

We detect change.

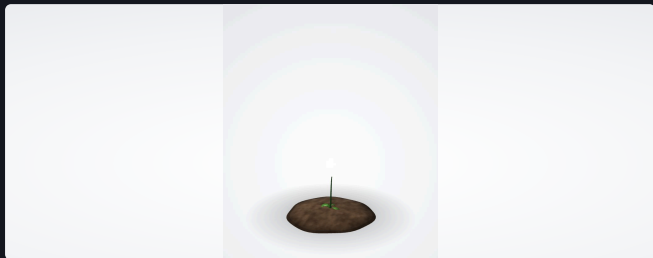
A corn plant goes from healthy to dead in 25 stages. Long before any of it is visible, the way it reflects light has already changed. This guide pairs every stage with a LATTICE filter worth flying for it and the indices that filter can feed, then lists the whole index catalog the filter line supports.

Band roles follow the remote-sensing literature: red edge runs about 700 to 800 nm and near-infrared about 800 to 1000 nm. Filters are named by model. Formulas are configurable, so the pairings here are a starting point, not a menu.



The stages

01 Before you can see it.



LATTICE cameras record the exact bands a crop changes in, from ultraviolet to near-infrared. Pick the filter that answers your question, then read it back as an index across the whole field.

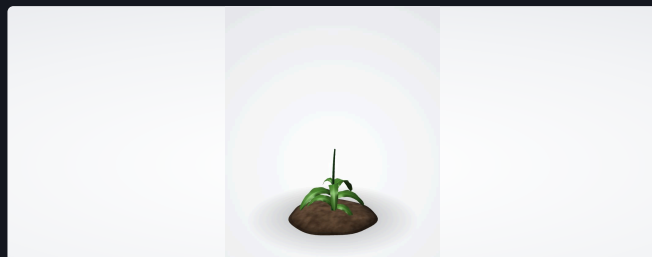


☒ F550 ☒ F650 ☒ F715 ☒ F850

☒ NDVI Agriculture ☒ NDRE Crop nitrogen

☒ GNDVI Chlorophyll

02 Emerged



A shoot and its first leaves clear the soil. There is more bare ground than crop in the frame, and soil brightness still dominates anything measured from the air.



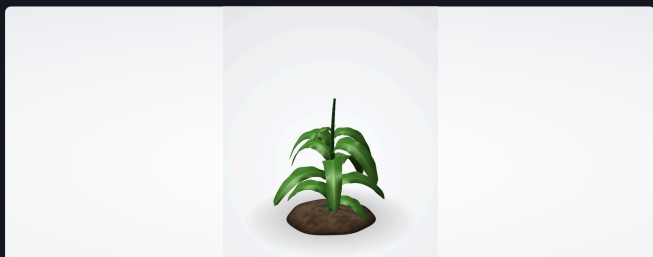
☒ F550 ☒ F650 ☒ F715 ☒ F850

☒ NDVI Stand count

☒ MSAVI2 Soil showing

☒ DVI Biomass

03 Six leaves



The plant is stacking leaves and internodes fast. Nitrogen demand is about to climb, and this is the window where a sidedress decision still pays.



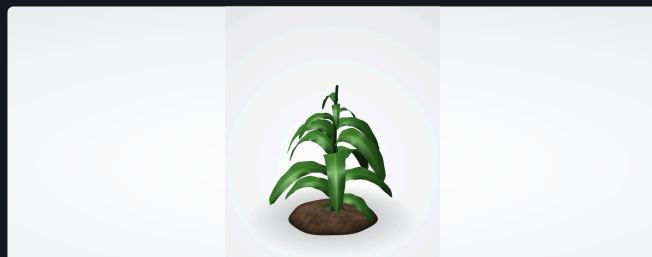
☒ F550 ☒ F650 ☒ F715 ☒ F850

☒ SAVI Sparse canopy

☒ GNDVI Chlorophyll

☒ NDVI Agriculture

04 Canopy closes



Rows touch and the ground disappears. From here the canopy is dense enough that red-based indices start to lose their grip on differences.



☒ F550 ☒ F725 ☒ F850

☒ NDRE Crop nitrogen

☒ Cirededge Canopy chlorophyll

☒ GNDVI Chlorophyll

05 **Tasseling**

The tassel pushes clear of the whorl. Leaf area is at its maximum and every leaf above the ear is now working directly on yield.



