

Table S1. Mean and standard error of two treatments (grafted, non-grafted) of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health) combination of the values of the four crops (melon, tomato, eggplant, pepper) n=152 for 5 years (2016-2020).

	Parameters	Mean grafted	Mean non- grafted
Leaf level pigments (SPAD, Dualex)	SPAD	45.77±0.87	43.82±0.86
	Chl	26.03±0.50	27.07±0.53
	Flav	0.91±0.04	1.00±0.02
	Anth	0.06±0.01	0.07±0.02
	NBI	33.66±0.64	32.02±0.61
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.46±0.03	0.46±0.02
	GA	0.39±0.02	0.38±0.03
	GGA	0.29±0.03	0.34±0.02
	NGRDI	0.06±0.26	0.33±0.27
	TGI	4145.16±444.77	3516.36±449.86
	CSI	34.15±1.92	25.07±1.90
Water stress and root health	Porometer	114.24±5.35	111.57±5.34
	Temperature	25.62±0.20	25.24±0.22
	δ ¹³ C	-26.26±0.85	-25.99±0.82
	Percent C	30.35±1.01	30.89±0.98
	δ ¹⁵ N	5.61±0.23	5.30±0.22
	Percent N	2.36±0.10	2.33±0.09

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S2. ANOVA of melon crops of two years combined (2016, 2017) n=20+16, including value of separate years of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	P Value Treatments Combined	P Value Treatments 2016	P Value Treatments 2017
Leaf level pigments (SPAD, Duallex)	SPAD	0.999	0.190	0.022
	Chl	0.096	0.736	0.060
	Flav	0.153	0.240	0.020
	Anth	0.153	0.266	0.380
	NBI	0.186	0.869	0.131
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.484	0.158	0.983
	GA	0.689	0.265	0.777
	GGA	0.575	0.392	0.965
	NGRDI	0.512	0.187	0.522
	TGI	0.325	0.000	0.001
	CSI	0.279	0.010	0.523
Water stress and root health	Porometer	0.471	0.325	0.721
	Temperature	0.513	0.123	0.888
	$\delta^{13}\text{C}$	0.848	0.305	0.297
	Percent C	0.665	0.985	0.508
	$\delta^{15}\text{N}$	0.827	0.990	0.402
	Percent N	0.292	0.186	0.857

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), $\delta^{13}\text{C}$ (isotopic composition of carbon 13), percent C (percentage of carbon), $\delta^{15}\text{N}$ (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S3. Mean and standard error of two treatments (grafted, non-grafted) of combined two years (2016, 2017) n=20+16 of melon crops grown in a greenhouse in soil infected by root knot nematode of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	Mean grafted	Mean non-grafted
Leaf level pigments (SPAD, Dualex)	SPAD	39.42±1.56	39.42±1.54
	Chl	31.24±1.62	35.15±1.64
	Flav	0.17±0.03	0.18±0.01
	Anth	0.17±0.01	0.18±0.02
	NBI	19.65±0.94	17.93±0.90
Canopy vigor, biomass (GA and GGA from RGB)	NDVI	0.43±0.03	0.39±0.05
	GA	0.44±0.03	0.42±0.04
	GGA	0.21±0.03	0.23±0.04
	NGRDI	-0.86±0.57	-0.33±0.58
	TGI	7106.46±1140.63	5494.99±1140.60
	CSI	54.75±5.98	45.43±5.97
Water stress and root health	Porometer	108.15±10.76	97.05±10.77
	Temperature	25.48±0.63	24.88±0.64
	δ ¹³ C	-14.08±3.35	-13.71±3.25
	Percent C	20.43±2.26	21.80±2.19
	δ ¹⁵ N	4.13±0.67	3.92±0.66
	Percent N	1.06±0.15	1.27±0.14

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S4. Mean and standard error of two treatments (grafted, non-grafted) of separate years (2016, 2017) n=20+16 of melon crops grown in a greenhouse in soil infected by root knot nematode of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	Mean grafted 2016	Mean non- grafted 2016	Mean grafted 2017	Mean non- grafted 2017
Leaf level pigments (SPAD, Dualox)	SPAD	40.33±2.02	44.18±2.00	38.28±1.34	33.48±1.32
	Chl	35.14±1.53	35.87±1.52	26.37±2.72	34.25±2.74
	Flav	1.91±0.04	1.97±0.03	1.37±0.16	1.98±0.18
	Anth	0.16±0.03	0.18±0.01	0.17±0.01	0.19±0.01
	NBI	18.56±1.05	18.31±1.03	21.02±1.59	17.46±1.57
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.52±0.03	0.46±0.05	0.31±0.23	0.31±0.22
	GA	0.46±0.04	0.40±0.32	0.41±0.08	0.44±0.07
	GGA	0.28±0.06	0.32±0.04	0.12±0.03	0.12±0.03
	NGRDI	-0.02±0.01	0.00±0.03	-1.92±1.29	-0.73±1.28
	TGI	2728.13±181.57	1575.86±181.55	12579.40±345.26	10393.90±345.25
	CSI	40.45±4.54	21.68±4.57	72.61±2.73	75.13±2.71
Water stress and root health	Porometer	119.89±17.25	95.24±17.23	93.49±11.36	99.33±11.34
	Temperature	23.68±0.44	22.69±0.43	27.73±0.58	27.61±0.59
	δ ¹³ C	-1.75±0.15	-1.97±0.14	-29.08±0.46	-28.38±0.45
	Percent C	23.81±3.25	23.72±3.08	16.62±2.88	19.40±2.89
	δ ¹⁵ N	5.00±1.08	5.01±1.09	3.04±0.41	2.55±0.40
	Percent N	1.12±0.22	1.55±0.22	0.97±0.14	0.93±0.15

