

PROTECTED HORTICULTURAL CROPS CHARACTERIZATION THROUGH OBJECT-BASED IMAGE ANALYSIS AND SATELLITE IMAGERY TIME SERIES IN ALMERÍA (SPAIN)

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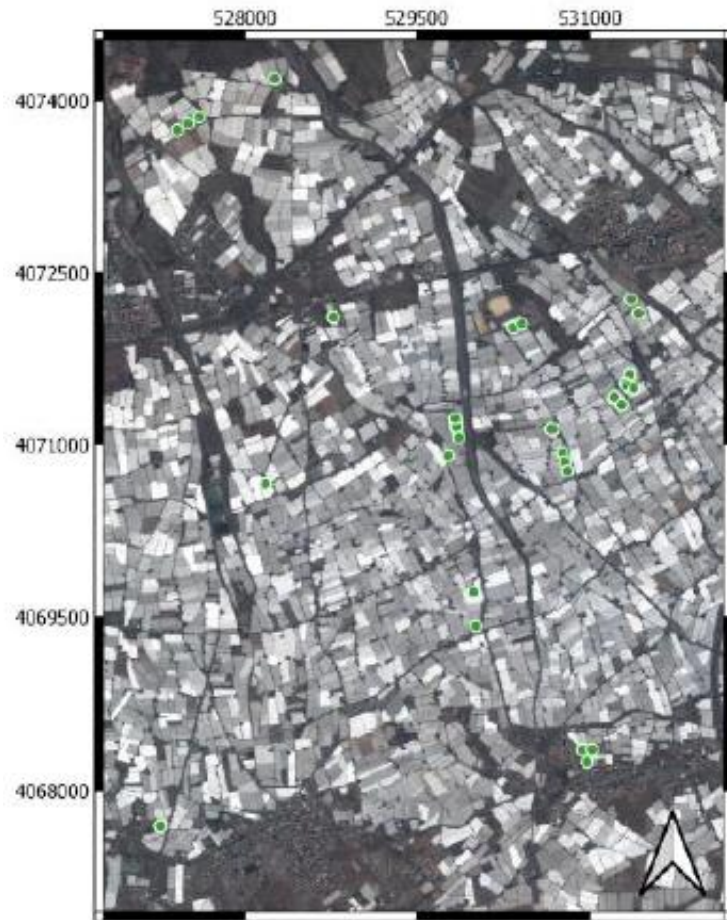


INTRODUCTION



- ❑ Greenhouse farming is an agricultural management system that has showed its efficiency in intensifying food production.
- ❑ In 2018, the global surface area of plastic agricultural structures was estimated as ~3,400,000 ha, where 15% of this area was greenhouses and their area is growing.
- ❑ This work is dealing with the optimized use of Sentinel-2 satellite image data for acquisition of consistent and near in time information associated to the greenhouse crops in spatial and temporal domain. The goal of the proposed study is to discriminate different inside greenhouse crops based on the multi temporal Sentinel-2 remotely sensed data temporal profile of NDVI, Brightness and the agricultural management of PCG.

STUDY SITE

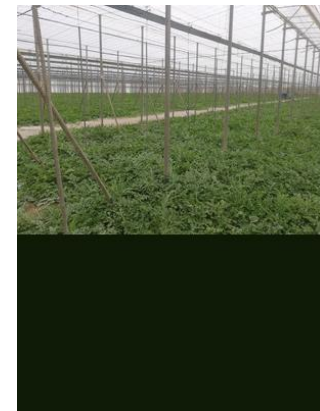
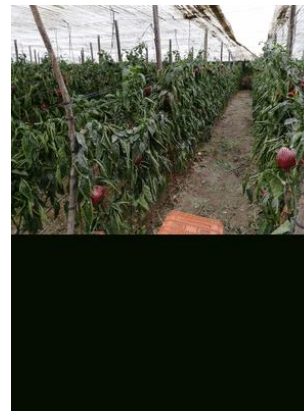


- ❑ The research has been carried out in Almería one of the eight provinces that make up the autonomous community of Andalusia in southern Spain.
- ❑ Over 32,554 hectares of this province are currently dedicated to greenhouse crops production.
- ❑ Considering the area cultivated by product in the 20/21 season, production was 52,350 hectares of which was 12,575 ha of watermelon, 12,310 ha of pepper, 8,423 ha of tomato, 8,061 ha of zucchini, 5,280 ha of cucumber, 3,205 ha of melon, 2,277 ha of aubergine, and 219 ha of green bean.

