

Table S1. Selected vegetation indices for RGB and IR cameras

Vegetation indices	Formula ^[a]	Equation	Reference	Definition
BMG	B-G	(1)	(Putra & Soni, 2017)	Blue minus green
BMR	B-R	(2)	(Putra & Soni, 2017)	Blue minus red
CB	-0.148R-0.291G+0.439B+128	(3)	(Vesali <i>et al.</i> , 2015)	Difference between the blue component and a reference value
CI_G	NIR/G-1	(4)	(Gitelson <i>et al.</i> , 2005)	Green chlorophyll index
CR	0.439R-0.368G-0.071B+128	(5)	(Vesali <i>et al.</i> , 2015)	Difference between the blue component and a reference value
CTVI	$NDVI+0.5/\sqrt{NDVI+0.5}$	(6)	(Perry Jr & Lautenschlager, 1984)	Corrected transformed vegetation index
CVI	$(NIR \times R)/G^2$	(7)	(Geelen <i>et al.</i> , 2017)	Chlorophyll vegetation index
DGCI	$[(Hue/60-1) + (1- Saturation) + (1- Brightness)]/3$	(8)	(Vesali <i>et al.</i> , 2015)	dark green colour index
DVI	NIR-R	(9)	(Tucker, 1979)	Difference vegetation index
EVI	$2.5((NIR-R)/(NIR+6R-7.5B+1))$	(10)	(Huete <i>et al.</i> , 2002)	Enhanced vegetation index
EXCESS-NIRB	2B-G-R	(11)	(Putra & Soni, 2017)	
EXG	$(2G-(R+B))/(R+G+B)$	(12)	(Louhaichi <i>et al.</i> , 2001)	Green excess index
GDR	G/R	(13)	(Vesali <i>et al.</i> , 2015)	Green divided by red
GDVI	NIR-G	(14)	(Tucker, 1979)	Green difference vegetation index
GMR	G-R	(15)	(Vesali <i>et al.</i> , 2015)	Difference between green component and red component
GNDVI	$(NIR-G)/(NIR+G)$	(16)	(Gitelson <i>et al.</i> , 1996)	Green normalized difference vegetation index
GNDVI-NDVI	GNDVI-NDVI	(17)	(Onoyama <i>et al.</i> , 2015)	
GOSAVI	$(1 + 0.16)(NIR - G)/(NIR + G + 0.16)$	(18)	(Cao <i>et al.</i> , 2015)	Green optimal soil adjusted vegetation index
GRDVI	$(NIR - G)/\sqrt{NIR + G}$	(19)	(Cao <i>et al.</i> , 2015)	Green re-normalized different vegetation index
GRVI	NIR/G	(20)	(Yang <i>et al.</i> , 2008)	Green ratio vegetation index
GSAVI	$1.5[(NIR - G)/(NIR + G + 0.5)]$	(21)	(Sripada <i>et al.</i> , 2006)	Green soil adjusted vegetation index
HUE	$\begin{cases} 60 \times \frac{G-B}{C} & \max(R, G, B) = R \\ 60 \times \left(2 + \frac{B-R}{C}\right) & \max(R, G, B) = G \\ 60 \times \left(4 + \frac{G-B}{C}\right) & \max(R, G, B) = B \end{cases}$	(22)	(Vesali <i>et al.</i> , 2015)	HUE
LIT	$(C_{max} + C_{min})/2$	(23)	(Vesali <i>et al.</i> , 2015)	Lightness
MCARI	$[(NIR-R) - (0.2(NIR-G))]/(NIR/R)$	(24)	(Sripada <i>et al.</i> , 2006)	Modified chlorophyll absorption and reflectance index