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S5. ANOVA of tomato crop of two years combined (2017, 2020) n=16+20, and melon separate years of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	P Value Treatments combined	P Value Treatments 2017	P Value Treatments 2020
Leaf level pigments (SPAD, Dualex)	SPAD	0.120	0.053	0.092
	Chl	0.046	0.242	0.086
	Flav	0.976	0.813	0.868
	Anth	0.717	0.467	0.660
	NBI	0.218	0.512	0.215
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.057	0.580	0.001
	GA	0.333	0.077	0.001
	GGA	0.753	0.564	0.882
	NGRDI	0.469	0.203	0.006
	TGI	0.768	0.648	0.017
	CSI	0.014	0.081	0.029
Water stress and root health	Porometer	0.426	0.055	0.321
	Temperature	0.635	0.249	0.247
	$\delta^{13}\text{C}$	0.960	0.537	0.222
	Percent C	0.932	0.980	0.215
	$\delta^{15}\text{N}$	0.016	0.326	0.000
	Percent N	0.675	0.763	0.153

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), $\delta^{13}\text{C}$ (isotopic composition of carbon 13), percent C (percentage of carbon), $\delta^{15}\text{N}$ (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S6. Mean and standard error of two treatments (grafted, non-grafted) of separate years (2017, 2020) n=17+20 of tomato crop grown in a greenhouse in soil infected by root knot nematode of three classes of parameters (leaf level pigments, canopy vigor and biomass, after stress and root health).

	Parameters	Mean grafted 2017	Mean non-grafted 2017	Mean, grafted 2020	Mean non-grafted 2020
Leaf level pigments (SPAD move to Duallex)	SPAD	59.31±2.74	51.13±2.73	41.19±0.71	39.47±0.72
	Chl	21.61±18.62	24.01±1.39	24.12±0.52	25.39±0.51
	Flav	0.75±0.04	0.76±0.03	0.67±0.01	0.66±0.01
	Anth	0.15±0.02	0.13±0.01	0.02±0.01	0.01±0.02
	NBI	30.67±2.07	32.64±2.09	37.18±1.10	39.16±1.12
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.64±0.03	0.61±0.04	0.36±0.03	0.24±0.02
	GA	0.59±0.04	0.69±0.03	0.32±0.03	0.21±0.02
	GGA	0.46±0.04	0.49±0.05	0.49±0.06	0.50±0.05
	NGRDI	4.10±1.10	6.18±1.10	0.00±0.01	-0.04±0.01
	TGI	11405.90±329. 14	11189.10±329.1 2	2017.40±113. 93	1615.59±113. 90
	CSI	21.19±2.82	28.64±2.80	11.65±1.77	17.28±1.75
Water stress and root health	Porometer	91.58±11.94	126.83±11.92	131.83±4.27	125.79±4.25
	Temperature	25.38±0.28	24.91±0.27	23.85±0.23	24.23±0.24
	δ ¹³ C	-30.23±0.46	-29.83±0.45	-30.71±0.12	-30.88±0.10
	Percent C	21.37±2.18	21.45±2.19	43.16±0.21	42.79±0.20
	δ ¹⁵ N	6.28±0.50	5.56±0.52	4.55±0.15	3.67±0.15
	Percent N	1.74±0.19	1.66±0.18	4.02±0.08	3.88±0.07

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S7. Mean and standard error of two treatments (grafted, non-grafted) of combined two years (2017 and 2020), with n=16+40 of tomato crop grown in a greenhouse in soil infected by root knot nematode of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	Mean grafted	Mean non-grafted
Leaf level pigments (SPAD, Dualex)	SPAD	46.37 ±1.60	42.80±1.62
	Chl	23.40±0.56	25.00±0.55
	Flav	0.69±0.01	0.69±0.01
	Anth	0.05±0.01	0.05±0.02
	NBI	35.32±1.14	37.29±1.12
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.44±0.03	0.35±0.05
	GA	0.40±0.05	0.34±0.04
	GGA	0.49±0.04	0.50±0.03
	NGRDI	1.17±0.56	1.74±0.55
	TGI	4699.83±833.09	4350.86±833.08
	CSI	14.37±1.72	20.52±1.72
Water stress and root health	Porometer	120.33±5.08	126.08±5.07
	Temperature	24.29±0.23	24.43±0.21
	δ ¹³ C	-30.57±0.16	-30.58±0.17
	Percent C	36.93±1.97	36.69±1.98
	δ ¹⁵ N	5.04±0.24	4.21±0.23
	Percent N	3.37±0.21	3.25±0.20