● F650 ● F715 ● F850

NDRE Crop nitrogen WDRVI Dense canopy

NDVI Agriculture

06 **Silking**

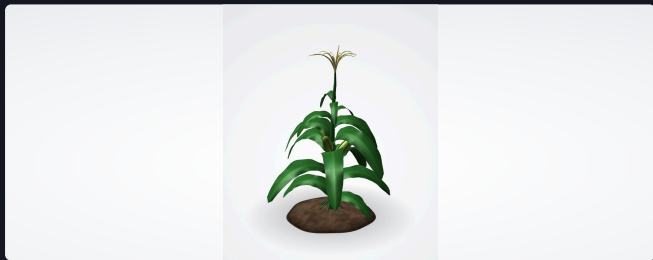
Silks emerge and the ear starts to fill. This is the most stress-sensitive fortnight of the whole season.



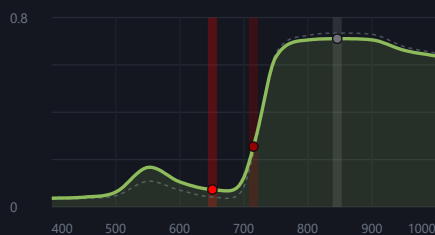
● F650 ● F750 ● F880

NDRE Crop nitrogen NDVI Yield potential

RDVI Canopy density

07 **NDVI saturates**

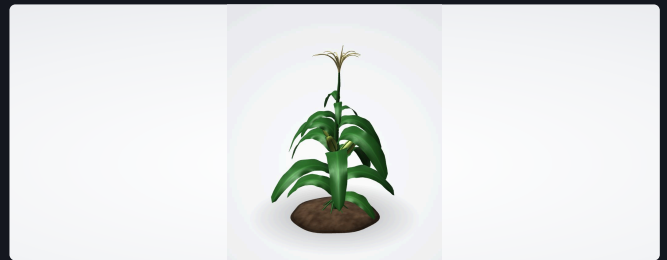
The canopy is now so dense that NDVI flattens out and stops separating a good field from a struggling one. Red-edge and wide dynamic range indices keep resolving.



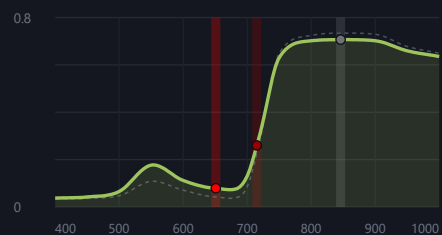
● F650 ● F715 ● F850

WDRVI Dense canopy NDRE Crop nitrogen

NDVI Agriculture

08 **Nitrogen shortfall**

Supply falls behind demand. Nothing shows on the leaf yet, but canopy chlorophyll has already started to slip, and that is what the red edge reports.

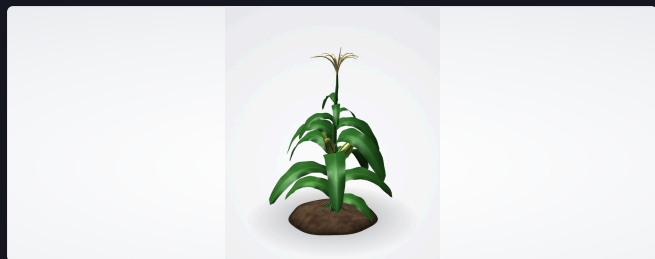


● F650 ● F715 ● F850

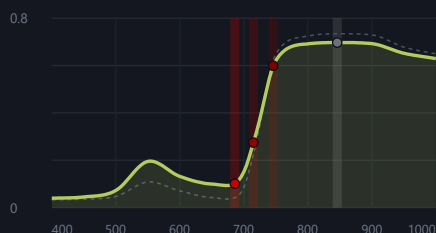
CCCI Crop nitrogen NDRE Sidedress timing

NDVI Agriculture

09 Red edge shifts



The steep rise in reflectance near 700 nm slides toward shorter wavelengths. A multispectral camera reads this days before the color changes.