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Table S1. Continued

Vegetation indices	Formula ^[a]	Equation	Reference	Definition
MGSAVI	$0.5 [2\text{NIR}+1-\sqrt{(2\text{NIR}+1)^2-8(\text{NIR}-\text{G})}]$	(25)	(Cao <i>et al.</i> , 2015)	Modified GSAVI
MSAVI	$0.5(2\text{NIR}+1-\sqrt{(2\text{NIR}+1)^2-8(\text{NIR}-\text{R})})$	(26)	(García <i>et al.</i> , 2017)	Modified soil adjusted vegetation index
MSR-G	$(\text{NIR}/\text{G}-1)/\sqrt{\text{NIR}/\text{G}+1}$	(27)	(Cao <i>et al.</i> , 2015)	Modified green simple ratio
MTVI2	$(1.5(2.5(\text{NIR}-\text{G})-2.5(\text{R}-\text{G}))/(\sqrt{(2\text{NIR}+1)^2-6\text{NIR}-5\sqrt{\text{R}}}-0.5))$	(28)	(García <i>et al.</i> , 2017)	Second modified triangular vegetation index
NDVI	$(\text{NIR}-\text{R})/(\text{NIR}+\text{R})$	(29)	(García <i>et al.</i> , 2017)	Normalized difference vegetation index
NDVI-CAM	$(\text{B}-\text{R})/(\text{B}+\text{R})$	(30)	(Putra & Soni, 2017)	normalized difference vegetation index
NGRDI	$(\text{G}-\text{R})/(\text{G}+\text{R})$	(31)	(García <i>et al.</i> , 2017)	Normalized green red difference index
SAT	$\begin{cases} 0, & C_{\max} = 0 \\ \frac{C}{\max(\text{R}, \text{G}, \text{B})} & C_{\max} \neq 0 \end{cases}$	(32)	(Vesali <i>et al.</i> , 2015)	saturation
SAVI	$1.5(\text{NIR}-\text{R})/(\text{NIR}+\text{R}+0.5)$	(33)	(García <i>et al.</i> , 2017)	Soil adjusted vegetation index
SAVI-CAM	$1.5\text{NIR}(\text{B}-\text{R})/(\text{B}+\text{R}+0.5\text{NIR})$	(34)	(Putra & Soni, 2017)	noise adjusted vegetation index
SR	NIR/R	(35)	(Le Maire <i>et al.</i> , 2004)	Simple ratio
TGI	$\text{G}-0.39\text{R}-0.61\text{B}$	(36)	(Hunt Jr <i>et al.</i> , 2013)	Triangular Greenness Index
TRVI	$\sqrt{(\text{NIR}-\text{R})/(\text{NIR}+\text{R})}+0.5$	(37)	(Rouse <i>et al.</i> , 1975)	Transformed vegetation index
TVI	$0.5(120(\text{NIR}-\text{G})-200(\text{R}-\text{G}))$	(38)	(García <i>et al.</i> , 2017)	Triangular vegetation index
VAL	$\text{C}_{\max}$	(39)	(Vesali <i>et al.</i> , 2015)	Value
YY	$0.257\text{R}+0.504\text{G}+0.098\text{B}+0.16$	(40)	(Vesali <i>et al.</i> , 2015)	relative luminance

^[a] R, G, B and NIR are mean of digital number of red, green, blue and near-infrared bands, respectively. $\text{C}=\max(\text{R}, \text{G}, \text{B})-\min(\text{R}, \text{G}, \text{B})$; $\text{R}'=\text{R}/255$; $\text{G}'=\text{G}/255$; $\text{B}'=\text{B}/255$; $\text{C}_{\max}=\max(\text{R}', \text{G}', \text{B}')$; Brightness = $\text{C}/255$.

Table S2. Performance results of the regression equations between field measured data (leaf N concentrations, SPAD value and RWC), and vegetation indices.

