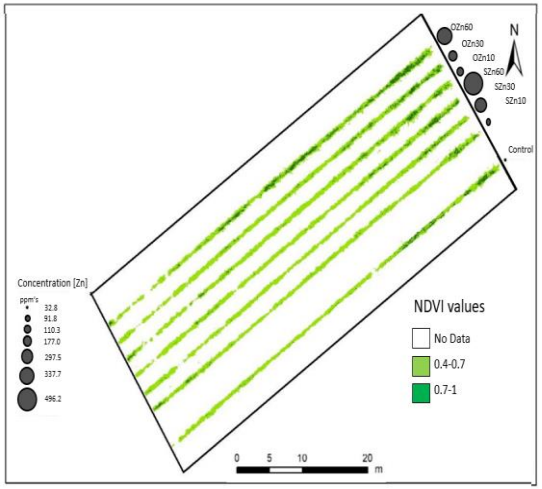
XRF

Results and Discussion









- Morphologically, the terrain is almost flat presenting a maximum variation of 1.10 m in the area.
- Regarding surface drainage conditions, only 1/3 of the total land area reflected aptitude for infiltration of surface waters.
- Zinc`s mineral content in leaf`s with $ZnSO_4$ and ZnO, were directly proportional with the applied concentrations and rows sprayed with ZnO presented greater vigor in comparison to rows sprayed with $ZnSO_4$.

IECAG 2021

Conclusions

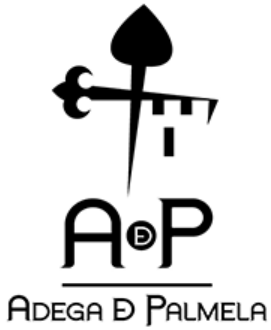
- The use of precision agriculture techniques, namely images processing from cameras coupled to UAV`s, in the vineyard submitted to the reported workflow for Zn enrichment allowed terrain characterization in terms of slopes and water drainage, to identify possible conditionings to the increase of Zn in fruits.

- Furthermore, NDVI enabled the assessment to different physiological responses in different zones of the vineyard, which can be related to the characteristics of the field.

- The applied workflow using foliar application of Zn, did not present negative influences in the vineyard, and increases of Zn in leaf`s from Fernão Pires variety occurred with ZnO and $ZnSO_4$. In both cases, Zn content rose with the increase of concentration, which become relevant, as assimilation of Zn by leaves through foliar sprays is crucial for this mineral`s increase in fruits by translocation mechanisms, and thus needed to attain fruits with added value.

Acknowledgments

The authors thanks to Adega Cooperativa de Palmela and Casa Agrícola Nunes Oliveira da Silva Lda. for technical assistance. We also give thanks to the Research centers (GeoBioTec) UIDB/04035/2020 and (CEF) UIDB/00239/2020 for support facilities.



IECAG
2021