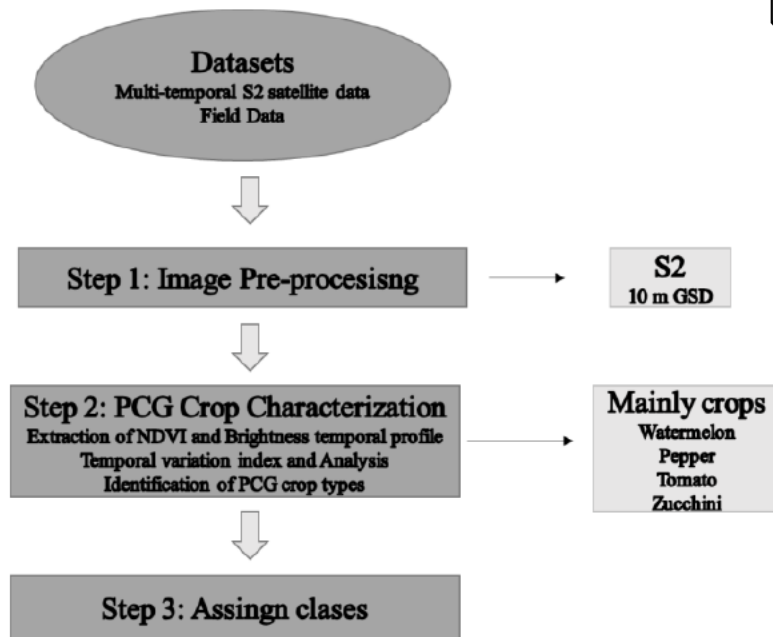
DATASETS

<i>Orbit</i>	<i>Granule</i>	<i>Date of Acquisition</i>	<i>Sensor</i>
R094	30SFW	January 3, 2021	2B
R051	30SFW	January 15, 2021	2A
R094	30SFW	February 7, 2021	2A
R094	30SFW	February 22, 2021	2B
R051	30SFW	March 14, 2021	2B
R051	30SFW	March 24, 2021	2B
R094	30SFW	April 18, 2021	2A
R051	30SFW	May 5, 2021	2A
R051	30SFW	May 25, 2021	2A
R051	30SFW	June 9, 2021	2B
R051	30SFW	June 29, 2021	2B
R051	30SFW	July 4, 2021	2A
R051	30SFW	July 19, 2021	2B
R051	30SFW	August 8, 2021	2B
R051	30SFW	August 28, 2021	2B
R051	30SFW	September 12, 2021	2A
R051	30SFW	September 17, 2021	2B
R051	30SFW	October 7, 2021	2B
R051	30SFW	November 11, 2021	2A
R094	30SFW	November 29, 2021	2B
R051	30SFW	December 6, 2021	2B
R094	30SFW	December 19, 2021	2B

- A time serie of 22 cloud-free Sentinel-2 satellite images both Sentinel-2A and 2B were acquired in different dates during the 2021. In this study, the six 20 m GSD bands Red Edge1, 2 and 3, SWIR 1 and 2 and NIR8a and four 10 m GSD bands Blue, Green Red and NIR8 were used.
- During 2021 were acquired field data to obtain rigorous and real information about 32 controlled greenhouses.



