

**Table S1. Mean performance of the 28 F<sub>1</sub> crosses and the check hybrid SC128 for all the studied traits under the three plant densities across the two locations.**

Cross	DTS			ASI			PLHT			EHT			LANG			CHLC		
	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3
L <sub>1</sub> ×L <sub>2</sub>	57.17	60.27	64.10	2.80	3.29	4.63	240.50	244.50	264.87	143.00	147.00	155.00	33.50	32.60	30.55	50.18	48.27	45.50
L <sub>1</sub> ×L <sub>3</sub>	56.17	58.95	62.85	3.27	4.22	5.13	231.75	238.00	247.35	132.09	140.50	144.76	40.25	38.23	36.05	49.50	48.00	46.00
L <sub>1</sub> ×L <sub>4</sub>	56.50	59.00	62.52	3.28	3.65	4.60	210.50	225.90	252.60	136.23	138.13	144.16	26.55	24.80	22.00	48.50	44.00	40.20
L <sub>1</sub> ×L <sub>5</sub>	58.85	61.20	64.60	2.73	3.07	4.00	238.00	241.00	276.20	133.38	136.20	138.39	28.25	26.00	22.25	52.00	49.00	48.80
L <sub>1</sub> ×L <sub>6</sub>	57.50	60.80	63.58	3.55	3.83	4.77	230.50	237.50	256.80	125.39	131.35	135.45	29.25	27.00	26.25	50.30	48.60	46.50
L <sub>1</sub> ×L <sub>7</sub>	57.90	62.00	65.10	2.47	2.75	3.64	266.50	268.25	271.35	110.17	118.39	125.36	30.55	27.53	25.62	51.23	50.13	47.53
L <sub>1</sub> ×L <sub>8</sub>	57.70	60.00	64.60	3.14	3.39	4.21	218.40	225.70	250.85	105.50	114.84	118.11	35.25	31.70	28.12	50.73	49.80	47.37
L <sub>2</sub> ×L <sub>3</sub>	58.50	62.30	65.68	4.15	4.50	5.35	258.00	279.50	286.59	118.12	123.00	129.07	38.50	36.60	34.75	50.23	47.80	46.03
L <sub>2</sub> ×L <sub>4</sub>	56.50	59.42	63.40	3.37	4.33	4.91	282.45	290.63	293.70	118.67	127.75	134.30	29.65	27.60	25.75	50.90	49.63	46.53
L <sub>2</sub> ×L <sub>5</sub>	60.50	60.75	64.25	2.15	2.28	3.12	224.00	232.91	246.80	108.30	115.00	127.28	28.75	28.20	26.95	52.23	50.80	47.53
L <sub>2</sub> ×L <sub>6</sub>	58.50	62.48	67.05	3.65	3.85	4.65	203.17	206.00	213.35	105.00	109.49	116.42	32.25	28.37	29.52	53.23	48.00	45.00
L <sub>2</sub> ×L <sub>7</sub>	56.90	60.00	66.35	2.70	2.90	3.86	242.50	248.00	255.75	115.40	129.29	132.24	36.35	34.37	33.77	51.07	50.80	47.37
L <sub>2</sub> ×L <sub>8</sub>	57.50	61.00	63.40	2.35	2.74	3.59	223.45	226.70	236.50	107.44	118.00	125.06	27.60	25.70	24.12	54.50	53.13	50.20
L <sub>3</sub> ×L <sub>4</sub>	57.95	58.50	64.60	2.75	2.78	3.39	239.30	257.00	268.45	119.12	128.40	132.00	31.60	30.70	30.45	52.40	51.47	48.53