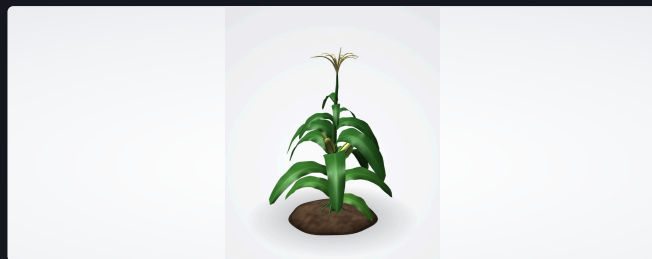


● F685 ● F715 ● F750 ● F850

MTCI Chlorophyll REP Red edge position

NDRE Crop nitrogen

10 Lower leaves fire



The plant pulls nitrogen out of its oldest leaves to feed the ear. Yellowing runs back from the tip along the midrib in a V.



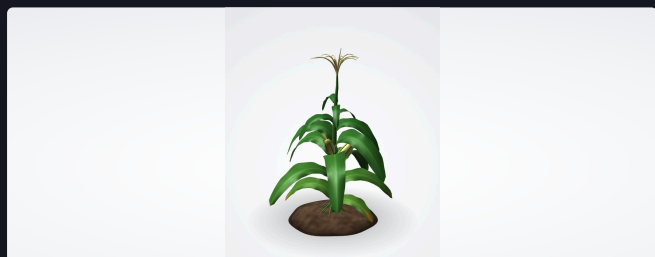
● ● ● RGN

GNDVI Chlorophyll

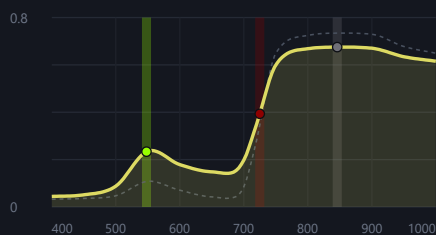
Clgreen Nitrogen status

NDVI Agriculture

11 Firing climbs



The V-shaped yellowing works its way up the plant, one leaf at a time. Canopy chlorophyll is falling faster than canopy cover.

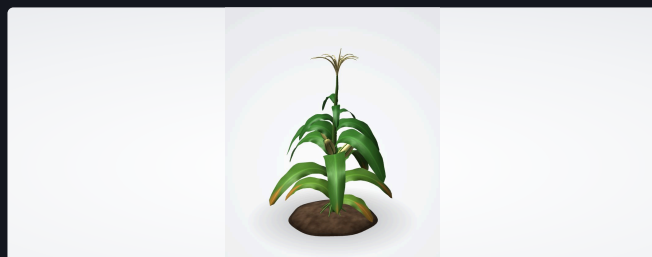


● F550 ● F725 ● F850

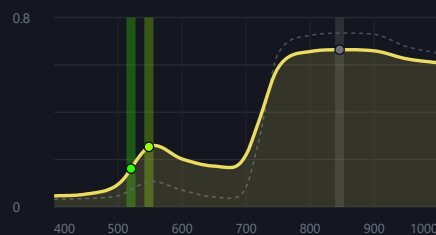
NDRE Crop nitrogen Clrededge Canopy chlorophyll

GNDVI Chlorophyll

12 Common rust



Puccinia sorghi. Small cinnamon-brown pustules break through both leaf surfaces, each ringed by a pale chlorotic halo.

