

**Supplementary Table 1.** Four clusters base on 9 agronomic traits and 4 seed pigments of 466 black soybean accessions including two checks (Cheongja 3, and Cheongja) by K-means cluster analysis

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 1	IT213183	1	44.3	129.7	73.4	21.0	5.7	23.7	8.0	7.0	6.0	56.0	25.6	64.0	89.6	21.3328
Cluster 1	IT161904	2	40.0	116.7	74.1	17.6	3.8	18.8	7.6	6.5	5.8	53.4	15.1	61.8	76.9	24.2965
Cluster 1	IT161905	3	49.0	116.7	77.6	16.6	4.1	19.9	7.6	6.3	5.6	55.6	15.5	65.8	81.3	23.0015
Cluster 1	IT162155	4	37.7	112.3	67.7	16.8	4.3	17.6	7.4	6.3	5.6	51.3	14.7	55.2	69.9	28.9028
Cluster 1	IT162593	5	44.3	112.3	62.4	14.9	3.9	17.8	7.4	6.1	5.4	51.4	14.5	53.7	68.2	27.0285
Cluster 1	IT186035	6	51.0	126.3	57.0	15.4	6.1	35.7	9.8	8.7	7.1	50.1	12.5	51.2	63.7	22.9069
Cluster 1	IT162602	7	42.7	116.3	82.9	17.7	2.8	20.6	7.3	6.5	5.7	49.9	12.4	48.1	60.5	38.2403
Cluster 1	IT177285	8	52.0	120.3	59.8	14.7	5.2	33.7	9.8	8.1	6.4	50.7	13.2	57.1	70.4	14.7167
Cluster 1	IT177318	9	52.0	122.7	59.3	15.2	4.4	34.8	9.8	8.3	6.3	48.7	11.6	48.5	60.1	27.2202
Cluster 1	IT177325	10	51.0	123.7	58.9	13.7	4.7	32.8	9.9	8.2	6.3	49.2	10.9	49.4	60.3	26.5941
Cluster 1	IT177326	11	50.3	120.0	59.9	14.7	4.8	33.0	9.6	8.0	6.2	49.4	10.8	47.2	58.0	29.9435
Cluster 1	IT177376	12	51.0	121.7	66.3	15.2	3.6	33.1	9.6	8.0	6.2	49.1	10.9	48.9	59.9	27.5923
Cluster 1	IT177419	13	51.0	121.3	67.2	14.9	3.8	32.3	10.1	8.3	6.3	50.3	12.9	54.4	67.3	18.7987
Cluster 1	IT186045	14	51.0	121.7	62.7	14.7	5.1	33.3	9.8	8.1	6.3	50.9	13.1	54.2	67.4	17.8249
Cluster 1	IT186071	15	51.0	122.7	62.1	16.1	6.5	31.5	10.0	8.1	6.4	49.8	12.4	52.9	65.2	20.3655
Cluster 1	IT191145	16	51.0	124.3	55.7	15.0	6.4	35.2	9.3	8.0	6.7	52.0	22.4	60.4	82.8	8.7940
Cluster 1	IT191160	17	51.0	124.3	56.1	15.4	6.0	34.6	9.6	8.4	7.3	52.9	25.1	66.2	91.3	14.1270
Cluster 1	IT195204	18	52.0	123.0	66.1	15.2	5.4	30.9	9.5	8.0	6.5	52.6	16.4	68.2	84.6	8.1609
Cluster 1	IT161934	20	38.0	113.7	64.3	13.9	3.0	17.7	8.9	7.0	5.7	52.5	15.1	59.2	74.3	25.0368
Cluster 1	IT189665	21	51.0	123.0	66.3	16.7	5.4	32.4	8.5	7.4	6.2	52.6	15.0	66.9	81.9	7.3197
Cluster 1	IT177300	23	51.0	126.7	57.7	14.7	6.9	39.0	9.8	8.3	7.0	52.5	25.2	65.9	91.1	14.7494
Cluster 1	IT195229	24	51.0	125.7	64.7	16.0	7.0	34.4	9.7	8.4	7.2	54.0	26.3	69.2	95.5	18.0078
Cluster 1	IT186023	25	52.0	128.0	59.8	14.7	4.9	34.1	9.8	8.3	6.7	51.2	12.7	59.8	72.5	11.5076
Cluster 1	IT186034	26	52.0	123.7	58.1	15.7	4.3	32.4	9.6	8.1	6.6	53.3	14.5	69.0	83.5	8.5115
Cluster 1	IT186057	27	52.0	123.7	62.9	15.3	4.0	33.7	9.9	8.2	6.5	48.7	10.7	46.1	56.8	31.1038
Cluster 1	IT186060	28	52.0	126.7	57.5	15.0	3.2	35.7	9.8	8.1	6.2	50.4	12.8	56.6	69.4	15.8645
Cluster 1	IT186094	29	51.7	114.0	57.6	14.8	5.3	28.9	9.4	7.9	6.0	52.8	14.8	69.0	83.8	14.7638
Cluster 1	IT186094	30	51.7	124.3	57.9	15.0	5.7	32.9	10.0	8.3	6.3	50.9	13.3	57.3	70.6	13.8596
Cluster 1	IT186105	31	51.0	118.7	62.6	15.0	4.9	29.5	9.6	8.0	6.3	51.8	14.3	60.0	74.3	11.4726
Cluster 1	IT186110	32	51.7	123.7	60.4	14.4	4.5	28.7	9.9	8.4	6.3	53.0	14.2	64.9	79.1	6.8150
Cluster 1	IT186111	33	51.7	122.3	62.5	15.5	5.8	32.8	9.8	8.1	6.4	50.7	12.6	55.9	68.4	16.2380
Cluster 1	IT219709	36	51.0	121.7	54.2	14.1	5.4	29.5	9.4	7.7	6.3	54.1	18.0	78.1	96.1	23.0164
Cluster 1	IT224435	37	51.7	123.7	72.9	16.3	6.1	33.4	9.5	8.2	7.0	54.8	29.4	77.5	106.9	33.5098
Cluster 1	IT224517	38	51.7	124.3	69.1	15.3	4.8	35.1	10.1	8.4	6.6	50.0	13.1	55.5	68.6	17.6295
Cluster 1	IT177210	40	55.0	131.3	97.1	18.9	8.0	30.3	9.2	7.7	5.9	58.8	31.6	88.4	120.0	60.6112
Cluster 1	IT177403	41	51.7	121.7	64.9	14.8	4.5	34.3	10.0	8.3	6.3	54.2	16.7	69.0	85.6	9.3513
Cluster 1	IT177412	42	51.7	124.0	75.8	15.8	4.9	35.2	9.8	8.3	6.5	51.3	14.8	61.2	76.0	15.7252
Cluster 1	IT177425	43	51.7	126.7	63.1	15.7	6.0	36.2	9.4	8.3	7.1	51.7	24.4	65.5	89.9	11.6757
Cluster 1	IT177431	44	51.7	130.0	64.8	16.4	4.4	32.5	10.0	8.1	6.4	53.3	16.0	71.5	87.5	11.9692
Cluster 1	IT180854	45	50.7	130.0	69.6	14.7	6.3	35.2	9.4	8.4	7.0	53.7	26.0	69.0	95.0	19.3515
Cluster 1	IT186059	46	51.7	124.3	67.5	15.5	4.9	33.5	9.8	8.1	6.2	51.3	14.0	61.8	75.8	9.1684
Cluster 1	IT186122	47	51.7	124.3	67.1	15.3	5.6	33.9	9.4	8.4	6.6	50.8	13.0	58.3	71.3	13.5083
Cluster 1	IT189264	48	52.0	124.0	65.5	14.4	5.2	34.6	9.8	8.1	6.5	51.2	13.3	60.8	74.1	10.1161
Cluster 1	IT189640	49	51.7	127.3	67.8	14.7	4.5	34.3	10.1	8.3	6.4	50.4	13.5	57.4	70.9	14.4257
Cluster 1	IT189640	50	51.7	126.7	66.0	15.9	5.4	35.7	10.0	8.1	6.6	51.4	13.6	55.5	69.1	16.0589
Cluster 1	IT195341	51	51.7	128.0	62.1	13.7	3.8	35.7	9.8	8.1	6.4	51.5	13.1	57.9	71.0	13.4309
Cluster 1	IT195522	52	51.7	121.7	51.7	13.6	4.0	35.4	10.0	8.2	6.2	52.1	14.4	63.1	77.5	12.6563

