

PlantScreen™ Field System

Field Systems are autonomous and semi-autonomous mobile platforms for fast and accurate to analysis of crop structural and functional traits in real-world agricultural environments. The **PlantScreen™ Field** sensor module is modularly mounted on field vehicle (e.g. high-clearance tractor) on height adjustable arm. The module is designed for modular integration of user defined set of imaging sensors. The system navigates the driver with RTK-GPS precision to user defined measuring points and automatically runs the pre-defined measuring protocols. Sensor specific automatic calibration functions are implemented to ensure optimal image exposition and correction implementation for the ambient environmental conditions. After the measurement data are automatically synchronised and stored in the internal database.



HARDWARE COMPONENTS

MOBILE PART HARDWARE

- Imaging sensors: RGB, MSC, Thermal, Lidar and Hyperspec (VNIR and SWIR)
- Environmental sensors: T, rH, Light intensity, PAR spectrometer
- Carrying frame with shock absorbers

- GNSS RTK navigation system
- Rover PC
- FieldScreen tablet
- Database servers
- Light dispersion mesh

STATIONARY PC HARDWARE

Plantscreen™ Database Servers
Weather station

SOFTWARE

MOBILE PART SOFTWARE

1. FieldScreen Client
2. FieldScreen Server

DATABASE SOFTWARE

1. PlantScreen Scheduler client for measurement protocol preparation
2. PlantScreen Data Analyzer for data viewing and analysis
3. PlantScreen Server (to manage weather station)
4. Analysis software for individual sensors: FluorCam10, Morpho-analyzer, HS Analyzer, 3D Analyzer

RGB SENSOR

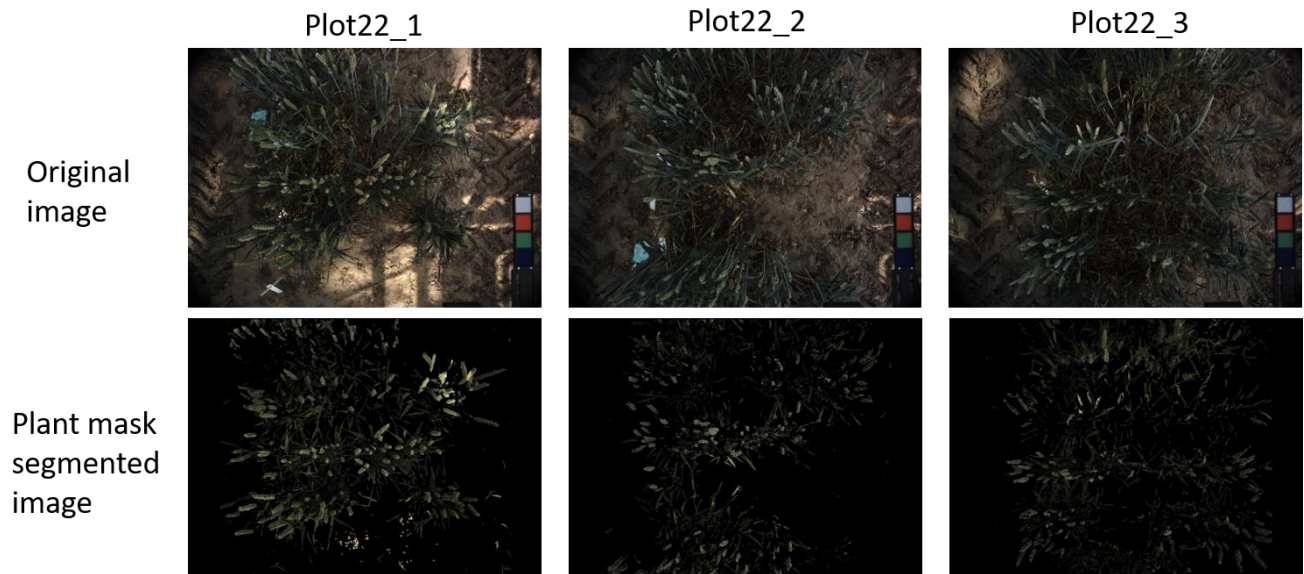
SETTINGS AND CALIBRATIONS

Height adjustment, white balance, autoexposure, sunshade mode, analysis settings

Parameters: Area (pixel count / mm²), color segmentation

Resolution: 4112 x 3006 px

EXAMPLES OF COLLECTED DATA



CALCULATED PARAMETERS

Measuring position	AREA	AREA mm ²
Plot22_1	2366808	176322
Plot22_2	1592196	118615
Plot22_3	2249422	167577