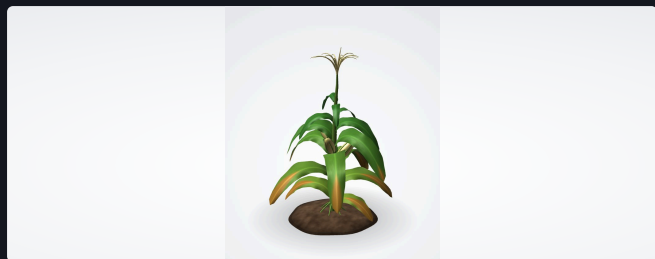


● F520 ● F550 ● F850

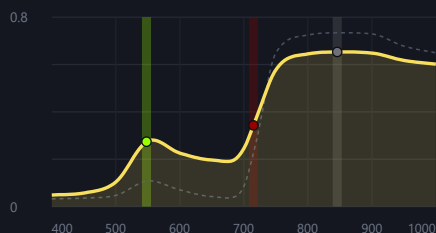
CRI Carotenoids

Clgreen Chlorophyll

GRVI Canopy vigour

13 **Rust spreads**

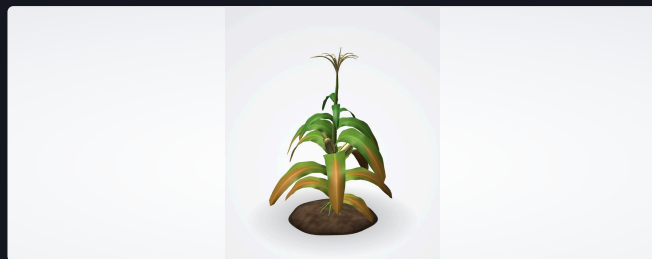
Pustules multiply and the tissue around them yellows. Pigment ratios move before whole-canopy greenness does.



● F550 ● F715 ● F850

ARI Anthocyanins NDRE Disease scouting

GNDVI Chlorophyll

14 **Southern rust**

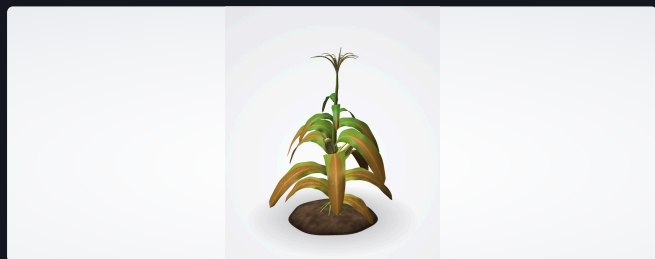
Puccinia polysora, the more aggressive one. Pustules crowd the upper surface and photosynthetic efficiency drops with them.



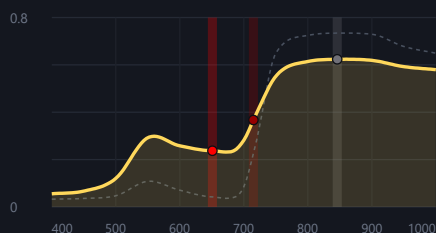
● F520 ● F590 ● F850

PRI Photosynthesis GNDVI Chlorophyll

GSAVI Sparse canopy

15 **Gray leaf spot**

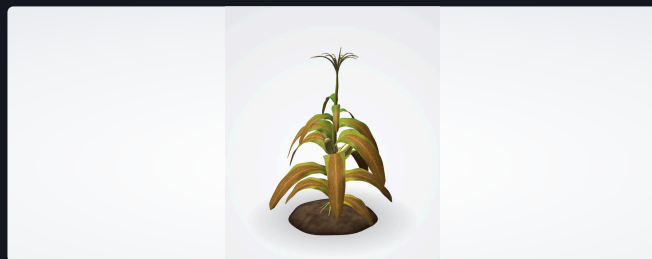
Cercospora zeae-maydis. Lesions run long and rectangular because the parallel veins box them in.



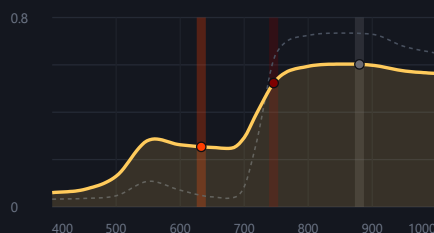
● F650 ● F715 ● F850

NDRE Disease scouting NDVI Disease scouting

Clrededge Canopy chlorophyll

16 **Lesions coalesce**

Individual lesions merge into grey-brown bands. Leaf spot severity tracks the red-edge and near-infrared bands most closely.

