



HAIP

HAIP Solutions

APPLICATION NOTE

BlackBird V2

Modern Plant Breeding with Hyperspectral Imaging

1. Plant Breeding nowadays

Plant breeding is currently facing numerous challenges, which are being exacerbated by climate change. Increased temperatures, water scarcity and diseases pose a serious challenge for efficient plant breeding. In response to these difficulties, advanced technologies such as hyperspectral imaging are being used to speed up and refine the plant breeding process. Hyperspectral imaging methods based on unmanned aerial vehicles (UAVs) are especially useful for field data



acquisition of crops, providing valuable information on yield, nitrogen content, leaf chlorophyll, biomass estimation, and both biotic and abiotic stress factors.

2. Problem: Climate Change

Climate change is putting pressure on humanity to develop new plant species that require less water and are more heat resistant to secure the world's food supply. The development of new plant varieties through conventional breeding can take 10-15 years. This lengthy process is insufficient to respond to rapidly changing environmental conditions and market needs. Hyperspectral imaging offers a powerful toolset to overcome these challenges by providing detailed, non-destructive insights into plant health, composition, and stress responses which enable efficient plant breeding.

3. Solution: Classification with Hyperspectral Imaging

There are several parameters of plants that can be monitored using hyperspectral cameras, including:

- Early detection of plant diseases
- Early stress detection
- Plant water status
- Nutrient content

These and many more criteria can be identified in the spectral reflectances of the hyperspectral camera BlackBird V2 for UAVs, making it possible for breeders to react quickly to changes in their crop with a reduced resource usage.

APPLICATION NOTE

BlackBird V2 - Modern Plant Breeding with HSI

HAIP BlackBird V2

- Spectral range: 500 – 1000 nm
- Spectral resolution: 5 nm
- Spatial resolution: 540 px
- Two sensors: HSI & RGB



HAIP Solutions BlackBird V2 is a hyperspectral imaging camera specifically designed for the use with DJI drones from the Matrice 300 & 350 RTK series. The camera enables the simultaneous acquisition of HSI and RGB images. It provides a spatial resolution of 540 pixels with 100 spectral bands in the VNIR wavelength range from 500 nm to 1000 nm.

4. Case Study: LAI Estimation on Agricultural Land



Orthomosaic image

HSI image (left); Vegetation Index MCARI2 (right)

The hyperspectral images acquired with the BlackBird V2 camera can be used to perform numerous valuable analyses for plant breeding. For monitoring purposes, it is particularly common to calculate vegetation indices based on selected spectral bands. In this application, the Leaf Area Index (LAI) is estimated at the edges of a field with young spring wheat. The vegetation index MCARI2, developed by Haboudane et al. 2004, is used for this purpose. The results are shown in the figure above. Thanks to the high spectral and spatial resolution of the BlackBird V2 camera, many more interesting projects can be realized. Which one will be yours?

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