METHODOLOGY

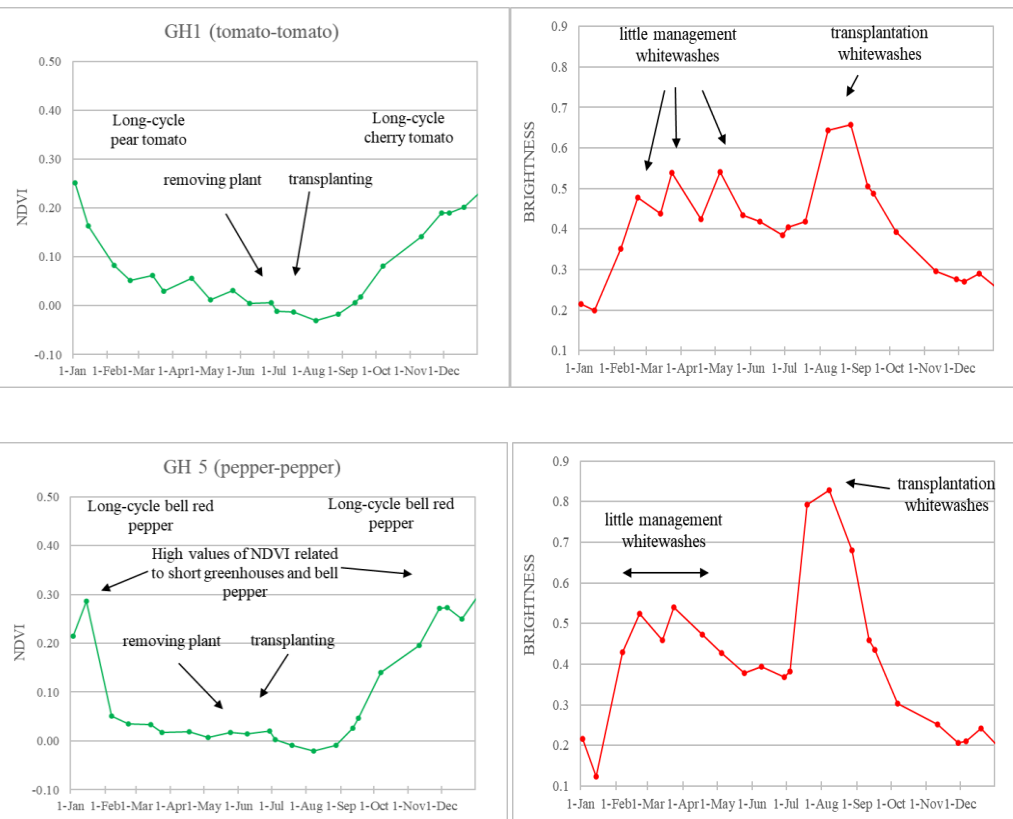


- These satellite images after the preprocessing operations are further used to PCG crop characterization. Trimble eCognition Developer v. 10.1 software was employed for the Object-Based Image Analysis (OBIA) and the extraction of NDVI and Brightness. Finally, an assignment of classes of the horticultural crops studied under PCG in winter-spring 2021 and summer-autumn 2022 is made.

$$NDVI = \frac{(NIR8-R)}{(NIR8+R)}$$

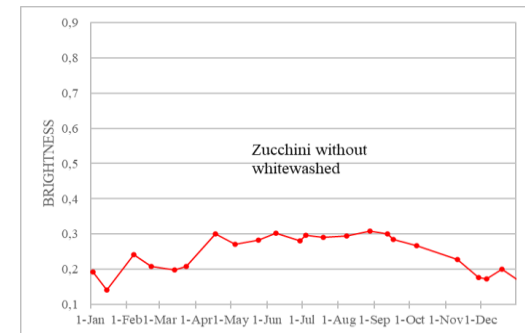
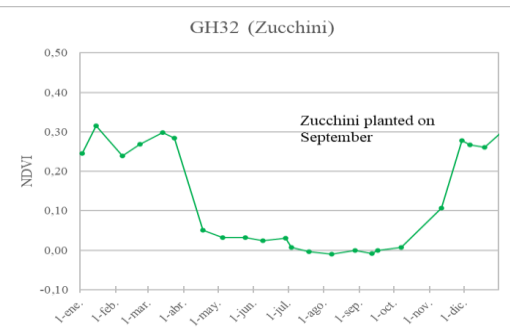
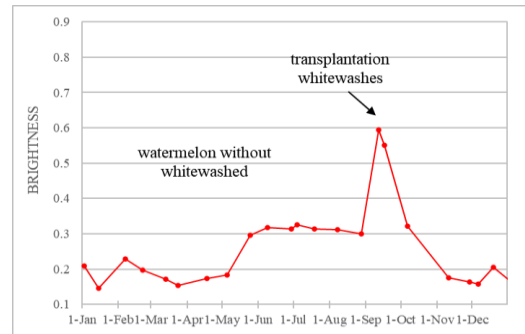
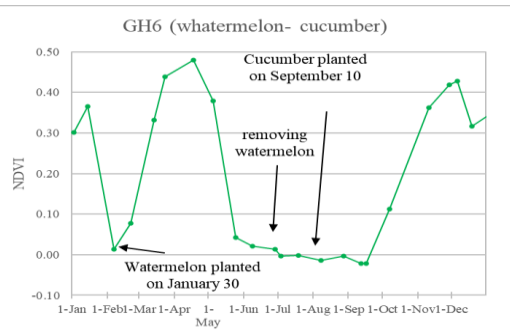
$$Brightness = \frac{(B+G+R+SWIR\ 1+SWIR\ 2)}{5}$$