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 1	IT195627	53	51.7	124.0	62.5	15.6	4.5	34.9	9.9	8.1	6.5	51.5	13.9	62.5	76.5	7.1240
Cluster 1	IT196434	54	51.7	124.0	61.3	14.7	4.8	32.5	9.8	8.2	6.3	52.4	14.5	64.5	79.1	4.8262
Cluster 1	IT177237	56	51.7	121.7	54.5	14.3	6.3	32.4	9.9	8.3	6.4	50.4	13.1	55.6	68.7	17.7851
Cluster 1	IT177305	57	51.7	126.7	52.0	14.1	3.4	36.3	9.4	8.4	7.0	56.0	29.8	81.7	111.5	39.0576
Cluster 1	IT177320	58	51.7	128.0	59.5	15.0	3.6	31.2	9.7	8.0	6.3	51.2	12.6	58.9	71.5	12.7339
Cluster 1	IT177340	59	51.7	121.7	58.1	14.7	4.8	32.6	10.0	8.3	6.8	48.8	11.0	48.0	59.0	28.6387
Cluster 1	IT177351	60	51.7	124.0	65.7	15.6	4.4	35.7	9.9	8.2	6.4	51.5	14.0	64.0	77.9	7.5647
Cluster 1	IT177361	61	51.7	123.0	58.9	15.1	4.5	30.3	10.0	8.3	6.4	51.5	13.6	61.3	74.9	9.3256
Cluster 1	IT177366	62	51.7	121.7	55.3	13.4	4.8	32.0	9.9	8.2	6.3	51.4	12.9	60.2	73.1	12.9100
Cluster 1	IT177367	63	51.7	124.0	59.5	14.7	5.0	33.4	9.7	8.3	6.4	50.7	12.8	56.7	69.6	14.7894
Cluster 1	IT177387	64	51.7	125.3	55.9	14.9	4.3	33.5	9.8	8.2	6.4	51.3	14.1	60.0	74.1	10.8124
Cluster 1	IT177405	65	52.3	124.3	58.7	15.6	5.5	34.3	9.5	8.4	6.8	51.7	14.0	60.6	74.6	9.2092
Cluster 1	IT177415	66	51.0	124.0	55.1	13.3	4.2	35.9	9.9	8.0	6.4	50.8	13.6	56.4	69.9	16.2242
Cluster 1	IT177420	67	51.7	126.7	63.7	15.2	5.0	33.9	9.8	8.2	6.4	52.6	14.9	65.3	80.2	4.7625
Cluster 1	IT177456	68	51.7	128.0	56.1	14.7	5.4	35.3	9.4	8.2	7.1	55.6	29.6	79.7	109.3	35.3395
Cluster 1	IT186055	69	51.0	126.7	56.9	14.8	6.1	34.0	9.4	8.4	6.9	50.4	11.8	53.4	65.2	20.6623
Cluster 1	IT189316	71	51.0	130.0	63.5	15.2	5.6	37.3	9.3	8.3	7.1	52.2	25.0	65.7	90.8	13.7594
Cluster 1	IT191126	72	50.0	130.0	62.1	15.7	4.9	36.1	9.5	8.5	7.2	53.1	25.3	67.6	92.9	15.5413
Cluster 1	IT191135	73	51.7	125.7	63.5	14.1	5.9	33.1	9.8	8.0	6.4	51.2	14.1	59.5	73.5	9.8018
Cluster 1	IT191649	74	51.7	130.0	65.1	15.3	4.7	34.7	10.0	8.3	6.4	51.1	13.8	59.6	73.4	11.3937
Cluster 1	IT195198	75	51.7	127.7	61.5	14.9	8.0	30.6	9.7	8.0	6.3	51.8	15.0	64.2	79.2	5.5394
Cluster 1	IT195508	76	50.7	128.7	74.2	14.6	5.2	35.2	9.9	8.2	6.4	49.6	12.2	52.7	64.9	24.2715
Cluster 1	IT175932	79	55.3	129.3	67.8	17.3	5.0	28.1	8.6	7.6	6.3	53.2	16.5	76.4	92.9	20.0618
Cluster 1	IT186238	88	52.3	123.7	61.5	14.5	7.3	33.4	9.2	8.2	6.9	54.0	26.1	68.9	94.9	17.2060
Cluster 1	IT228631	95	51.7	123.0	57.8	13.6	5.3	33.1	8.9	7.6	6.6	50.7	13.1	57.5	70.6	14.1814
Cluster 1	IT196887	102	51.7	130.0	67.7	15.3	4.6	32.0	9.6	8.0	6.1	50.1	13.1	54.1	67.2	19.1047
Cluster 1	IT216023	104	51.7	129.3	62.7	17.4	6.8	34.9	9.2	8.2	6.9	51.1	23.3	58.4	81.7	8.8677
Cluster 1	IT186026	109	50.3	125.7	63.9	14.4	6.4	34.4	9.3	8.1	7.0	50.5	22.0	57.9	79.9	7.6427
Cluster 1	IT186212	113	50.7	126.0	54.3	14.7	6.6	34.2	9.1	8.2	6.9	52.1	24.2	63.6	87.8	11.9528
Cluster 1	IT186232	116	51.7	125.7	58.9	15.6	4.3	36.7	10.2	8.3	6.5	49.6	12.4	53.6	66.0	19.8156
Cluster 1	IT186027	129	54.7	141.0	62.0	15.7	6.1	34.5	10.1	8.4	6.5	48.8	12.1	53.1	65.2	25.7277
Cluster 1	IT203723	147	51.7	130.3	55.1	15.2	8.4	36.2	9.1	8.3	7.2	51.7	26.2	60.9	87.1	14.0326
Cluster 1	IT104617	235	51.7	129.0	63.4	15.1	4.6	31.9	10.0	8.5	6.8	49.9	12.5	54.2	66.7	18.5921
Cluster 1	IT177203	240	50.7	123.3	58.0	15.9	5.4	31.7	9.3	8.2	7.0	54.3	27.6	72.4	99.9	23.4159
Cluster 1	IT177235	242	51.7	125.3	60.7	16.0	5.0	36.8	10.0	8.4	6.5	50.8	13.2	55.7	69.0	15.9323
Cluster 1	IT177331	245	57.0	133.0	67.3	16.4	9.0	35.7	10.2	8.6	7.0	51.4	26.4	56.3	82.6	16.2076
Cluster 1	IT177363	247	51.0	127.3	62.1	16.0	4.8	33.6	9.9	8.2	6.4	50.2	13.6	57.6	71.2	12.7235
Cluster 1	IT177454	251	52.3	130.3	64.5	15.8	5.2	32.2	9.7	8.2	6.6	50.9	13.9	59.2	73.1	11.5168
Cluster 1	IT177475	253	51.0	125.7	55.3	14.1	4.5	30.3	9.6	8.1	6.2	51.3	14.9	60.7	75.6	10.0095
Cluster 1	IT177890	284	51.7	124.0	57.7	14.9	6.4	30.8	9.7	8.1	6.3	49.3	13.4	59.3	72.7	11.9589
Cluster 1	IT211784	315	50.5	135.0	49.8	13.6	4.2	35.5	10.1	8.5	6.5	46.9	18.5	43.1	61.6	32.6745
Cluster 1	IT224518	320	51.7	125.7	64.6	15.5	5.5	32.4	9.5	8.2	6.2	48.9	14.6	60.4	75.0	8.7675
Cluster 1	IT262937	335	51.7	125.3	51.3	14.9	6.8	31.0	9.3	8.4	7.4	50.3	25.5	63.0	88.6	15.1398
Cluster 1	IT263283	361	50.0	137.7	49.6	14.4	5.5	29.7	9.9	8.8	7.9	47.3	22.6	53.3	75.8	21.9411
Cluster 1	IT263283	362	52.0	138.7	52.3	15.1	5.4	29.0	9.9	8.7	7.4	47.9	23.2	57.7	80.9	18.7521
Cluster 1	IT263371	383	50.7	139.7	53.1	15.1	4.6	24.1	8.7	7.8	6.8	48.7	22.7	57.6	80.3	20.3505
Cluster 1	IT263373	385	51.7	139.7	59.2	15.7	6.0	33.3	9.2	8.3	6.8	46.5	11.4	45.5	57.0	34.4527
Cluster 1	IT263375	388	50.7	127.0	54.2	15.7	5.9	34.6	9.1	7.9	6.8	51.0	28.1	71.4	99.5	23.7803