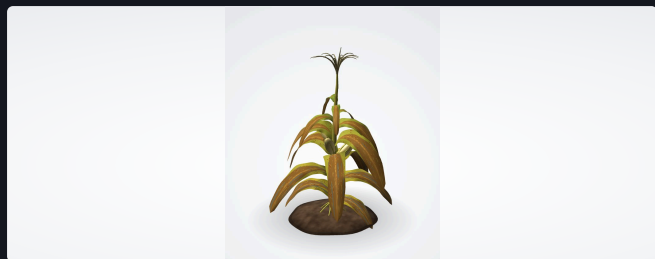


● F632 ● F750 ● F880

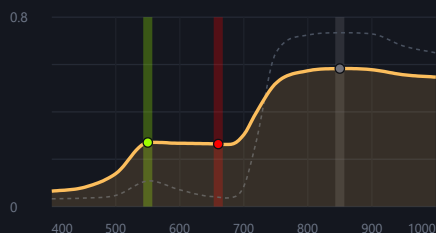
NDRE Disease scouting PSSRb Chlorophyll b

NDVI Disease scouting

17 Northern leaf blight



Exserohilum turcicum. Long cigar-shaped grey-green lesions, big enough to take out whole sections of a blade.



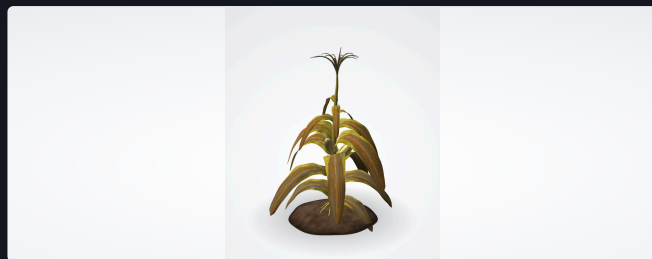
● ● ● RGN

NDVI Disease scouting

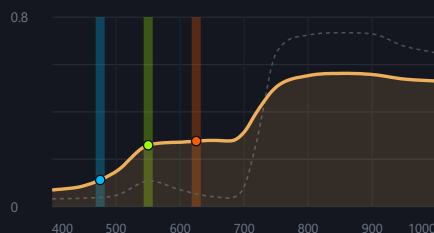
GNDVI Chlorophyll

MSR Canopy density

18 Tar spot



Phyllachora maydis. Raised black stromata speckle the blade and do not rub off. They are dark enough to read in plain visible bands.



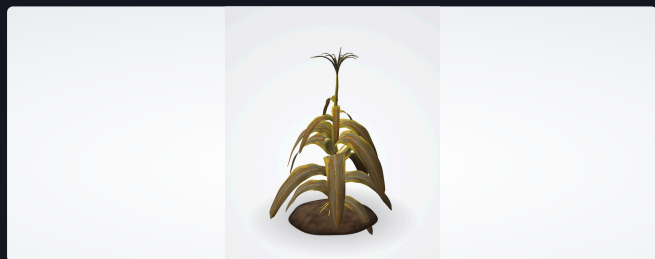
● ● ● RGB

VARI Disease scouting

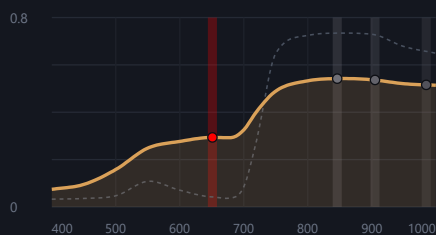
GLI Disease scouting

NGRDI Canopy cover

19 Blades roll



Water runs short and the leaves roll inward along the midrib to cut the surface facing the sun. Water absorption near 950 nm shallows as the tissue dries.



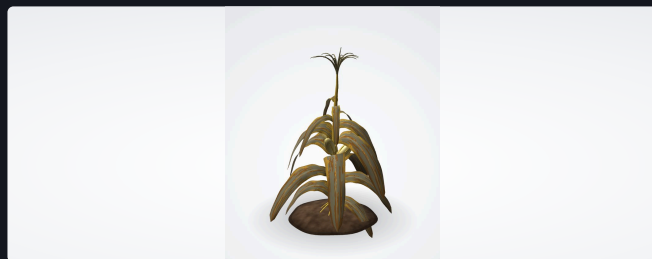
● F650 ● F850 ● F905 ● F988

WBI Leaf water

NDVI Agriculture

MSR Canopy density

20 Water stress deepens



Rolling holds through the morning instead of relaxing overnight. Near-infrared scattering falls with the cell structure behind it.



