The Seventeenth International Conference on Networking and Services (ICNS 2021)
May 30, 2021 to June 03, 2021 - Valencia, Spain

Workshop
SeSAM: Sensing Systems for Agricultural Management

Estimating the Canopy Cover of *Camelina sativa* (L.) Crantz through Aerial RGB Images

David Mostaza-Colado[1], Lidia Díaz-Fuentes[2], Andrea Collado-Gómez[2], Pedro V. Mauri[1], and Aníbal Capuano [3]

[1]Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario (IMIDRA), Finca "El Encín", Ctra. A-2, Km 38.200, 28805 - Alcalá de Henares, Madrid, Spain.
[2] Universidad de Alcalá, Alcalá de Henares, Madrid, Spain.
[3] Camelina Company España, Fuente el Saz de Jarama, Madrid, Spain.

iMiDRA Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario

GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN

European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas

PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

INDEX

iMiDRA
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

I. INTRODUCTION

- **Soil erosion** is one of the most important factors in land degradation and one of the principal mechanisms of desertification at national and regional levels.

- Effects caused by erosion are the **loss of agricultural and forest soil fertility**, increased degradation of vegetation cover, and a decrease in natural hydrologic control.

- The establishment of **vegetal covers** is an excellent alternative to prevent erosive processes, since it increases the hydraulic resistance of the land by increasing the stability of the soil aggregates.

I. INTRODUCTION

- **Camelina** [*Camelina sativa* (L.) Crantz] is considered as a growing crop in Spain, leading a special interest in crop diversification. It is a practical and economically viable alternative, supported by its short growth period.

- Within the CAMEVAR project, we are assessing several varieties of camelina provided by Camelina Company Spain, together with cultivation techniques and practices in combination with new technologies.

iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

I. INTRODUCTION

- In this paper, we analyze the use of Red, Green and Blue [RGB] images gathered with a Parrot Bebop 2 UAV [Unmanned Aerial Vehicle] to estimate the Crop Coverage or Canopy Cover [CC] of camelina.

- We will determine the percentage of soil and vegetation through a combination of the images bands to assess the evolution of the crop, seeded in two different dates.




iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

II. RELATED WORK

- **Alatorre et al**. analyzed the temporal evolution of plant activity on vegetated areas and in erosion risk zones in a small area of the central Pyrenees during the period 1984 - 2007 from two Landsat Normalized Difference Vegetation Index [NDVI] time through Multi Spectral [MS] sensors.

- **Basterrechea et al.** used the Sentinel-2 satellite platform to gather images in the different bands of RGB, Near InfraRed [NIR], Water Vapor Permeability [WVP], and NDVI index for different times of the year to evaluate changes between plots with coverage and plots without grass coverage.

- **Marín et al**. showed the accessibility, easy use and low cost of digital RGB cameras as a perfect device for turfgrass green biomass estimation and water management.

III. MATERIALS AND METHODS

- **Four replicas** of a winter camelina variety (V11) in two different dates:
  - December 2nd, 2020, and February 18th, 2021.
- Two **seeding techniques** and applied two concentrations of Urine derived Fertilizer [UdF]:
  - Low-60 and high-90.
- 4 bands in 8 plots randomly distributed.
- **Bebop 2 UAV** with a 24-bit color RGB camera and a resolution of 1440x1080 pixels to take zenithal pictures of the camelina canopy at 15 m height.

iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

III. MATERIALS AND METHODS

P4	F.1	G.2	F.3	H.4	C.1	B.2	A.3	A.4	P5
P3	E.1	F.2	G.3	F.4	B.1	A.2	D.3	C.4	P6
P2	G.1	H.2	H.3	E.4	A.1	C.2	B.3	B.4	P7
P1	H.1	E.2	E.3	G.4	D.1	D.2	C.3	D.4	P8

(A) 1st seeding date – broadcast – 60UdF

(B) 1st seeding date – broadcast – 90UdF

(C) 1st seeding date – rows – 60UdF

(D) 1st seeding date – rows – 90UdF

(E) 2nd seeding date – broadcast – 60UdF

(F) 2nd seeding date – broadcast – 90UdF

(G) 2nd seeding date – rows – 60UdF

(H) 2nd seeding date – rows – 90UdF

iMiDRA Instituto Madrileño de Investigación y Desarrollo Rural, Agrario y Alimentario