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 2	IT141511	55	51.7	124.0	129.5	25.8	6.0	25.6	9.1	7.5	5.9	55.8	14.8	76.7	91.6	40.3275
Cluster 2	IT186089	87	58.0	135.0	118.5	22.6	5.3	33.2	9.3	7.8	6.3	51.9	35.2	43.1	78.3	24.0578
Cluster 2	IT189256	137	58.3	131.7	141.9	24.7	7.6	31.6	9.6	8.2	6.3	59.7	39.0	43.3	82.3	42.3714
Cluster 2	IT237550	322	60.0	142.0	112.5	19.2	6.2	44.0	11.3	9.2	6.8	46.8	13.0	58.5	71.5	10.0670
Cluster 2	IT262924	332	45.5	126.0	94.0	17.1	3.4	16.4	7.7	6.8	6.1	50.8	14.9	51.7	66.6	34.4775
Cluster 2	IT263327	374	63.0	146.0	111.3	20.0	5.8	43.2	11.0	9.0	6.9	46.1	12.0	57.4	69.3	12.7675
Cluster 2	IT263328	375	61.0	145.7	113.7	20.4	4.3	46.3	11.0	9.1	6.8	47.6	13.5	59.8	73.2	13.6444
Cluster 2	IT263334	379	63.0	144.0	108.6	20.0	4.3	49.3	11.5	9.1	6.9	45.7	11.0	53.7	64.7	17.7825
Cluster 2	IT263372	384	64.3	143.3	110.6	20.0	4.5	45.7	11.0	9.2	6.8	45.5	11.5	53.1	64.6	15.2230
Cluster 2	IT263376	390	67.0	148.0	112.6	20.2	5.1	43.9	11.1	8.7	6.6	44.8	10.8	50.5	61.3	19.8386
Cluster 2	IT263515	396	60.0	129.3	125.8	23.9	6.0	24.9	8.0	7.6	6.4	49.8	40.8	42.8	83.6	35.4550
Cluster 2	IT263849	445	61.7	143.0	110.5	21.2	5.5	41.9	10.9	9.0	6.9	45.9	10.9	52.9	63.8	13.2241
Cluster 2	RCS640	459	58.5	140.0	106.8	20.4	3.8	38.8	10.7	9.1	6.7	44.2	9.1	46.4	55.5	21.6483
Cluster 2	RCS1105	461	59.5	142.5	104.2	20.4	4.8	39.0	10.0	8.4	6.7	44.2	11.9	53.2	65.1	13.7236
Cluster 2	RCS1201	462	58.5	142.5	100.0	18.2	3.0	39.3	11.0	8.9	6.6	44.5	9.2	47.3	56.5	23.9014
Cluster 2	RCS0902S	463	61.5	142.0	116.8	21.6	4.7	36.1	10.0	8.6	6.9	44.9	9.3	48.9	58.1	18.5093
Cluster 3	IT213193	19	50.0	118.7	64.1	15.9	4.7	34.9	10.1	8.4	6.7	44.5	12.8	13.5	26.3	42.9989
Cluster 3	IT213186	22	51.0	118.3	77.4	16.5	5.2	33.1	9.9	8.1	6.5	45.9	14.9	17.4	32.4	32.5853
Cluster 3	IT213192	34	51.7	118.3	54.7	13.7	5.7	31.8	9.4	8.1	6.3	44.4	14.9	17.7	32.6	44.3738
Cluster 3	IT213192	35	51.7	125.3	61.2	15.1	6.5	33.2	9.7	8.1	6.4	45.0	17.0	19.4	36.3	34.2487
Cluster 3	IT224517	39	45.5	130.0	73.0	14.8	3.9	33.2	10.0	8.6	6.7	46.1	11.0	45.9	56.9	32.7139
Cluster 3	IT186158	70	63.3	129.3	79.3	20.9	10.2	12.5	6.9	6.3	5.1	48.4	21.8	22.3	44.1	25.6691
Cluster 3	IT115797	78	61.7	131.7	74.8	16.7	7.8	19.6	7.9	7.2	5.7	49.0	23.9	24.2	48.1	20.0049
Cluster 3	IT177712	81	56.7	129.3	73.5	17.9	8.6	37.6	10.6	9.0	6.6	48.6	16.2	43.2	59.4	26.8504
Cluster 3	IT177829	83	65.0	142.0	85.3	18.4	10.0	42.0	10.6	9.1	7.1	48.7	27.5	31.5	59.0	16.4797
Cluster 3	IT189217	89	58.3	128.0	61.7	15.4	7.1	21.7	8.7	7.3	5.2	46.8	23.5	22.8	46.3	30.1563
Cluster 3	IT203576	90	59.0	130.3	71.7	18.4	5.8	29.0	9.3	8.1	6.0	46.3	19.3	21.9	41.3	20.2483
Cluster 3	IT210089	91	63.0	128.0	83.5	19.0	8.3	12.2	6.3	5.9	5.0	46.8	18.1	17.8	35.9	29.5385
Cluster 3	IT219701	92	63.0	128.0	87.5	19.3	8.7	12.4	6.6	6.1	5.0	46.8	17.6	17.4	35.0	29.9074
Cluster 3	IT219704	93	64.0	131.3	101.5	19.6	7.6	13.9	6.8	6.1	5.2	48.7	23.6	24.7	48.3	26.6956
Cluster 3	IT225110	94	60.3	125.7	79.5	19.5	7.6	12.9	6.4	6.0	5.0	46.9	17.6	17.1	34.7	31.3785
Cluster 3	IT194548	96	63.7	139.7	88.7	18.2	5.2	43.7	10.4	8.5	6.2	49.6	27.5	33.5	61.0	18.9863
Cluster 3	IT194556	97	63.0	141.0	90.5	18.8	5.3	40.3	10.5	8.9	6.7	48.9	26.3	30.4	56.6	13.3118
Cluster 3	IT209383	103	61.0	141.7	93.3	19.2	7.5	40.7	10.3	8.8	6.3	47.4	23.7	26.8	50.5	11.0897
Cluster 3	IT178512	105	63.0	148.0	85.4	17.7	8.8	43.7	10.8	9.1	6.8	46.5	22.2	24.8	47.0	14.2038
Cluster 3	IT178739	106	61.0	147.0	90.4	19.5	8.3	39.5	10.1	8.7	6.7	45.9	19.7	22.1	41.8	14.0092
Cluster 3	IT180621	108	61.3	135.3	90.5	18.3	7.2	36.5	10.3	8.7	6.5	45.4	17.4	19.8	37.2	16.2973
Cluster 3	IT186205	112	63.7	139.7	87.8	19.7	7.3	42.0	10.4	8.8	6.5	47.2	24.2	28.5	52.7	10.7573
Cluster 3	IT186215	114	63.7	140.7	90.5	20.0	7.5	43.0	10.2	8.6	6.3	47.1	24.3	28.5	52.9	12.4247
Cluster 3	IT113044	118	64.3	143.3	83.8	19.0	8.8	25.5	8.6	7.6	6.0	47.6	21.7	23.2	44.9	11.0167
Cluster 3	IT142935	119	63.7	144.3	86.0	20.0	5.6	44.3	10.3	8.8	6.6	45.9	21.5	24.3	45.7	13.3460
Cluster 3	IT153438	122	63.0	146.0	88.7	20.4	6.0	43.4	10.8	9.0	6.8	47.0	23.9	26.9	50.8	13.0772
Cluster 3	IT160586	124	62.7	139.7	87.6	20.0	8.1	39.2	10.4	9.0	6.8	46.9	25.0	27.7	52.7	8.5331
Cluster 3	IT175855	125	64.3	143.7	85.7	19.4	7.8	40.7	10.5	9.0	6.8	46.3	23.8	26.2	50.0	9.6995
Cluster 3	IT186058	130	63.7	141.3	84.9	19.7	6.0	33.6	9.0	8.1	6.5	47.2	24.0	26.7	50.7	4.6244
Cluster 3	IT186093	131	60.7	149.3	86.1	20.4	7.7	40.6	10.3	8.9	6.7	47.6	25.8	28.2	54.0	13.9696
Cluster 3	IT189212	134	62.0	142.7	89.1	20.6	8.4	40.7	10.3	8.8	6.8	48.8	25.9	29.0	55.0	12.0841
Cluster 3	IT189214	135	63.7	149.0	92.3	20.2	7.3	39.7	10.3	8.2	6.0	48.2	24.0	27.2	51.2	13.7946