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S8. ANOVA of eggplant crop of 2018 with n=20 of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	P Value Treatments
Leaf level pigments (SPAD, Dualex)	SPAD	0.127
	Chl	0.398
	Flav	0.040
	Anth	0.251
	NBI	0.041
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.572
	GA	0.973
	GGA	0.369
	NGRDI	0.914
	TGI	0.279
	CSI	0.017
Water stress and root health	Temperature	0.337
	$\delta^{13}\text{C}$	0.175
	Percent C	0.672
	$\delta^{15}\text{N}$	0.223
	Percent N	0.022

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), $\delta^{13}\text{C}$ (isotopic composition of carbon 13), percent C (percentage of carbon), $\delta^{15}\text{N}$ (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S9. Mean and standard error of two treatments (grafted, non-grafted) of 2018 with n=20 of eggplant crop grown in a greenhouse in soil infected by root knot nematode.

	Parameters	Mean grafted	Mean non- grafted
Leaf level pigments (SPAD, Dualex)	SPAD	42.39±1.99	37.92±1.98
	Chl	24.42±0.64	23.66±0.62
	Flav	0.62±0.01	0.67±0.02
	Anth	0.01±0.01	0.02±0.03
	NBI	40.10±1.28	36.07±1.29
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.63±0.06	0.66±0.04
	GA	0.68±0.05	0.68±0.06
	GGA	0.44±0.06	0.53±0.07
	NGRDI	0.04±0.02	0.05±0.03
	TGI	3833.18±293.60	3369.63±293.63
	CSI	40.10±4.56	23.15±4.55
Water stress and root health	Temperature	25.87±0.47	25.19±0.49
	δ ¹³ C	-30.41±0.23	-29.97±0.21
	Percent C	38.20±0.88	37.68±0.84
	δ ¹⁵ N	6.55±0.58	5.54±0.55
	Percent N	3.21±0.15	2.70±0.14

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S10. ANOVA of Pepper crop of 2019 with n=40 of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	P value Treatments
Leaf level pigments (SPAD, Dualex)	SPAD	0.881
	Chl	0.437
	Flav	0.017
	Anth	0.468
	NBI	0.076
Canopy vigor. biomass (GA and GGA and on from RGB)	NDVI	0.000
	GA	0.001
	GGA	0.000
	NGRDI	0.000
	TGI	0.204
	CSI	0.000
Water stress and root health	Temperature	0.110
	$\delta^{13}\text{C}$	0.106
	Percent C	0.051
	$\delta^{15}\text{N}$	0.024
	Percent N	0.004

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), $\delta^{13}\text{C}$ (isotopic composition of carbon 13), percent C (percentage of carbon), $\delta^{15}\text{N}$ (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).

Table S11. Mean and standard error of two treatments (grafted, non-grafted) of 2019 with n=40 of pepper crop grown in a greenhouse in soil infected by root knot nematode of three classes of parameters (leaf level pigments, canopy vigor and biomass, water stress and root health).

	Parameters	Mean grafted	Mean non- grafted
Leaf level pigments (SPAD, Dualex)	SPAD	54.91±1.15	55.15±1.14
	Chl	25.05±0.53	24.47±0.54
	Flav	0.64±0.03	0.68±0.01
	Anth	0.02±0.02	0.01±0.01
	NBI	39.56±1.07	36.78±1.08
Canopy vigor, biomass (GA and GGA up to RGB)	NDVI	0.33±0.04	0.46±0.02
	GA	0.05±0.02	0.09±0.01
	GGA	0.04±0.02	0.08±0.01
	NGRDI	-0.12±0.01	-0.15±0.03
	TGI	941.18±48.55	849.98±51.17
	CSI	27.39±2.44	11.18±2.41
Water stress and root health	Temperature	26.86±0.18	26.48±0.17
	δ ¹³ C	-29.45±0.11	-29.70±0.13
	Percent C	25.86±0.56	27.41±0.54
	δ ¹⁵ N	6.70±0.26	7.53±0.25
	Percent N	1.82±0.06	2.10±0.07

SPAD (Soil Plant Analysis Development), Chl (chlorophyll), Flav (flavonoid), Anth (anthocyanin), NBI (Nitrogen Balance Index), GA (Green area), GGA (Greener Green Area), TGI (Triangular Greenness Index), NGRDI (Normalized Green Red Difference Index), CSI (Crop Senescence Index), δ¹³C (isotopic composition of carbon 13), percent C (percentage of carbon), δ¹⁵N (isotopic composition of nitrogen 15), percent N (percentage of nitrogen).