THERMAL CAMERA

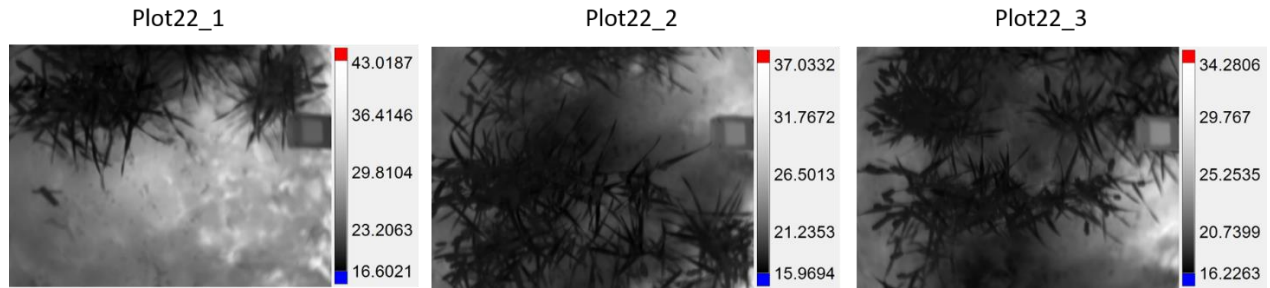
SETTINGS AND CALIBRATIONS

Height and focus adjustment, non-uniformity correction

Resolution: 1024 × 768 px

Parameters Thermogram with heated calibration surface

EXAMPLES OF COLLECTED DATA



HYPERSPECTRAL CAMERA VNIR

SETTINGS AND CALIBRATIONS

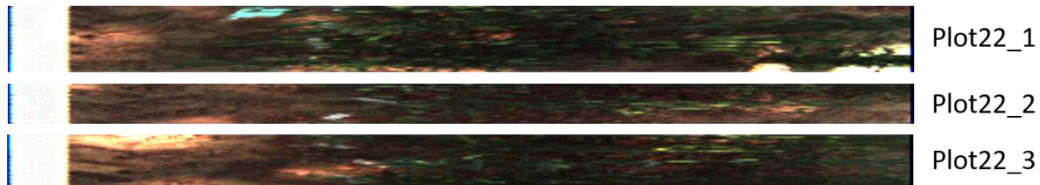
Height adjustment, Auto- exposure, gain, sunshade mode ON, analysis settings

Parameters: PRI, NDVI, SIPI, MCARI1, OSAVI

Resolution: Spatial res. 1000 px, spectral resolution 1920 px, wavelength resolution 0.8 nm (FWHM) and dispersion per pixel 0.27nm

EXAMPLES OF COLLECTED DATA

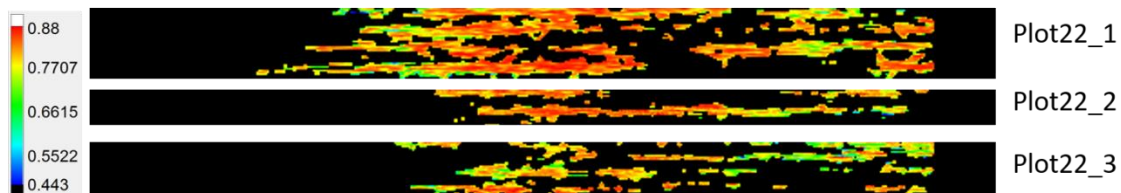
VNIR scan: RGB preview



VNIR scan: plant mask segmented image



VNIR scan: NDVI on plant mask



CALCULATED PARAMETER EXAMPLE

	NDVI- avg	NDVI- stddev
Plot22_1	0.707961	0.132807011
Plot22_2	0.669006	0.11841905
Plot22_3	0.710333	0.101474871