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 3	IT194562	139	58.3	136.3	84.5	17.8	5.2	36.8	9.7	8.5	7.2	46.4	19.4	22.5	41.9	10.8374
Cluster 3	IT195020	140	61.7	146.0	92.3	21.3	7.7	41.2	10.8	9.0	6.7	47.2	24.1	25.7	49.8	12.7297
Cluster 3	IT195628	142	60.0	133.0	91.0	20.0	6.0	35.1	9.6	8.4	6.5	50.6	27.0	29.9	56.9	13.8681
Cluster 3	IT195629	143	59.7	138.7	53.4	16.3	6.2	23.0	8.3	7.1	5.4	46.4	24.3	24.3	48.5	34.5373
Cluster 3	IT196819	144	62.0	139.7	86.6	17.8	9.2	39.7	10.9	9.2	6.9	46.9	23.6	25.6	49.2	7.7848
Cluster 3	IT203582	146	62.0	137.0	84.6	20.2	9.2	39.9	10.6	9.1	6.7	50.4	30.7	42.4	73.1	31.3067
Cluster 3	IT204078	148	62.7	137.3	85.8	18.8	7.1	44.2	10.5	9.0	6.7	48.0	28.1	32.7	60.8	18.7046
Cluster 3	IT204081	149	62.0	140.0	88.7	19.2	8.0	40.2	10.0	8.8	6.5	47.9	25.5	29.4	55.0	10.9010
Cluster 3	IT224172	154	64.3	140.0	93.0	19.6	7.4	38.1	9.9	8.7	6.4	47.5	25.1	29.0	54.1	11.3253
Cluster 3	IT224192	157	62.0	140.0	90.9	19.2	9.4	38.5	10.4	8.9	6.6	47.4	25.8	28.6	54.4	10.5167
Cluster 3	IT224211	158	64.3	142.3	92.9	19.6	8.5	41.4	10.7	9.0	6.8	47.7	25.6	28.6	54.1	13.5653
Cluster 3	IT228789	161	61.0	144.7	95.4	18.8	7.8	29.7	10.0	8.7	7.2	45.0	18.0	20.1	38.1	17.5278
Cluster 3	IT228789	162	61.0	141.0	91.9	19.8	7.0	40.0	10.2	8.6	7.1	47.1	22.2	25.1	47.3	9.6722
Cluster 3	IT230132	163	60.3	151.7	88.8	18.6	5.9	41.0	10.1	8.4	6.7	45.2	17.5	20.2	37.7	20.2123
Cluster 3	IT177819	166	64.3	140.3	89.9	20.1	7.4	31.7	10.1	8.8	6.9	47.6	29.7	33.8	63.5	18.7266
Cluster 3	IT177858	168	64.3	146.3	95.7	20.0	5.9	33.0	10.3	8.6	6.3	45.8	20.4	22.4	42.7	14.5802
Cluster 3	IT177925	172	64.3	148.7	92.7	19.2	6.6	38.6	10.4	8.7	6.6	46.8	23.4	26.0	49.3	13.0390
Cluster 3	IT177945	174	61.0	141.3	88.6	18.6	8.6	30.6	9.1	8.2	6.7	46.3	20.3	21.8	42.2	9.6406
Cluster 3	IT177978	176	65.5	147.5	94.6	19.2	5.6	36.7	9.9	8.5	6.4	46.8	23.3	25.9	49.2	13.0938
Cluster 3	IT178376	177	63.3	144.7	85.6	16.8	6.9	42.3	10.5	8.8	6.4	45.9	22.6	25.4	48.0	11.1943
Cluster 3	IT186030	179	64.3	145.0	85.7	19.4	6.7	42.6	10.4	8.7	6.4	47.3	25.5	28.0	53.5	12.9122
Cluster 3	IT186043	181	63.7	146.0	86.5	19.4	5.5	38.7	10.3	8.7	6.6	47.0	24.5	26.1	50.6	9.5933
Cluster 3	IT186207	183	63.3	141.0	91.3	17.5	6.8	35.8	10.5	8.7	6.3	47.3	24.5	28.1	52.6	8.1573
Cluster 3	IT189223	184	65.3	141.3	86.9	18.5	8.4	39.2	10.0	9.0	6.9	48.8	24.3	26.7	51.0	8.8491
Cluster 3	IT189224	185	66.0	142.3	84.5	18.8	8.4	38.1	10.2	9.0	7.1	47.3	21.4	22.6	44.0	10.4148
Cluster 3	IT189238	186	62.3	145.0	93.1	19.8	10.3	43.5	10.7	9.1	6.8	46.8	23.3	25.1	48.4	14.4666
Cluster 3	IT189261	188	60.0	144.3	56.2	16.2	5.2	19.0	8.4	7.1	5.2	47.5	27.2	27.0	54.2	34.3204
Cluster 3	IT191120	189	63.3	149.3	91.9	18.6	7.2	37.6	10.6	9.0	6.8	47.3	24.6	26.7	51.4	12.8946
Cluster 3	IT194536	191	60.3	145.0	87.0	19.0	8.0	40.2	10.0	8.6	6.4	46.7	24.8	27.0	51.7	9.8720
Cluster 3	IT194538	192	63.0	148.3	91.4	20.5	5.9	42.5	9.9	8.4	6.4	45.3	23.7	25.5	49.2	14.3647
Cluster 3	IT194546	193	61.0	143.3	83.7	18.7	9.0	38.7	10.3	8.8	6.6	47.0	24.3	26.9	51.2	8.1503
Cluster 3	IT108780	194	61.0	143.3	91.7	19.9	6.0	36.3	9.7	8.2	6.0	48.5	27.2	29.6	56.8	12.5293
Cluster 3	IT153770	195	61.0	146.3	95.5	20.2	6.5	40.6	10.6	8.9	6.6	45.6	20.8	22.6	43.4	15.6617
Cluster 3	IT153780	196	60.3	143.3	87.7	19.1	7.6	39.8	10.8	8.8	6.6	44.8	17.6	18.7	36.3	17.7472
Cluster 3	IT160127	197	60.0	148.3	97.5	18.8	7.4	36.6	10.6	8.5	6.6	44.1	15.8	17.2	32.9	24.8076
Cluster 3	IT160153	198	61.0	141.3	93.7	19.8	8.7	37.2	10.6	8.7	6.5	46.7	22.6	25.3	48.0	9.3974
Cluster 3	IT177284	201	57.3	133.7	71.5	18.3	9.5	32.7	9.7	8.3	6.4	44.9	12.5	13.1	25.6	33.1672
Cluster 3	IT177879	202	62.3	138.3	84.3	19.4	8.5	40.7	10.3	8.8	6.7	49.9	30.8	33.3	64.0	20.6544
Cluster 3	IT181891	209	62.7	145.0	91.3	19.2	7.1	41.8	10.7	8.7	6.2	47.3	24.6	26.4	51.0	12.1985
Cluster 3	IT186149	214	71.5	147.0	85.9	18.4	8.8	32.6	9.8	8.7	6.7	52.5	28.4	29.8	58.2	18.3491
Cluster 3	IT186222	215	62.3	144.0	86.4	19.4	7.3	34.9	10.2	8.7	6.5	50.1	30.0	36.2	66.2	21.9970
Cluster 3	IT194544	219	64.3	138.0	95.9	19.2	7.7	34.6	9.6	8.0	6.3	48.1	20.3	24.3	44.6	12.0729
Cluster 3	IT194567	220	63.7	152.0	81.5	18.8	7.2	35.9	10.2	8.6	6.5	48.6	27.6	29.6	57.2	17.2201
Cluster 3	IT194567	221	65.0	149.0	87.9	18.6	6.8	39.1	10.3	8.9	6.9	47.2	24.2	26.3	50.4	12.2701
Cluster 3	IT196826	222	63.3	154.3	92.9	19.2	7.7	34.5	11.0	8.9	7.0	47.0	20.1	21.0	41.1	19.2041
Cluster 3	IT196826	223	69.5	154.3	85.1	18.4	9.6	35.1	10.2	8.6	6.4	46.9	23.6	25.9	49.5	17.3174
Cluster 3	IT213320	227	57.5	140.5	87.4	18.2	4.1	31.1	9.4	8.2	6.5	44.3	20.8	23.2	43.9	8.5304
Cluster 3	IT219694	228	61.0	149.3	80.7	18.4	9.5	40.4	10.6	9.1	6.8	48.3	27.0	29.2	56.2	16.3761