RESULTS AND DISCUSSIONS

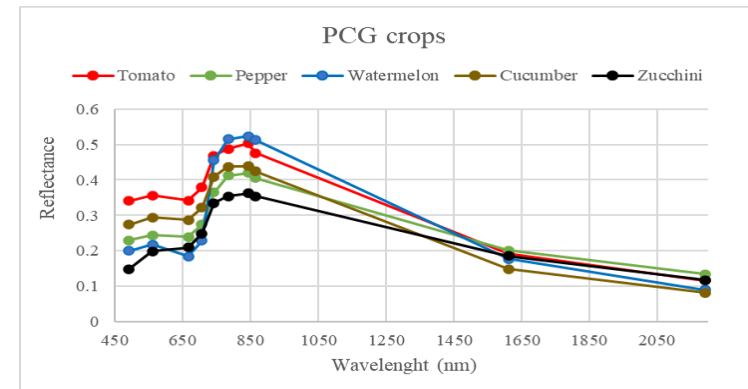


- Temporal and spatial variations in the numerical values of the NDVI may be successfully used to crop growth monitoring
- Brightness is another key factor that makes it possible to determine one of the actions on greenhouses that is easiest to detect in remote sensing, whitewashing
- The ability of a vegetation index as robust as the NDVI to detect phenological variations in crops has been demonstrated, allowing outdoor crops and land use to be mapped. By applying this methodology in PCG crops the potential of its application.

RESULTS AND DISCUSSIONS



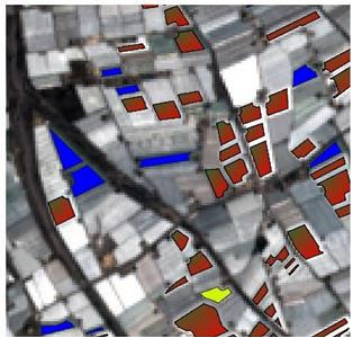
- An analysis of the spectral signature was carried out on Sentinel-2 images of the crops in which the highest NDVI values and lowest Brightness values, the moment where the reflectance values of the crop in the greenhouse are best remotely detected.
- The spectral signatures of the characterized PCG crops are plotted are characterized by increasing reflectance values as they approach the near-infrared spectrum





CONCLUSIONS

- ❑ The present study demonstrated that temporal indices as NDVI and Brightness using an OBIA approach may be effectively used for the discrimination of PCG Crops.
- ❑ The previous analysis of the greenhouse conditions and crop management, as well as the extraction of the correct indices, is necessary for the characterization of the crops.
- ❑ The process of collecting the field data and extracting the data from the S2 im-ages is laborious and needs to be done simultaneously over time.
- ❑ Although this study is carried out over one year, the results obtained indicate that studies carried out in longer time series would allow a better characterization of the PCG crops.
- ❑ Similar approaches could be used in other greenhouse areas and for analysis or estimation of production and yield or environmental parameters of crops.



Watermelon
Pepper and Tomato
Zucchini

0 100 200 300 m

Zucchini
Tomato
Cucumber
Pepper

0 100 200 300 m



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Thank you very much for your attention

Muchas gracias por su atención



<https://w3.ual.es/Proyectos/SentinelGH/>