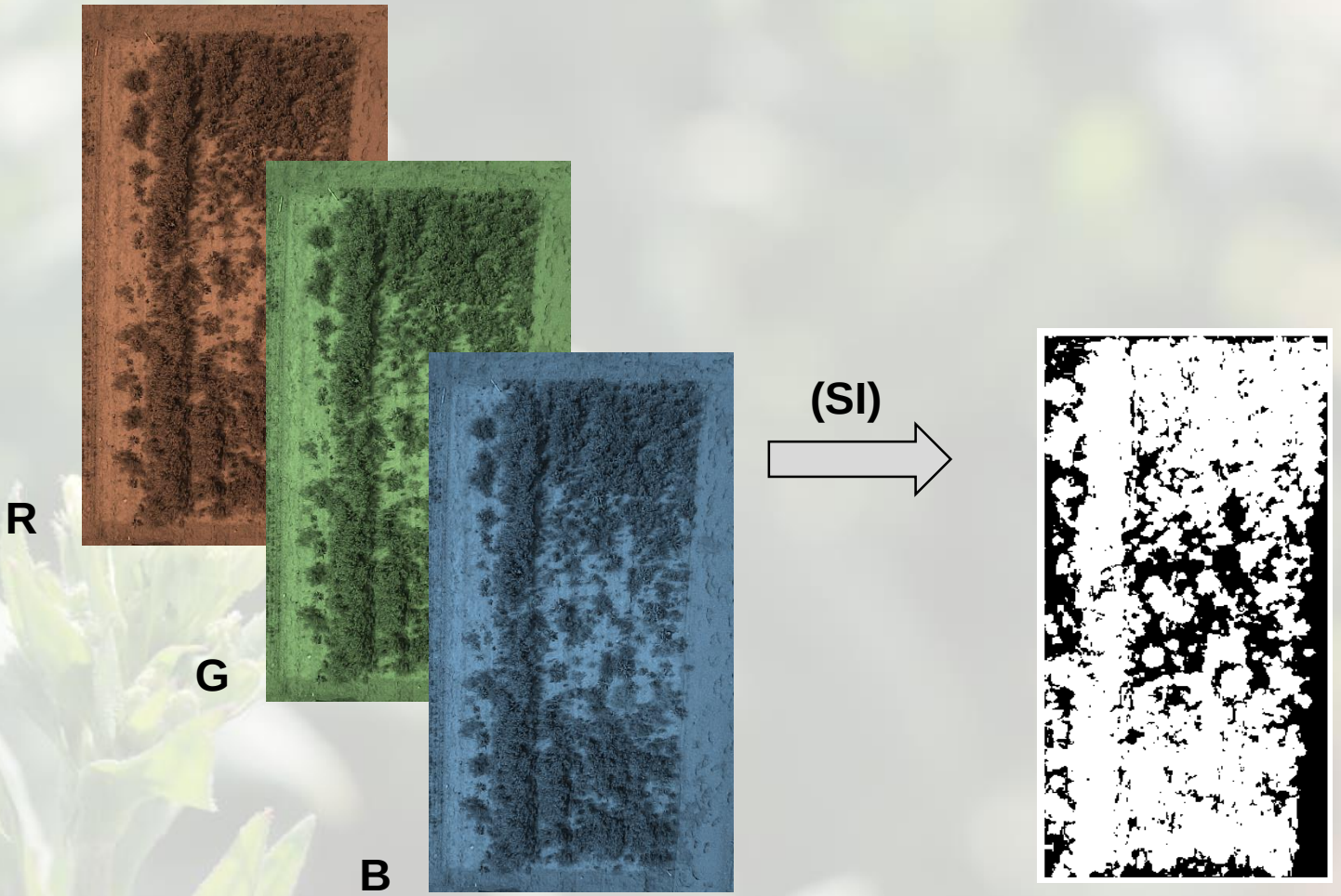
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN