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 3	IT228785	230	64.0	141.7	86.1	20.2	9.1	39.9	10.7	9.1	7.1	47.7	23.4	24.9	48.3	8.8536
Cluster 3	IT228785	231	60.3	142.3	84.7	21.2	7.6	43.2	10.5	9.0	6.9	47.5	23.7	25.6	49.3	11.2723
Cluster 3	IT228787	232	62.3	149.0	94.5	18.6	8.0	38.5	10.0	8.5	7.4	48.7	20.5	21.4	41.9	16.6517
Cluster 3	IT228791	233	61.0	148.7	82.9	19.2	8.4	35.5	10.2	9.0	6.9	47.6	23.7	25.0	48.7	10.3420
Cluster 3	IT153439	236	62.7	141.0	93.2	20.0	8.5	40.2	9.7	8.1	6.2	47.4	22.9	24.8	47.7	10.9291
Cluster 3	IT153440	237	63.3	139.7	92.2	19.9	6.8	41.4	10.7	9.0	6.8	47.4	25.2	29.1	54.3	12.7244
Cluster 3	IT153440	238	67.0	146.0	83.8	20.0	8.6	38.3	10.3	9.0	6.9	47.7	24.1	26.1	50.1	11.0396
Cluster 3	IT177218	241	60.0	142.3	90.9	18.6	7.0	46.9	10.7	9.1	6.7	48.3	26.5	29.1	55.6	17.2766
Cluster 3	IT177249	243	60.3	141.3	86.2	20.1	8.5	33.7	10.4	9.0	6.6	49.8	32.3	36.8	69.1	25.0825
Cluster 3	IT177332	246	62.0	144.7	83.5	17.8	6.1	38.6	10.1	8.5	6.4	48.2	26.5	29.3	55.8	11.8465
Cluster 3	IT177369	248	59.0	142.3	81.8	19.7	6.8	40.1	10.7	8.9	6.3	47.6	27.0	29.2	56.2	12.8702
Cluster 3	IT177421	249	62.0	142.0	83.2	18.3	6.7	27.8	10.1	8.7	6.6	49.6	29.8	31.8	61.6	17.2075
Cluster 3	IT177443	250	62.0	146.0	86.0	20.0	9.2	38.8	10.5	9.0	6.8	48.7	27.7	30.4	58.1	14.6480
Cluster 3	IT177484	255	62.0	140.0	87.5	20.5	6.5	40.0	10.7	8.7	6.4	47.3	29.8	33.1	62.9	18.7563
Cluster 3	IT177545	258	63.3	137.5	94.8	18.8	8.5	36.5	10.5	8.8	6.2	46.6	19.0	21.2	40.2	14.9041
Cluster 3	IT177567	262	62.0	145.7	79.0	19.4	7.1	44.3	9.8	8.5	6.6	44.0	17.8	21.0	38.8	19.4060
Cluster 3	IT177571	264	60.3	146.0	94.2	17.0	5.7	34.2	9.7	8.5	6.5	47.1	24.1	27.7	51.8	11.1512
Cluster 3	IT177609	266	70.5	145.0	84.8	19.0	6.4	36.3	10.0	8.8	6.8	48.2	26.8	29.5	56.3	14.7655
Cluster 3	IT177664	268	61.7	146.0	88.1	19.2	8.5	37.5	10.5	9.0	6.8	46.7	25.7	29.7	55.5	11.4958
Cluster 3	IT177670	269	64.7	144.3	85.7	19.2	7.1	30.9	9.6	8.1	5.9	49.1	25.9	27.9	53.8	9.2362
Cluster 3	IT177826	274	58.0	154.0	91.4	17.0	6.4	34.7	9.9	8.7	6.6	46.0	20.6	22.8	43.4	17.1767
Cluster 3	IT177835	276	63.0	144.7	85.5	19.8	5.2	28.5	10.7	8.8	7.0	45.9	25.7	28.5	54.2	9.9786
Cluster 3	IT177873	281	64.3	137.0	93.0	18.0	6.7	35.5	10.6	8.8	6.3	48.5	23.9	24.8	48.7	9.3869
Cluster 3	IT177876	282	63.0	138.5	97.2	20.6	7.4	39.8	10.5	8.7	6.7	46.0	21.8	23.7	45.5	14.3085
Cluster 3	IT177890	285	65.0	142.0	81.7	19.0	7.5	44.8	10.6	9.2	7.1	46.3	27.6	28.6	56.2	16.4374
Cluster 3	IT177895	286	62.0	141.7	90.7	17.3	9.1	36.9	10.7	9.1	6.8	47.3	27.1	29.9	57.0	12.2960
Cluster 3	IT177954	294	60.3	149.0	92.0	19.4	8.0	43.7	10.4	9.0	7.1	45.4	21.7	23.7	45.4	16.2164
Cluster 3	IT177974	296	62.7	152.3	84.9	19.2	7.5	37.9	10.0	8.6	6.5	46.8	20.6	23.5	44.1	14.9075
Cluster 3	IT177980	297	61.0	152.7	87.9	19.4	4.9	38.8	10.0	8.8	6.8	47.6	26.0	28.0	54.0	15.8765
Cluster 3	IT177998	299	62.3	148.3	84.3	17.2	5.9	34.9	9.4	8.2	6.6	45.5	26.7	30.3	57.0	13.5484
Cluster 3	IT178004	300	61.3	151.0	78.6	18.6	7.9	39.1	10.2	8.8	6.8	45.1	22.5	23.7	46.2	15.5203
Cluster 3	IT178010	301	61.7	149.3	80.9	18.4	6.4	34.9	10.2	9.0	6.8	47.2	25.8	28.1	53.8	12.7393
Cluster 3	IT178015	302	60.0	147.3	91.8	19.8	7.4	38.6	10.7	8.9	6.3	46.7	25.0	28.0	53.1	12.3314
Cluster 3	IT178020	303	62.0	146.3	88.0	19.5	8.3	38.6	10.1	8.8	6.4	48.2	27.1	31.6	58.7	15.0614
Cluster 3	IT178086	307	62.0	143.0	90.4	17.8	8.7	38.5	10.5	8.9	6.7	45.8	23.2	23.9	47.1	9.0170
Cluster 3	IT178108	309	62.0	141.0	68.6	20.4	6.0	41.1	10.3	9.0	6.5	46.3	26.6	28.5	55.0	20.9498
Cluster 3	IT208787	313	59.0	138.0	82.0	18.8	7.9	33.8	10.0	8.4	6.4	43.7	14.1	13.9	28.0	26.5670
Cluster 3	IT213033	317	52.0	132.0	67.4	12.3	10.5	39.2	9.6	8.3	6.3	45.0	21.1	17.0	38.0	28.3857
Cluster 3	IT215992	318	60.0	145.7	91.5	18.2	8.4	44.9	10.7	9.1	6.9	44.8	26.7	27.2	53.8	16.1723
Cluster 3	IT215992	319	57.5	140.5	91.0	18.6	6.0	30.3	9.3	8.3	6.6	47.2	23.4	24.3	47.6	7.5406
Cluster 3	IT224537	321	51.7	124.7	60.5	15.0	5.9	35.0	10.0	8.3	6.5	46.1	11.4	36.9	48.2	34.5827
Cluster 3	IT252530	324	62.0	149.0	88.5	19.8	8.4	39.1	10.0	8.6	6.5	44.7	22.2	22.8	45.0	13.0083
Cluster 3	IT252541	326	62.7	148.7	92.5	19.6	9.4	37.8	10.6	9.0	6.8	45.1	24.8	25.7	50.5	13.0408
Cluster 3	IT262881	327	65.0	148.7	92.6	18.0	7.8	34.1	9.5	8.5	6.3	45.5	23.6	33.2	56.8	15.6327
Cluster 3	IT262883	330	60.0	153.0	89.0	18.0	6.5	39.1	9.8	8.7	6.9	45.0	16.6	19.3	35.9	21.9509
Cluster 3	IT262894	331	65.0	153.0	73.9	18.8	7.2	26.5	9.3	8.1	6.2	45.6	23.7	23.5	47.2	19.9907
Cluster 3	IT262932	334	63.3	143.0	92.4	19.0	5.4	41.0	10.2	8.9	6.7	45.7	23.7	27.3	51.0	11.4700