HYPERSPPECTRAL CAMERA SWIR

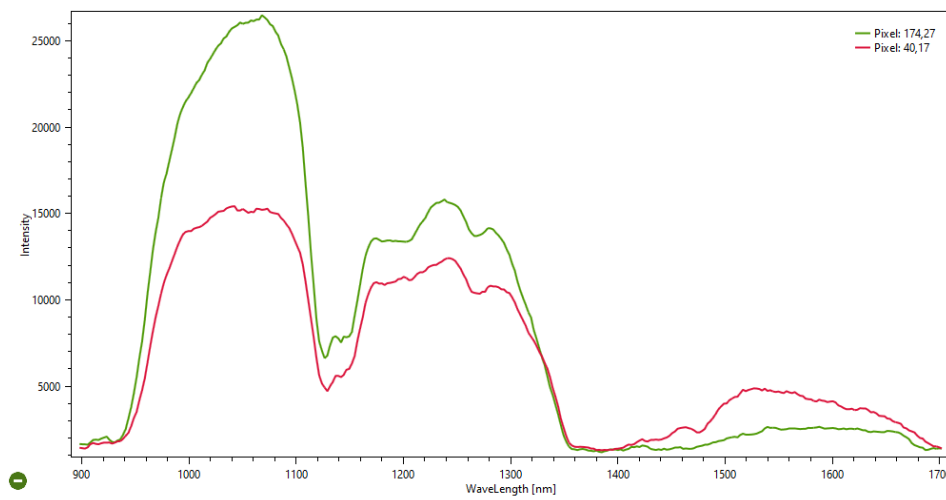
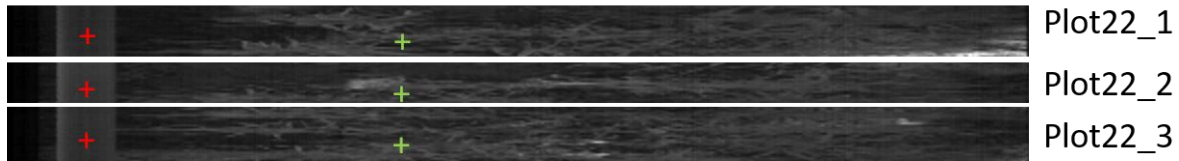
SETTINGS AND CALIBRATIONS

Height adjustment, autoexposure, sunshade mode ON

Parameters: Water indices WI1, WI2

Resolution: Spatial 510 px, spectral 636 px, wavelength res. FWHM 3 nm, dispersion per pixel 1.25

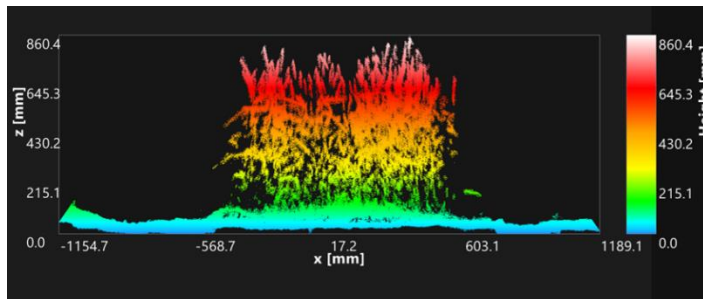
EXAMPLES OF COLLECTED DATA



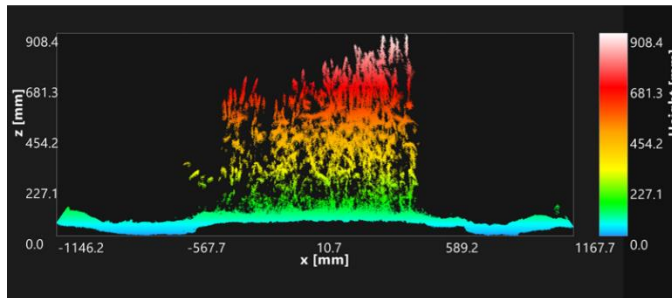
LIDAR

Analysis result: height profile, height map
 Min. object size (L×W×H): 50 mm x 50 mm x 20 mm

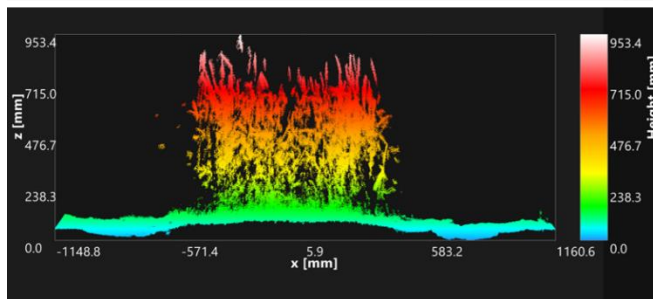
EXAMPLES OF COLLECTED DATA



Plot22_1



Plot22_2



Plot22_3

CALCULATED PARAMETERS

Area Name	(P100) Max Height	(P95) Max Height	(P90) Max Height	Min Height	Average Height	Median Height	StdDev Height
Plot22_1	860.4	592.76	487.71	0	126.82	42.34	187.47
Plot22_2	908.37	556.32	400.09	0.75	121.54	70.22	164.42
Plot22_3	953.38	640.17	535.18	2.44	169.22	86.56	194.52