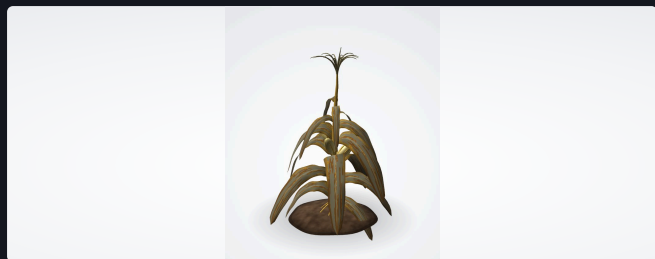
● F650 ● F850 ● F940 ● F988

WBI Irrigation

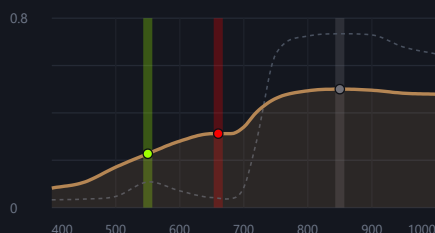
NDVI Agriculture

TDVI Canopy density

21 Leaf area lost



Dead tissue is no longer photosynthesising. Enough soil shows through the canopy that soil-adjusted indices start to matter again.



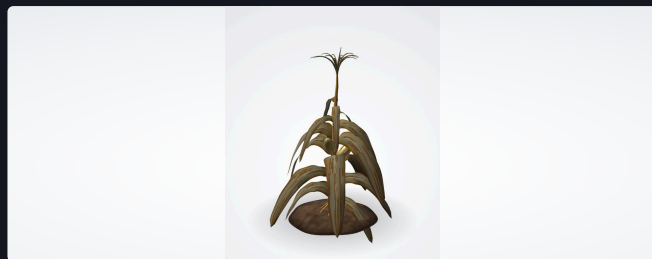
● ● ● RGN

NDVI Canopy cover

SAVI Sparse canopy

MSAVI2 Soil showing

22 Senescence



The natural end of the season arrives on top of everything else. Pigments break down in order, chlorophyll first, carotenoids after.



● F485

● F685

● F750

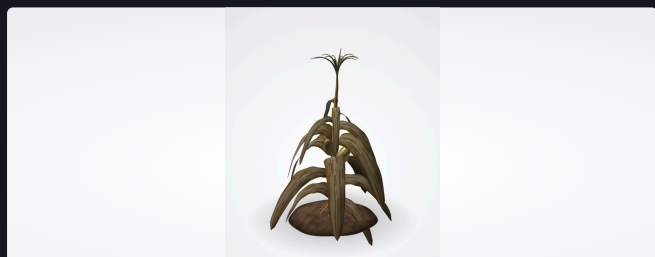
● F850

PSRI Senescence

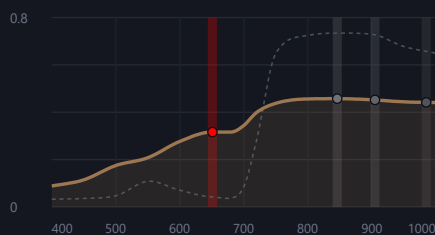
NPCI Senescence

NDRE Crop nitrogen

23 Dry-down



Grain moisture falls. The water absorption features flatten out, which is the signal that says the crop is drying rather than dying.



● F650

● F850

● F905

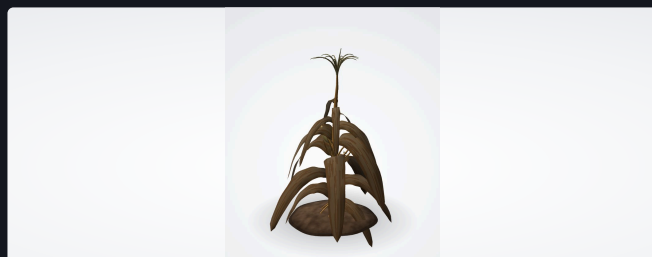
● F988

WBI Grain moisture

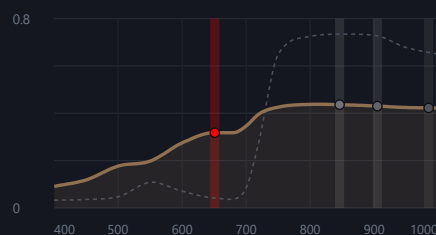
NDVI Agriculture

MSR Canopy density

24 Harvest



Grain corn is the one crop meant to come off dry, and the map that says which corner of the field is ready first is a moisture map, not a green one.