L <sub>3</sub> ×L <sub>5</sub>	56.50	60.00	62.85	4.00	4.50	5.25	238.00	247.65	255.60	106.15	116.00	123.00	40.70	39.20	36.25	46.91	43.50	40.20
L <sub>3</sub> ×L <sub>6</sub>	58.50	60.75	67.60	3.47	3.78	4.58	233.10	234.90	252.58	104.32	112.67	125.28	34.45	34.20	33.28	47.07	42.00	39.69
L <sub>3</sub> ×L <sub>7</sub>	59.00	62.50	65.40	4.65	5.20	5.65	228.20	243.50	254.57	116.35	118.28	123.00	45.35	42.30	39.05	50.63	48.60	43.00
L <sub>3</sub> ×L <sub>8</sub>	56.50	60.00	62.60	3.14	3.70	4.79	230.00	236.45	248.78	105.44	113.00	133.33	39.65	36.20	34.85	48.50	43.70	41.23
L <sub>4</sub> ×L <sub>5</sub>	56.90	60.80	63.90	2.45	2.80	3.63	252.50	273.88	292.53	113.44	119.14	131.13	25.70	24.40	22.55	51.33	46.00	42.12
L <sub>4</sub> ×L <sub>6</sub>	58.50	63.75	66.60	3.89	4.50	4.96	266.30	289.00	293.10	112.80	125.63	138.23	37.60	37.20	34.95	47.31	46.00	40.00
L <sub>4</sub> ×L <sub>7</sub>	56.80	60.00	64.70	3.59	3.74	4.71	283.00	289.75	304.35	120.39	131.50	139.13	29.25	26.90	24.75	48.87	46.87	41.02
L <sub>4</sub> ×L <sub>8</sub>	59.25	62.80	66.90	3.26	3.42	4.37	256.00	262.79	272.40	112.24	128.22	135.17	34.45	34.03	33.28	51.50	46.50	43.50
L <sub>5</sub> ×L <sub>6</sub>	60.50	63.00	64.10	3.65	3.85	4.79	221.50	229.00	243.20	113.33	120.13	130.39	34.45	32.70	30.45	53.60	48.60	45.30
L <sub>5</sub> ×L <sub>7</sub>	58.80	63.15	65.90	2.72	3.17	4.26	241.48	248.50	253.25	118.13	121.00	122.27	38.60	36.87	35.75	50.60	46.20	42.50
L <sub>5</sub> ×L <sub>8</sub>	58.50	61.00	64.85	3.35	3.50	5.05	238.25	249.92	258.36	106.00	110.13	118.23	37.25	35.00	32.25	52.50	46.60	43.60
L <sub>6</sub> ×L <sub>7</sub>	59.50	61.00	67.10	4.48	4.95	5.45	231.50	241.45	287.40	144.14	151.23	160.29	38.25	35.00	33.25	49.40	48.60	40.22
L <sub>6</sub> ×L <sub>8</sub>	61.50	65.00	65.75	4.10	4.50	5.25	241.80	251.50	261.43	127.27	138.30	143.15	36.25	32.00	31.25	48.46	47.50	41.51
L <sub>7</sub> ×L <sub>8</sub>	58.50	61.00	65.00	2.41	3.89	5.13	247.30	254.99	275.37	118.18	126.20	134.29	29.50	27.30	25.65	44.37	41.80	39.39
Check SC128	61.00	63.00	64.00	3.05	3.68	4.60	245.45	252.00	268.00	122.00	136.00	143.00	37.25	35.40	32.47	52.00	48.20	46.30
LSD 5%	1.02			0.42			10.38			7.36			1.86			1.57		
LSD 1%	1.34			0.55			13.66			9.69			2.44			2.07		