Cluster 3	IT263087	338	65.3	132.7	90.2	21.4	8.7	12.5	6.4	6.1	5.0	46.0	21.0	22.0	43.0	24.3986

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 3	IT263088	339	63.0	133.0	92.0	22.2	8.1	13.2	6.7	6.1	4.9	45.4	17.6	17.3	34.8	28.6493
Cluster 3	IT263149	350	67.0	140.7	92.6	18.1	6.5	36.3	10.0	8.7	6.6	45.5	25.0	26.2	51.2	10.4249
Cluster 3	IT263227	352	65.0	141.7	91.0	18.1	5.6	32.3	9.5	8.1	5.9	43.5	15.9	16.3	32.2	22.0923
Cluster 3	IT263228	353	60.0	143.0	81.1	18.9	7.7	12.1	6.5	6.0	4.9	43.7	16.9	16.0	32.9	30.0249
Cluster 3	IT263232	354	60.3	133.0	86.4	21.4	7.3	12.7	6.6	6.2	5.1	43.9	15.7	16.2	31.8	30.6227
Cluster 3	IT263233	355	60.3	134.0	71.7	17.5	4.9	11.4	6.4	6.1	5.0	44.1	15.4	14.8	30.2	35.7500
Cluster 3	IT263235	356	59.3	138.0	83.1	19.3	6.0	12.7	6.3	6.0	5.0	43.6	14.2	14.5	28.7	32.8669
Cluster 3	IT263237	357	63.0	140.7	91.0	18.2	6.6	31.7	7.9	7.1	5.7	43.9	17.2	17.7	34.9	18.6880
Cluster 3	IT263271	358	62.3	143.3	82.2	18.2	8.2	37.0	10.0	8.6	6.6	45.7	26.9	28.6	55.5	10.8836
Cluster 3	IT263297	368	66.0	148.0	87.5	18.4	5.9	36.2	10.2	8.5	6.4	44.7	21.1	22.1	43.2	12.9465
Cluster 3	IT263320	371	64.0	143.3	80.7	18.6	8.3	35.7	10.1	8.7	6.7	43.4	18.7	19.5	38.3	15.8267
Cluster 3	IT263325	373	63.0	142.7	91.8	19.6	8.4	38.0	9.9	8.7	6.5	42.8	20.4	20.5	40.9	14.0690
Cluster 3	IT263331	376	61.0	141.0	85.6	17.5	5.9	32.9	10.3	8.9	6.7	43.9	25.0	25.1	50.1	5.2429
Cluster 3	IT263332	377	61.0	142.0	93.0	20.2	6.0	40.8	10.8	9.0	6.6	43.9	21.0	21.8	42.8	13.8700
Cluster 3	IT263333	378	62.0	142.0	89.1	18.2	6.2	41.2	10.4	9.1	6.8	45.0	24.7	27.4	52.0	10.2389
Cluster 3	IT263340	380	60.0	143.0	82.6	19.2	8.0	12.8	6.5	6.1	5.1	43.6	15.2	20.3	35.5	26.9714
Cluster 3	IT263341	381	60.3	139.7	83.5	21.0	7.2	11.8	6.2	5.9	5.0	43.8	15.9	14.7	30.6	31.8151
Cluster 3	IT263342	382	61.0	143.0	91.2	19.5	6.6	12.8	6.7	6.2	5.1	43.3	14.5	14.0	28.5	33.3474
Cluster 3	IT263374	387	61.0	145.7	75.3	18.8	6.8	41.0	10.1	8.9	6.7	44.6	23.7	25.4	49.1	15.0055
Cluster 3	IT263376	389	64.3	138.0	90.2	19.4	7.3	30.4	9.0	8.1	6.4	43.9	21.2	28.7	49.9	7.1508
Cluster 3	IT263377	391	61.0	146.7	82.6	18.2	6.1	13.5	9.1	8.0	6.1	43.4	21.6	21.7	43.3	22.6130
Cluster 3	IT263518	398	63.0	141.0	83.6	19.4	6.6	40.2	10.6	9.1	6.7	46.6	28.2	30.3	58.5	14.4177
Cluster 3	IT263519	399	63.0	141.0	96.6	20.0	5.8	36.3	10.2	8.7	6.4	43.0	19.9	20.4	40.3	16.3371
Cluster 3	IT263524	400	61.0	141.3	104.7	17.0	4.6	24.0	9.3	7.4	5.7	44.4	18.9	17.8	36.7	26.2470
Cluster 3	IT263527	401	63.0	146.3	89.8	17.6	7.2	38.7	10.5	8.9	6.6	45.9	23.2	25.3	48.5	10.0315
Cluster 3	IT263746	404	60.3	131.7	84.5	19.8	5.6	13.2	6.4	5.8	4.8	45.3	18.9	17.9	36.8	26.8944
Cluster 3	IT263747	405	65.0	134.7	77.1	17.4	7.1	12.6	6.7	6.1	5.0	44.9	16.1	16.6	32.7	31.0507
Cluster 3	IT263747	406	61.0	129.3	84.9	18.9	6.2	11.4	6.4	5.9	4.9	47.3	22.6	22.2	44.8	25.2568
Cluster 3	IT263750	408	61.0	134.7	90.7	20.5	7.4	12.1	6.5	6.0	5.0	46.3	20.2	19.6	39.8	25.4085
Cluster 3	IT263751	409	63.7	132.7	87.3	19.8	7.1	11.8	6.3	5.7	4.6	46.1	19.4	19.1	38.5	26.6196
Cluster 3	IT263752	410	64.3	135.3	80.3	18.0	4.3	13.4	6.3	5.7	4.6	46.2	20.6	20.4	41.0	24.1832
Cluster 3	IT263753	411	58.7	132.7	98.0	19.3	7.4	22.7	8.4	7.9	5.7	46.0	21.7	22.7	44.4	18.6228
Cluster 3	IT263754	413	64.3	133.0	93.8	21.1	8.4	11.8	6.4	6.0	4.9	44.9	17.7	17.1	34.8	30.1817
Cluster 3	IT263755	414	63.0	132.7	100.4	20.4	6.0	12.3	6.2	5.9	4.8	44.0	14.5	13.9	28.4	36.9795
Cluster 3	IT263760	415	63.0	129.3	83.5	20.3	7.9	11.5	6.3	5.8	4.9	45.4	17.8	17.8	35.6	29.7842
Cluster 3	IT263761	416	63.7	138.3	81.3	20.0	8.1	28.6	8.2	7.3	6.1	46.6	24.9	27.8	52.7	9.0171
Cluster 3	IT263762	417	64.3	129.7	92.9	20.7	8.1	13.1	6.5	6.1	5.0	45.0	17.0	15.9	32.9	31.3871
Cluster 3	IT263763	418	63.3	129.7	87.6	21.9	6.9	12.9	6.7	6.2	4.9	45.5	19.4	18.6	38.0	27.1480
Cluster 3	IT263794	420	62.7	140.7	93.6	19.4	6.1	39.5	10.4	8.8	6.6	47.1	24.8	28.8	53.6	11.7764
Cluster 3	IT263794	421	66.0	142.0	85.4	18.4	7.2	39.5	10.5	8.9	6.7	45.7	22.8	25.6	48.4	8.8616
Cluster 3	IT263809	422	52.3	122.3	73.2	15.3	6.3	15.8	6.9	6.3	5.0	46.3	24.9	26.5	51.4	29.7233
Cluster 3	IT263814	425	63.0	129.3	87.4	17.9	5.4	13.5	6.6	5.8	4.7	45.4	18.2	19.7	37.9	26.6066
Cluster 3	IT263815	426	63.0	131.7	85.0	20.0	7.0	11.7	6.2	5.8	4.9	45.2	17.2	16.6	33.7	30.1795
Cluster 3	IT263815	427	68.5	135.0	84.8	18.0	6.0	12.1	6.5	5.7	4.9	46.9	20.0	21.4	41.4	25.0916
Cluster 3	IT263816	428	70.0	140.3	88.5	21.1	5.1	29.9	9.1	8.4	6.6	45.8	20.9	22.9	43.8	12.3263
Cluster 3	IT263817	429	66.0	144.3	85.7	19.0	8.1	41.0	10.4	8.9	6.3	44.7	26.7	27.1	53.8	12.7512
Cluster 3	IT263819	430	61.0	142.7	77.7	15.4	7.8	33.5	9.5	8.0	6.1	47.3	21.0	23.0	44.1	11.4457