Index	SPAD				N				RWC			
	Ran scor	R ²	RMSE	MBE	Rank score	R ²	RMSE	MBE	Rank score	R ²	RMSE	MBE
BMG		0.28	0.9456	0.0004		0.19	0.8218	-0.0002		0.12	16.1863	-0.0011
BMR		0.13	1.0366	0.0002		0.08	0.88	-0.0001		0.00	17.2287	-0.0001
CB		0.34	0.9071	0.0517		0.23	0.7901	-0.0155		0.00	17.2181	-0.0314
CIG	8	0.46	0.8202	-0.0001	9	0.32	0.7271	0		0.01	17.1315	-0.0004
CR	3	0.53	0.7676	-0.0917	6	0.34	0.6976	-0.1102		0.04	16.8709	-0.0846
CTVI	2	0.56	0.7385	-0.0031	3	0.37	0.6668	-0.0087		0.01	17.1828	0.0048
CVI		0.36	0.8894	-0.0004		0.25	0.7814	-0.0005		0.09	16.3945	0.0101
DGCI		0.25	0.9626	-0.0001		0.19	0.8275	0.0001		0.00	17.2011	-0.0004
DVI		0.12	1.0424	-0.0087		0.07	0.8844	0.0093	3	0.39	13.4396	0.3526
EVI	9	0.43	0.8397	-0.0029	8	0.32	0.7363	0.0017	4	0.36	13.8213	0.0073
EXCESSNIRB		0.00	1.1117	0		0.01	0.9325	0.0001		0.00	17.2095	0.0002
EXG		0.33	0.9079	0.0002		0.25	0.7987	-0.0002		0.08	16.5436	0.0014
GDR		0.21	0.9879	0		0.18	0.842	0.0006	9	0.23	15.143	0.0028
GDVI		0.30	0.9307	-0.0001		0.23	0.7981	-0.0001	7	0.28	14.5976	0.0034
GMR	5	0.47	0.8095	0	7	0.34	0.7253	0.0001		0.01	17.129	-0.0002
GNDVI		0.42	0.8498	-0.0005	10	0.31	0.7438	0.0003	8	0.24	15.0018	-0.0009
GNDVI-NDVI		0.38	0.8737	0.0001		0.30	0.76	-0.0006		0.10	16.3477	0.0003
GOSAVI		0.27	0.9481	0.0003		0.17	0.8153	0.0002		0.00	17.2028	0.0001
GRDVI		0.37	0.8813	0.0001		0.23	0.7747	0		0.00	17.2188	0.0003
GRVI		0.38	0.8794	-0.0001		0.27	0.7729	0.0004		0.00	17.2292	-0.0001
GSAVI		0.19	1.0024	-0.0007		0.16	0.8548	-0.0007		0.14	15.9635	0.0022
HUE	4	0.48	0.8003	-0.0013	2	0.38	0.7028	-0.004		0.04	16.8747	-0.0019
LIT		0.05	1.082	0.0001		0.04	0.914	-0.0001		0.04	16.8966	0.0003
MCARI	1	0.59	0.7136	-0.0043	1	0.43	0.653	-0.0041	6	0.31	14.3349	-0.0182
MGSAVI		0.25	0.9635	-0.0004		0.19	0.8452	-0.0004		0.14	16.0175	-0.0003
MSAVI		0.13	1.0384	0		0.10	0.871	-0.0003		0.00	17.2074	-0.0011
MSRG		0.32	0.9139	0		0.21	0.7867	0		0.08	16.5621	-0.002
MTVI2		0.12	1.0407	-0.0001		0.08	0.8914	0		0.00	17.2116	0.0027
NDVI	7	0.47	0.8117	-0.0005	5	0.35	0.713	0.0004	2	0.42	13.068	0.0035
NDVI-CAM		0.28	0.9432	0		0.20	0.8156	0		0.01	17.111	0.0003
NGRDI		0.39	0.8699	-0.0001		0.31	0.7567	0.0001		0.00	17.2114	-0.0001
SAT		0.03	1.0939	-0.0002		0.02	0.9163	-0.0001		0.01	17.1859	0.0001
SAVI		0.21	0.9863	-0.0001		0.18	0.8438	-0.0003	10	0.15	15.8624	0.0013
SAVI-CAM		0.24	0.9694	0.0004		0.15	0.8366	0.0007		0.00	17.2201	-0.0048
SR		0.41	0.8538	0.0007		0.31	0.7461	0.0001	5	0.34	13.9463	0.004
TGI		0.39	0.8699	0		0.31	0.7567	0		0.00	17.2114	-0.0001
TRVI	6	0.47	0.8111	-0.0008	4	0.35	0.7133	0.0041	1	0.45	12.7501	0.0069
TVI	10	0.43	0.8408	0.0005		0.29	0.7426	-0.0002		0.00	17.2268	-0.0005
VAL		0.37	0.8797	-0.0003		0.24	0.7757	-0.0002		0.00	17.2254	-0.0025
YY		0.33	0.9088	-0.0065		0.18	0.7916	0.0181		0.01	17.1854	0.0352

Table S3. Length of growth stages (days) of maize in 2017 and 2018.

Growth stage	Planting	V3	V5	V8	V10	V14	R1	Harvesting
		Thirth leaf	Fifth leaf	Eighth leaf	Tenth leaf	Fourteenth leaf	Silking	
2017 (days)	0	17	26	35	40	55	65	96
2018 (days)	0	15	22	32	35	45	62	81