Table S1. Cont.

Cross	ED			NRPE			NKPR			TKW			GYPP			GYPH		
	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3	D1	D2	D3
L1×L2	5.27	4.60	4.30	15.00	14.50	14.00	40.40	37.67	32.87	400.00	372.00	340.00	200.53	180.30	156.25	11.93	12.87	13.02
L1×L3	5.48	5.15	4.50	13.25	12.80	12.18	39.00	36.95	33.76	354.00	340.00	314.00	180.57	156.81	135.75	10.74	11.20	11.31
L1×L4	5.65	5.00	5.00	15.00	14.70	14.13	40.00	38.13	32.87	402.00	374.00	353.00	152.52	140.61	123.85	9.08	10.04	10.32
L1×L5	4.85	4.80	4.73	15.50	15.20	14.70	35.20	34.00	31.67	335.00	321.00	305.50	190.44	177.01	159.25	11.33	12.64	13.27
L1×L6	5.10	4.90	4.70	14.65	13.80	13.43	42.00	40.30	37.10	388.00	371.00	353.50	200.53	180.00	157.25	11.93	12.85	13.10
L1×L7	4.70	4.60	4.30	14.20	14.00	13.60	39.60	35.00	32.50	349.00	325.00	306.50	157.67	136.00	118.05	9.38	9.71	9.83
L1×L8	5.80	4.80	4.70	15.20	14.30	14.20	42.00	37.60	33.47	335.00	321.00	296.50	170.48	156.20	139.25	10.14	11.15	11.60
L2×L3	5.20	4.90	4.00	15.20	14.60	14.40	44.90	38.00	30.29	344.00	331.00	313.50	155.46	140.00	126.25	9.25	10.00	10.52
L2×L4	4.80	4.20	3.60	14.30	14.00	13.70	39.00	36.80	33.40	368.00	343.00	306.00	179.62	175.50	157.75	10.69	12.53	13.14
L2×L5	5.60	5.00	4.80	16.40	15.00	14.20	40.26	38.68	34.67	393.00	368.50	328.50	220.59	200.00	172.25	13.13	14.28	14.35
L2×L6	5.00	4.50	4.20	14.62	13.30	12.60	37.00	35.00	32.75	350.00	332.00	317.00	140.44	130.00	112.25	8.36	9.28	9.35
L2×L7	5.50	5.00	4.80	14.80	13.50	13.20	43.70	38.70	35.77	340.00	310.00	282.00	161.66	142.00	118.75	9.62	10.14	9.89
L2×L8	5.40	4.70	4.20	15.62	15.00	14.45	45.10	42.00	37.95	405.00	370.00	335.50	236.45	215.01	187.44	14.07	15.35	15.61
L3×L4	5.00	4.80	4.60	13.80	12.30	12.20	40.90	36.40	32.87	355.00	333.00	286.00	169.43	157.80	126.16	10.08	11.27	10.51
L3×L5	5.00	5.00	4.60	14.00	13.50	13.20	42.30	38.30	31.92	365.00	334.00	320.00	143.70	122.91	106.25	8.55	8.78	8.85
L3×L6	4.80	4.70	4.80	15.30	14.00	13.70	40.30	36.20	31.37	330.00	324.00	312.00	154.94	135.29	123.95	9.22	9.66	10.33
L3×L7	5.00	4.60	4.30	13.00	12.80	12.60	38.60	36.30	31.67	317.00	298.00	288.00	130.88	132.40	103.75	7.79	9.45	8.78
L3×L8	5.50	5.00	4.60	14.70	14.00	12.20	39.60	35.00	31.87	315.00	304.00	288.00	145.27	122.71	113.14	8.64	8.76	9.42
L4×L5	5.30	4.90	4.30	15.31	14.26	13.39	37.60	35.90	32.87	385.00	363.00	344.00	203.05	175.90	152.25	12.08	12.56	12.68
L4×L6	5.20	4.80	4.40	15.30	14.00	13.20	40.00	37.90	30.87	360.00	336.00	324.00	141.70	136.40	120.05	8.43	9.74	10.00
L4×L7	5.00	4.45	4.20	15.00	13.30	13.10	42.00	39.00	32.57	329.00	301.00	278.00	173.42	154.61	127.85	10.32	11.04	10.65
L4×L8	5.40	5.00	4.60	15.70	13.00	12.70	38.30	36.85	31.07	328.00	300.00	281.00	136.24	132.00	125.55	8.11	9.42	10.46
L5×L6	4.80	4.50	4.00	15.00	13.20	13.21	39.90	37.80	34.40	318.00	291.00	276.50	140.44	134.91	118.36	8.36	9.63	9.86
L5×L7	5.00	4.60	4.20	13.60	12.80	12.25	37.70	35.40	30.47	344.00	311.00	276.00	167.33	152.40	136.45	9.96	10.88	11.37
L5×L8	5.00	4.70	4.30	16.30	15.00	13.54	40.00	36.00	31.87	350.00	320.50	280.00	155.57	130.00	117.25	9.26	9.28	9.77
L6×L7	5.00	4.50	4.00	14.70	14.00	13.40	43.30	40.00	35.93	374.00	346.00	318.00	174.26	155.01	142.85	10.37	11.07	11.90
L6×L8	4.90	4.80	4.60	15.00	14.60	13.50	37.40	36.00	32.07	336.00	312.00	288.50	145.06	130.00	117.25	8.63	9.28	9.77
L7×L8	5.10	4.90	4.80	14.00	13.80	13.20	40.00	36.00	32.19	380.00	358.00	333.00	190.02	167.90	152.25	11.31	11.99	12.68
Check SC128	5.30	4.75	4.55	15.50	14.00	13.50	42.00	40.00	37.40	380.00	364.00	326.00	215.00	190.00	170.00	12.79	13.57	14.16
LSD 5%	0.43			0.70			1.76			13.57			7.61			0.56		
LSD 1%	0.57			0.92			2.31			17.86			10.02			0.74		