Cluster 3	IT263820	431	63.7	143.3	104.8	19.6	5.8	31.4	10.3	8.5	6.4	42.7	11.1	11.5	22.6	37.9866

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 3	IT263821	432	70.0	143.0	88.3	17.2	6.9	21.6	8.0	7.3	5.8	45.1	19.9	19.7	39.6	19.4851
Cluster 3	IT263822	433	63.0	146.0	92.7	18.6	7.2	31.0	9.9	8.6	6.7	43.3	19.2	19.1	38.2	16.9527
Cluster 3	IT263825	435	65.0	152.3	90.6	19.0	7.7	40.1	9.6	8.2	6.6	45.8	22.3	23.3	45.6	16.4106
Cluster 3	IT263828	437	63.0	139.7	83.6	20.0	9.2	11.6	6.1	5.8	4.7	45.0	19.5	18.6	38.1	26.3087
Cluster 3	IT263835	439	63.0	135.7	89.4	20.7	6.7	12.6	6.7	6.2	5.1	43.5	14.4	14.3	28.8	33.1626
Cluster 3	IT263836	440	63.0	129.7	97.0	20.3	5.5	13.4	6.6	6.0	5.0	44.5	17.3	17.2	34.6	30.9575
Cluster 3	IT263837	441	63.0	129.7	85.5	20.2	8.6	11.9	6.4	6.0	4.9	44.2	16.3	16.2	32.4	31.6580
Cluster 3	IT263838	442	62.0	132.7	87.0	20.0	7.1	11.3	6.4	5.9	4.8	44.6	16.7	15.9	32.6	31.0619
Cluster 3	IT263839	443	63.0	133.0	96.4	20.0	7.7	13.3	6.8	6.1	5.0	44.5	16.6	16.4	33.0	31.0073
Cluster 3	IT263849	446	66.0	141.0	92.0	19.2	6.0	38.7	10.7	9.1	6.4	45.4	24.8	26.9	51.6	10.7155
Cluster 3	IT263863	447	63.7	129.3	94.7	21.9	8.0	12.4	6.4	5.9	4.9	44.6	16.6	17.1	33.7	31.7651
Cluster 3	IT263864	448	63.7	129.3	85.1	19.8	8.7	12.3	6.4	6.0	4.9	44.8	16.0	15.9	31.9	31.9577
Cluster 3	IT263868	449	63.7	141.0	85.6	18.8	5.1	34.9	9.2	8.0	6.4	42.8	20.5	20.1	40.6	12.2611
Cluster 3	IT263875	450	61.7	129.7	80.5	20.1	4.3	13.1	6.5	6.0	5.1	44.3	16.6	15.3	31.8	31.9264
Cluster 3	RCS618	451	57.5	136.0	86.2	19.4	5.1	12.9	6.5	6.0	5.1	43.8	14.1	15.8	29.9	31.7400
Cluster 3	RCS620	453	57.5	136.0	93.6	18.0	4.8	13.0	6.2	6.0	5.2	43.0	11.8	11.9	23.7	38.5588
Cluster 3	RCS628	454	45.5	136.0	77.6	16.8	4.8	31.6	9.6	8.2	7.0	45.3	15.1	16.3	31.4	28.3998
Cluster 3	RCS639	458	57.5	135.5	92.4	19.0	4.6	12.0	6.0	5.8	4.8	42.8	13.7	13.6	27.3	35.6152
Cluster 3	RCS1102	460	57.5	140.5	88.2	18.8	4.7	11.9	6.3	6.0	5.0	43.6	15.5	15.6	31.1	31.3547
Cluster 3	RCS0902F	464	57.5	136.0	88.2	18.6	5.3	34.4	10.4	8.8	6.9	43.4	12.8	14.7	27.5	27.2435
Cluster 3	RCS0906	465	48.0	134.5	55.6	15.8	4.7	19.4	8.2	6.7	5.1	45.4	17.1	16.8	33.8	41.0656
Cluster 3	IT216312	466	55.5	140.5	87.0	18.0	4.7	35.6	10.4	9.0	6.9	43.8	16.9	21.1	38.0	15.2614
Cluster 3	IT224515	467	45.5	124.5	57.8	15.0	5.6	30.9	9.8	8.1	6.4	45.5	7.7	35.9	43.6	40.0401
Cluster 3	Cheonja 3	468	50.3	127.7	74.2	16.4	4.7	38.7	10.5	8.6	7.0	44.3	16.5	17.8	34.3	27.9275
Cluster 3	Cheonja	470	48.0	128.3	77.7	15.9	5.0	41.5	10.3	8.6	6.6	43.4	12.8	13.9	26.7	34.8676
Cluster 4	IT196847	77	62.0	140.3	100.9	19.2	6.0	44.1	11.2	9.3	6.7	47.7	24.9	27.4	52.3	9.4847
Cluster 4	IT177712	80	60.3	139.7	102.7	19.8	7.4	38.7	10.6	8.8	6.5	47.7	18.6	21.8	40.4	18.1131
Cluster 4	IT177829	82	60.7	142.3	93.4	18.8	9.7	39.4	10.4	8.8	6.7	49.0	27.6	30.8	58.3	13.8338
Cluster 4	IT177832	84	63.7	139.3	88.5	19.4	7.4	36.5	10.0	8.9	6.4	50.0	30.7	37.9	68.6	24.6399
Cluster 4	IT177832	85	63.0	139.7	94.9	18.9	5.8	36.5	10.4	8.9	6.6	47.6	24.8	28.7	53.5	11.1847
Cluster 4	IT194568	98	63.3	140.7	108.3	20.2	5.2	42.3	10.2	8.8	6.5	47.0	21.8	25.4	47.1	11.2414
Cluster 4	IT195330	99	59.3	137.0	97.7	20.0	6.2	40.2	10.3	8.8	6.7	47.4	24.0	27.7	51.7	11.1692
Cluster 4	IT195330	100	64.0	139.7	95.3	20.7	8.7	40.7	10.5	9.0	6.7	47.2	23.3	26.9	50.1	12.7724
Cluster 4	IT196848	101	63.0	140.3	104.4	19.9	7.5	33.7	10.1	8.5	6.0	46.9	22.5	25.4	47.9	9.2898
Cluster 4	IT178751	107	62.3	146.0	101.2	20.0	6.6	38.2	10.4	8.7	6.3	46.8	22.8	25.4	48.2	9.8313
Cluster 4	IT186084	110	62.0	141.3	99.2	19.8	6.1	42.8	10.3	8.6	6.3	48.1	27.0	30.8	57.8	9.5978
Cluster 4	IT186163	111	63.0	140.7	99.4	20.2	5.8	40.1	11.0	9.2	6.7	45.7	20.9	24.0	44.8	14.1148
Cluster 4	IT186226	115	63.0	139.3	99.4	18.8	6.3	41.7	10.1	8.9	6.9	48.2	26.7	31.9	58.6	9.8471
Cluster 4	IT105500	117	65.7	138.7	96.1	20.9	5.8	41.6	10.8	9.2	6.5	47.6	24.8	28.9	53.7	11.7450
Cluster 4	IT143119	120	64.3	139.7	95.1	19.8	5.6	41.8	11.0	9.2	6.8	47.0	23.7	26.6	50.2	13.2284
Cluster 4	IT143174	121	63.7	139.7	98.4	20.6	5.7	43.9	10.9	9.1	6.7	48.7	28.8	33.0	61.8	13.7620
Cluster 4	IT160157	123	62.7	138.3	104.9	19.8	7.5	40.5	10.8	9.1	6.8	47.4	26.8	29.6	56.4	6.1162
Cluster 4	IT175866	126	61.0	144.7	95.1	18.4	7.0	42.6	10.7	9.0	6.7	48.3	28.0	30.7	58.7	13.3710
Cluster 4	IT177439	127	63.0	143.7	96.0	20.2	9.2	42.8	10.6	9.0	7.0	48.4	27.8	30.1	57.9	12.3723
Cluster 4	IT177852	128	64.3	144.0	98.9	20.7	6.4	40.5	10.0	8.8	6.5	47.2	25.1	28.2	53.3	8.1178
Cluster 4	IT186101	132	58.3	141.7	121.9	25.9	8.2	34.0	9.6	8.2	6.9	50.5	31.3	35.4	66.8	23.7584
Cluster 4	IT189254	136	65.3	143.7	93.2	20.3	8.6	40.4	10.7	9.2	6.6	47.6	26.4	28.7	55.1	13.4121