European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas

PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

III. MATERIALS AND METHODS

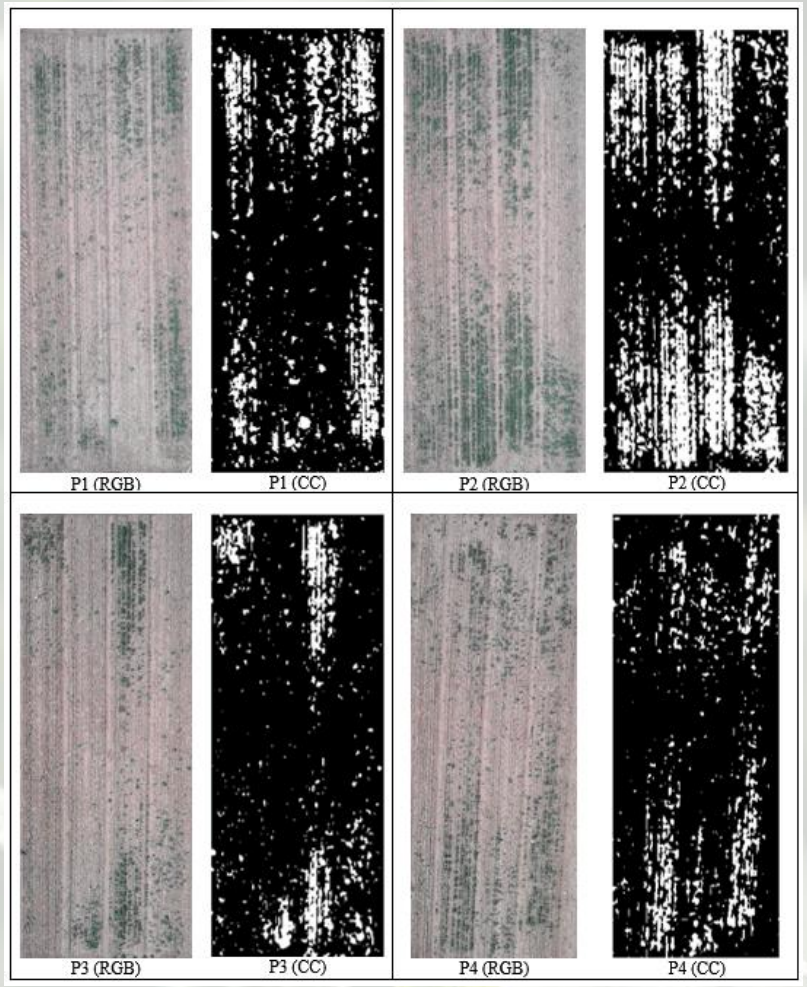
- **QGIS 3.16.4-Hannover**
- **Soil Index (SI) = G_{band}/R_{band}**
- Pixels between 0 and 1 where reclassified as 0 and considered soil (black pixels)
- Pixels over 1 were classified as 1 and considered vegetation (white pixels).
- QGIS tool “zonal statistics”