**Table S2.** Physical and chemical soil properties for the two locations during 2018 season.

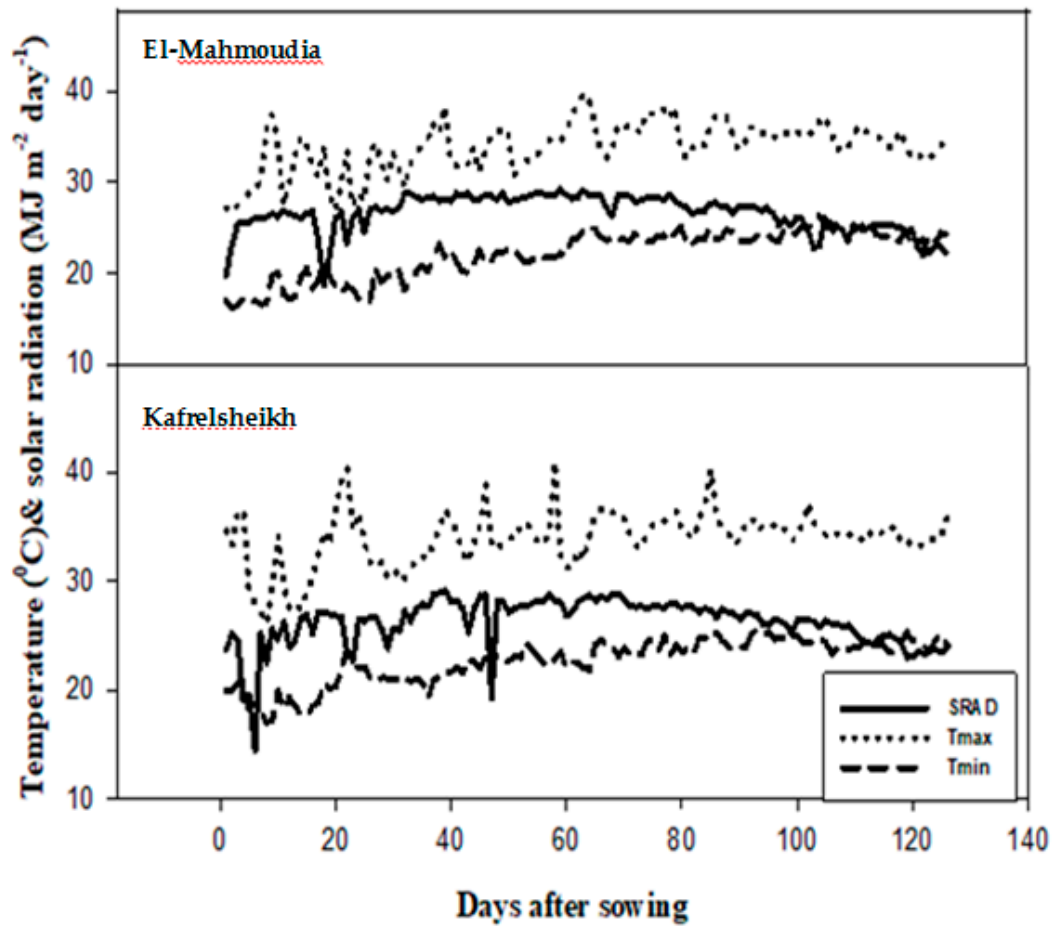
Properties	El-Mahmoudia	Kafrelsheikh
Sand %	16.9	16.56
Silt %	26.5	23.64
Clay %	56.5	59.8
Soil texture	Clay	Clay
Field capacity, %	40.8	41.8
Wilting point, %	20.3	21.2
Bulk density, Mg m <sup>-3</sup>	1.24	1.38
Organic matter, %	1.85	1.45
CaCO <sub>3</sub> , %	2.45	4.4
pH*	7.65	8.0
EC **, dS m <sup>-1</sup>	1.06	1.88
Ca <sup>++</sup> meq l <sup>-1</sup>	3.72	13.0
Mg <sup>++</sup> meq l <sup>-1</sup>	2.08	12.3
Na <sup>+</sup> meq l <sup>-1</sup>	12.8	30.1
K <sup>+</sup> meq l <sup>-1</sup>	0.20	0.6
CO <sub>3</sub> <sup>-</sup> meq l <sup>-1</sup>	0.00	0.0
HCO <sub>3</sub> <sup>-</sup> meq l <sup>-1</sup>	5.4	4.0
CL <sup>-</sup> meq l <sup>-1</sup>	8.90	22.7
SO <sub>4</sub> <sup>-</sup> meq l <sup>-1</sup>	4.5	29.3
Available Nitrogen, mgkg <sup>-1</sup>	50.6	30.1
Available phosphorus. mgkg <sup>-1</sup>	16.3	10.0