● F650

● F850

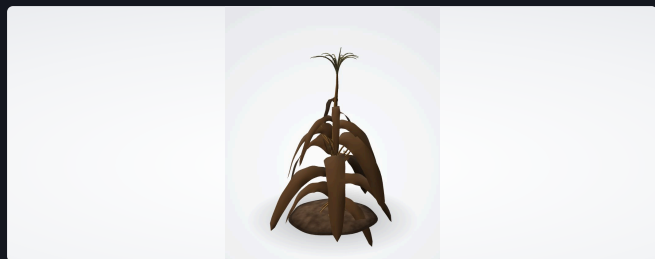
● F905

● F988

WBI Grain moisture

NDVI Harvest timing

MSR Canopy density

25 **Change detected**

Every stage since the seventh changed how this canopy reflects light. That is what our cameras measure, starting at the stage you could not see.



☒ F550 ☐ F685 ☐ F850

☒ NDVI ☐ Harvest timing

☐ GNDVI ☐ Chlorophyll

☐ PSSRa ☐ Chlorophyll a

44 indices from one filter catalog

The last column is one way to fly each index: a color model where one fits, and the mono filters.

Canopy and biomass

NDVI	Agriculture	$(\text{NIR} - \text{red}) / (\text{NIR} + \text{red})$	RGN · F650 F850
EVI2	Agriculture	$2.5 (\text{NIR} - \text{red}) / (\text{NIR} + 2.4 \text{ red} + 1)$	RGN · F650 F850
EVI	Canopy structure	$2.5 (\text{NIR} - \text{red}) / (\text{NIR} + 6 \text{ red} - 7.5 \text{ blue} + 1)$	F450 F650 F850
DVI	Biomass	$\text{NIR} - \text{red}$	RGN · F650 F850
SR	Biomass	NIR / red	RGN · F650 F850
RDVI	Canopy density	$(\text{NIR} - \text{red}) / \sqrt{\text{NIR} + \text{red}}$	RGN · F650 F850
MSR	Canopy density	$(\text{NIR}/\text{red} - 1) / (\sqrt{\text{NIR}/\text{red}} + 1)$	RGN · F650 F850
TDVI	Canopy density	$1.5 (\text{NIR} - \text{red}) / \sqrt{\text{NIR}^2 + \text{red} + 0.5}$	RGN · F650 F850
GEMI	Canopy density	$\text{eta} (1 - 0.25 \text{ eta}) - (\text{red} - 0.125)/(1 - \text{red})$	RGN · F650 F850
WDRVI	Dense canopy	$(0.2 \text{ NIR} - \text{red}) / (0.2 \text{ NIR} + \text{red})$	RGN · F650 F850
LAI	Leaf area	$3.618 \text{ EVI} - 0.118$	F450 F650 F850
ENDVI	Scouting	$(\text{NIR} + \text{green} - 2 \text{ blue}) / (\text{NIR} + \text{green} + 2 \text{ blue})$	NGB · F450 F550 F850

Soil adjusted

SAVI	Rangeland	$1.5 (\text{NIR} - \text{red}) / (\text{NIR} + \text{red} + 0.5)$	RGN · F650 F850
OSAVI	Sparse canopy	$(\text{NIR} - \text{red}) / (\text{NIR} + \text{red} + 0.16)$	RGN · F650 F850
MSAVI2	Bare soil	$(2 \text{ NIR} + 1 - \sqrt{(2 \text{ NIR} + 1)^2 - 8 (\text{NIR} - \text{red})}) / 2$	RGN · F650 F850
GSAVI	Sparse canopy	$1.5 (\text{NIR} - \text{green}) / (\text{NIR} + \text{green} + 0.5)$	RGN · F550 F850
GOSAVI	Sparse canopy	$(\text{NIR} - \text{green}) / (\text{NIR} + \text{green} + 0.16)$	RGN · F550 F850