MSC

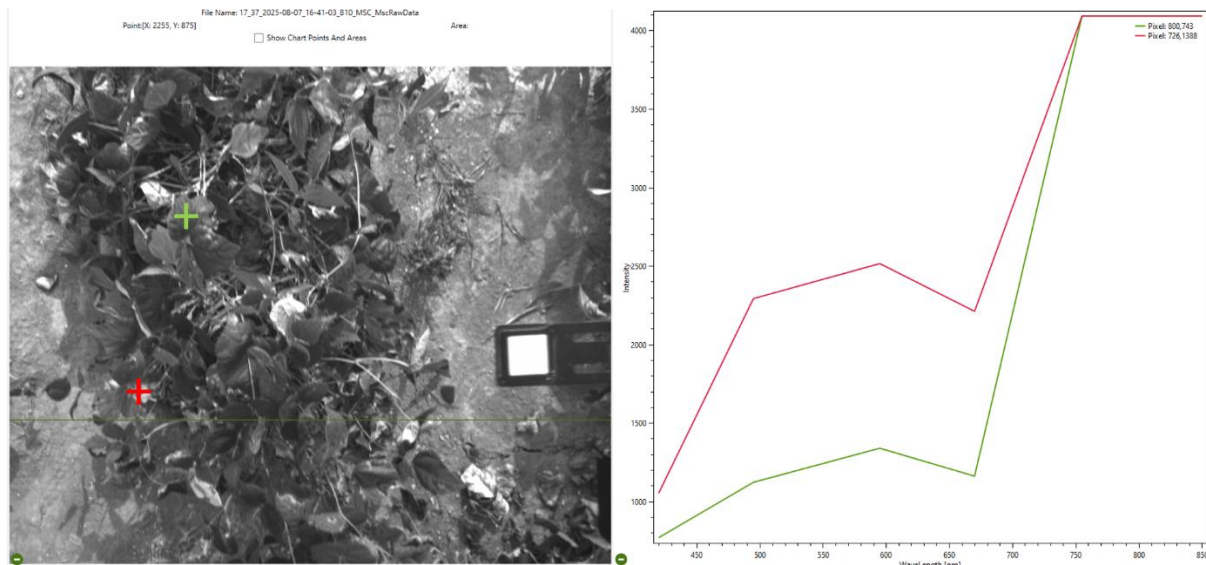
SETTINGS AND CALIBRATIONS

Height adjustment, autoExposure, 6 channels gains, Autoexposure ON, sunshade mode ON

Resolution: 5.07 Mpx (2464 x 2056 px)

Further specifications: Sensor1 370 - 450 nm, Sensor2 450 - 540 nm, Sensor3 560 - 635 nm, Sensor4 655-690 nm, Sensor5 720 - 785 nm, Sensor6 805 - 950 nm

EXAMPLE OF COLLECTED DATA



FLUORCAM

MEASUREMENT SETTINGS

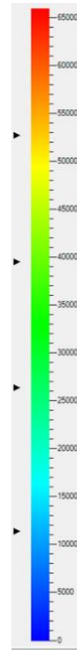
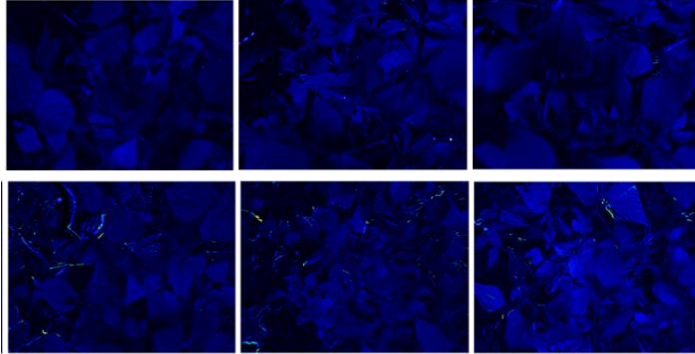
Height adjustment, el. shutter, sensitivity, light intensity settings, sunshade mode ON, analysis settings

Parameters:

- Ft_Lss (Steady-state fluorescence in light)
- Fm_Lss (Steady-state maximum fluorescence in light)
- F0_Lss (Steady-state minimum fluorescence in light)
- Fv_Lss (Variable fluorescence in light-adapted state)
- QY_Lss (Steady-state PSII quantum yield Φ_{PSII})

Resolution: 1360 × 1024 pixels

EXAMPLES OF COLLECTED DATA



False color scale