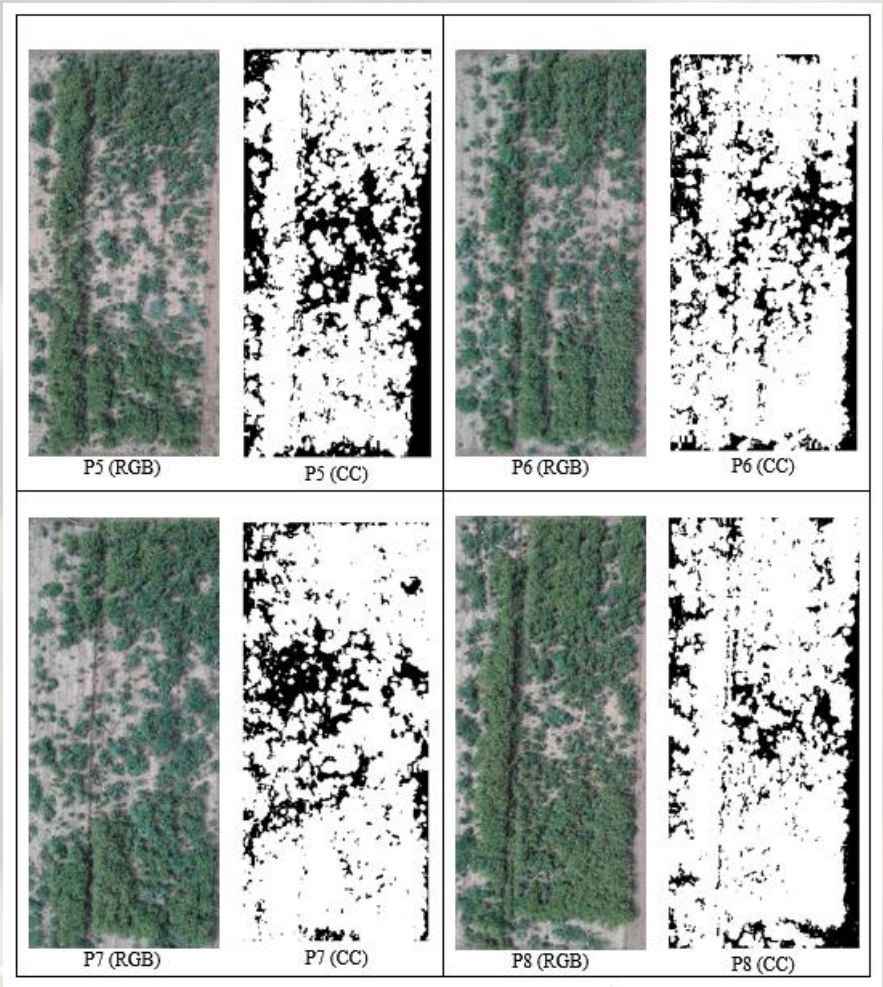


iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

IV. RESULTS

CROP COVER	PLOT
14,88%	P1
27,04%	P2
9,67%	P3
10,64%	P4
69,17%	P5
76,19%	P6
78,24%	P7
80,76%	P8





iMiDRA
GOBIERNO DE ESPAÑA
MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

IV. RESULTS

- Crop Coverage estimation:
  - Issues with the Wintersteiger plot seeder: the middle of the seeding route has less density than the edges. Some differences in the seeding procedure: **P5-C.1** and **P8-D.1-D.2-C.3-D.4**
  - Correctness of the seeding procedure or the effects of the different crop management procedures employed.
  - Differences in the effect of fertilization: **P8-D.1 to P5-C.1**

- Work in progress, as the crop is still growing. We keep gathering data.

iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

V. CONCLUSIONS

- Easy, cheap, and effective way to assess the canopy coverage of camelina crops.
- Allows the farmer or investigator to assess the growing of the crop and determine if there has been any issue during the seeding procedure.
- Even though, once the essay or crop are seeded, if there is any problem it would be difficult to solve. So, by flying the UAV as a check procedure, this could be issued in further campaigns to avoid echoing the previous mistakes.

- As this paper is a current work, we aim to compare the gathered data with results from seed yield and plant development, and with thermal images in larger plot areas. Therefore, we could aim to assess detecting diseases in large crop areas, or not growing spots that could reduce the final yield of the crop.

iMiDRA
Gobierno de España Ministerio de Agricultura, Pesca y Alimentación
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

ACKNOWLEDGMENT

This work has been funded by PDR-18-CAMEVAR project, funded under the PDR-CM 2014-2020 by the EU (European Agricultural Fund for Rural Development, EAFRD), Spanish Ministry of Agriculture, Fisheries and Food (MAPA) and Comunidad de Madrid regional government through IMIDRA.

PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020

THANK YOU FOR YOUR ATTENTION

David Mostaza-Colado

david.mostaza@madrid.org

iMiDRA
GOBIERNO DE ESPAÑA MINISTERIO DE AGRICULTURA, PESCA Y ALIMENTACIÓN
European Union
European Agricultural Fund for Rural Development (EAFRD)
Europe invests in rural areas
PROGRAMA DE DESARROLLO RURAL DE LA COMUNIDAD DE MADRID 2014-2020