Chlorophyll and nitrogen

GNDVI	Chlorophyll	$(\text{NIR} - \text{green}) / (\text{NIR} + \text{green})$	RGN · F550 F850
Clgreen	Chlorophyll	$\text{NIR} / \text{green} - 1$	RGN · F550 F850
GRVI	Canopy vigour	$\text{NIR} / \text{green}$	RGN · F550 F850
NDRE	Crop nitrogen	$(\text{NIR} - \text{red edge}) / (\text{NIR} + \text{red edge})$	F715 F850
Clrededge	Canopy chlorophyll	$\text{NIR} / \text{red edge} - 1$	F715 F850
CCCI	Crop nitrogen	$\text{NDRE} / \text{NDVI}$	F650 F715 F850
MTCI	Chlorophyll	$(\text{RE2} - \text{RE1}) / (\text{RE1} - \text{red})$	F685 F715 F750
REP	Red edge position	linear interpolation of the red edge	F685 F715 F750
PSSRa	Chlorophyll a	NIR / red	RGN · F685 F850
PSSRb	Chlorophyll b	NIR / red	RGN · F632 F850

Pigments and senescence

PRI	Photosynthesis	$(\text{green} - \text{yellow}) / (\text{green} + \text{yellow})$	F520 F590
CRI	Carotenoids	$1/\text{green}1 - 1/\text{green}2$	F520 F550
ARI	Anthocyanins	$1/\text{green} - 1/\text{red edge}$	F550 F715
SIPI	Pigment ratio	$(\text{NIR} - \text{blue}) / (\text{NIR} - \text{red})$	F450 F685 F850
NPCI	Senescence	$(\text{red} - \text{blue}) / (\text{red} + \text{blue})$	RGB · F450 F685
PSRI	Senescence	$(\text{red} - \text{blue}) / \text{red edge}$	F485 F685 F750
BGI	Pigment stress	$\text{blue} / \text{green}$	RGB · F450 F550

Water

WBI	Leaf water	$\text{NIR}1 / \text{NIR}2$	F905 F988
NDWI	Water bodies	$(\text{green} - \text{NIR}) / (\text{green} + \text{NIR})$	RGB · F550 F850
NDCI	Water quality	$(\text{red edge} - \text{red}) / (\text{red edge} + \text{red})$	F650 F715

Visible only

VARI	Disease scouting	$(\text{green} - \text{red}) / (\text{green} + \text{red} - \text{blue})$	RGB · F450 F550 F650
GLI	Turf	$(2 \text{ green} - \text{red} - \text{blue}) / (2 \text{ green} + \text{red} + \text{blue})$	RGB · F450 F550 F650
TGI	Chlorophyll	$-0.5 (190 (\text{red} - \text{green}) - 120 (\text{red} - \text{blue}))$	RGB · F450 F550 F650
ExG	Weed detection	$2 \text{ green} - \text{red} - \text{blue}$	RGB · F450 F550 F650
NGRDI	Turf	$(\text{green} - \text{red}) / (\text{green} + \text{red})$	RGB · F550 F650
BI	Bare soil	$\sqrt{(\text{red}^2 + \text{green}^2 + \text{blue}^2) / 3}$	RGB · F450 F550 F650
IOR	Soil mineralogy	red / blue	RGB · F450 F650

27 filters, one camera

Every index in this guide is built from these: one mono filter per camera on the M3M, one color filter on the M3C.

M3C color, 4 models

RGB

red	625 nm
green	550 nm
blue	475 nm

RGN

red	660 nm
green	550 nm
NIR	850 nm

OCN

red	615 nm
green	490 nm
NIR	808 nm

NGB

NIR	850 nm
green	550 nm
blue	475 nm

M3M mono, 23 filters

F385	379 nm	UV
F405	404 nm	blue
F450	455 nm	blue
F485	490 nm	blue
F520	520 nm	green
F550	548 nm	green
F590	589 nm	yellow
F615	624 nm	red
F632	633 nm	red
F650	651 nm	red
F685	686 nm	red
F715	715 nm	red edge
F725	725 nm	red edge
F750	746 nm	red edge
F780	775 nm	red edge
F808	810 nm	NIR
F832	826 nm	NIR
F850	846 nm	NIR
F880	880 nm	NIR
F905	905 nm	NIR
F940	941 nm	NIR
F950	945 nm	NIR
F988	985 nm	NIR