Available potassium, mgkg <sup>-1</sup>	489.5	650

\* pH was determined in soil: water suspension (1:2.5)

\*\* EC was determined in soil paste extract

**Table S3. List of SSR primers and their sequences.**

No.	Marker	Forward primer	Reverse primer
1	phi308707	GCAACAAGATCCAGCCGAT	GTCGCCCTCATATGACCTTC
2	phi96100	AGGAGGACCCCAACTCCTG	TTGCACGAGCCATCGTAT
3	phi453121	ACCTTGCCTGTCCTTCTTCT	CAAGCAAGACTTTTGATCAGCC
4	phi072	ACCGTGCATGATTAATTTCTCCAGCCTT	GACAGCGCGCAAATGGATTGAACT
5	phi024	ACTGTCCACCAAACCAAGCCGAGA	AGTAGGGGTTGGGGATCTCCTCC
6	Umc1014	GAAAGTCGATCGAGAGACCCTG	CCCTCTTTCACCCCTTCCTT
7	phi112	TGCCCTGCAGGTTACATTGAGT	AGGAGTACGCTTGGATGCTCTTC
8	phi015	GCAACGTACCGTACCTTTCCGA	ACGCTGCATTCAATTACCGGGAAG
9	umc1033	CTTCTTCGTAAAGGCATTTTGTGC	GTGCGGGATTCCCTTAGTTTGC
10	phi301654	GAATGCATGCTTTTCAAGGAC	CGCACAGAGAGCAGAACG



**Figure S1.** Daily maximum temperature (T max), minimum temperature (T min) and solar radiation (SRAD) for the two locations.