Cluster 4	IT194547	138	60.0	148.3	100.0	21.6	6.8	35.2	10.4	8.9	6.7	49.2	27.1	29.7	56.7	9.4473

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 4	IT195624	141	62.7	141.3	100.4	19.4	6.3	38.2	10.6	9.1	6.8	47.1	24.0	26.1	50.1	7.9593
Cluster 4	IT196845	145	61.7	143.0	100.4	19.6	6.9	38.3	10.0	8.4	6.1	49.4	28.8	31.8	60.6	9.4191
Cluster 4	IT209356	150	63.0	139.7	116.7	21.6	6.0	37.9	10.4	8.8	6.6	47.0	24.5	26.4	50.9	12.6574
Cluster 4	IT210088	151	63.3	140.0	102.1	20.0	6.7	41.1	10.7	8.8	6.4	47.5	24.3	27.4	51.7	7.0166
Cluster 4	IT219702	152	63.3	137.7	93.2	18.8	6.6	38.9	10.8	9.1	6.7	48.1	27.7	29.9	57.5	14.0217
Cluster 4	IT219707	153	60.0	144.0	110.9	20.0	6.3	35.5	10.0	8.6	6.5	48.6	27.3	30.6	57.9	7.6615
Cluster 4	IT224177	155	61.0	141.3	106.6	20.5	8.5	44.4	10.3	8.9	6.6	48.4	28.8	33.9	62.7	12.7766
Cluster 4	IT224177	156	65.0	138.7	105.2	20.5	5.0	38.3	10.2	8.8	6.5	47.6	26.3	29.7	55.9	5.3081
Cluster 4	IT224415	159	62.0	140.0	102.3	20.7	5.3	37.3	10.7	9.1	6.8	47.2	25.0	27.4	52.3	5.4244
Cluster 4	IT228629	160	64.3	141.0	99.8	20.4	7.7	35.3	9.5	8.2	6.8	48.6	24.1	25.8	49.9	9.0013
Cluster 4	IT177440	164	64.0	151.7	99.3	19.4	8.3	39.8	10.3	8.6	6.2	47.4	23.4	27.0	50.5	12.8162
Cluster 4	IT177472	165	61.0	143.7	100.8	19.0	7.5	41.1	10.3	7.8	5.7	47.6	25.9	29.3	55.2	6.8873
Cluster 4	IT177854	167	61.3	148.3	95.8	19.2	6.4	40.9	10.5	8.7	6.5	46.7	23.6	25.5	49.1	13.9989
Cluster 4	IT177888	169	63.0	142.7	94.5	18.7	8.7	44.2	10.6	9.0	6.6	48.2	25.6	35.1	60.7	15.8159
Cluster 4	IT177888	170	63.0	143.3	99.7	20.9	7.5	41.7	10.6	9.1	6.8	46.4	24.5	27.0	51.5	8.7297
Cluster 4	IT177915	171	64.3	142.3	102.2	21.0	7.1	42.4	10.3	8.7	6.5	47.3	28.3	30.9	59.1	8.7723
Cluster 4	IT177938	173	63.7	143.7	97.0	19.0	9.0	43.4	10.3	8.8	6.5	45.8	22.2	23.9	46.1	15.4209
Cluster 4	IT177978	175	64.3	140.0	97.2	19.4	4.6	35.6	10.4	8.9	6.8	48.1	28.3	30.5	58.8	10.7036
Cluster 4	IT180860	178	65.0	143.7	105.3	19.3	8.0	46.2	10.9	9.2	6.6	47.3	22.3	26.4	48.6	12.2501
Cluster 4	IT186040	180	63.7	141.3	113.4	20.6	5.4	39.7	10.4	8.8	6.6	47.3	24.8	27.6	52.4	9.1040
Cluster 4	IT186138	182	65.0	142.3	103.8	19.2	8.4	46.3	10.9	9.3	6.6	47.0	22.6	24.5	47.1	13.7379
Cluster 4	IT189259	187	61.3	138.0	101.1	20.5	5.7	41.0	9.9	8.7	6.5	46.5	21.8	24.8	46.6	12.4861
Cluster 4	IT191169	190	62.3	149.3	94.1	19.6	7.5	42.0	10.3	8.7	6.6	47.4	24.3	27.4	51.8	14.7329
Cluster 4	IT175792	199	64.3	137.7	120.6	21.1	4.7	28.8	8.3	7.5	5.9	47.7	26.3	27.9	54.2	18.2627
Cluster 4	IT175818	200	62.0	139.7	95.0	19.9	7.4	40.9	9.9	8.5	6.3	47.3	26.7	29.7	56.4	11.8358
Cluster 4	IT177926	203	64.3	141.0	111.6	21.2	6.3	31.0	8.9	8.1	6.4	51.2	28.6	30.7	59.3	11.4848
Cluster 4	IT178116	204	63.7	148.7	95.1	19.2	7.9	32.8	9.8	8.6	6.7	48.4	26.5	29.8	56.3	13.2371
Cluster 4	IT180851	205	63.7	145.0	100.3	18.8	6.8	37.9	9.5	8.3	5.7	47.5	23.6	26.3	49.9	8.5763
Cluster 4	IT180852	206	63.7	142.7	102.9	19.6	8.0	37.1	10.2	8.5	6.8	48.9	26.9	30.9	57.8	5.3255
Cluster 4	IT180857	207	62.7	141.0	92.0	18.8	6.1	38.3	10.0	8.6	6.4	49.0	28.7	33.0	61.7	16.3398
Cluster 4	IT181665	208	62.7	139.7	101.1	18.4	7.5	38.0	10.3	8.5	6.0	48.2	28.2	33.4	61.6	10.3035
Cluster 4	IT181941	210	62.7	147.7	97.9	19.0	6.8	41.4	10.5	8.8	6.6	47.4	22.6	24.1	46.7	14.3191
Cluster 4	IT181945	211	62.0	143.0	98.4	18.8	7.6	40.2	10.5	8.8	6.8	47.4	25.1	26.6	51.6	9.0476
Cluster 4	IT181945	212	62.7	147.7	99.4	19.4	8.0	37.5	10.3	8.9	6.9	48.5	28.0	30.6	58.6	9.7471
Cluster 4	IT186149	213	65.3	145.7	105.0	19.0	7.6	30.3	9.7	8.4	6.6	48.2	19.5	20.4	39.9	19.9223
Cluster 4	IT189215	216	62.3	142.3	96.2	20.0	7.1	39.2	10.5	8.7	6.2	49.8	28.4	32.0	60.4	12.2204
Cluster 4	IT189225	217	61.3	148.7	99.0	18.7	7.5	38.3	10.0	8.7	6.4	48.0	24.0	27.3	51.2	10.2969
Cluster 4	IT191115	218	60.7	143.7	96.0	19.8	8.4	38.0	10.2	8.8	6.8	49.7	29.8	31.9	61.7	13.5500
Cluster 4	IT208522	224	63.0	148.3	94.4	21.2	8.9	39.0	10.4	8.9	6.8	47.6	24.7	27.1	51.8	13.5247
Cluster 4	IT208522	225	67.0	151.0	99.2	19.8	6.4	40.4	10.8	9.1	6.9	46.3	21.0	22.6	43.6	18.2525
Cluster 4	IT213320	226	62.3	149.3	102.3	20.8	7.4	36.8	10.4	9.0	6.9	47.6	23.5	26.2	49.7	9.8478
Cluster 4	IT219700	229	67.7	146.0	116.5	19.2	6.6	27.7	9.5	8.3	6.3	49.5	24.6	27.0	51.6	16.3649
Cluster 4	IT103162	234	62.0	144.7	91.0	19.4	8.6	37.8	10.2	8.8	6.3	49.8	30.7	36.2	66.9	21.3243
Cluster 4	IT162905	239	62.7	146.0	99.7	21.1	6.9	39.6	10.6	9.0	6.8	47.4	23.9	25.9	49.8	9.6362
Cluster 4	IT177254	244	60.0	145.0	93.2	19.3	8.0	39.9	10.0	8.8	6.5	50.9	31.7	36.2	67.9	21.3041
Cluster 4	IT177466	252	62.0	148.3	94.4	20.6	7.3	39.6	10.2	8.7	6.6	47.9	27.0	29.0	56.0	13.1226
Cluster 4	IT177475	254	62.5	144.7	91.2	20.3	8.3	38.1	9.9	8.6	6.5	48.0	31.6	33.0	64.6	19.2003
Cluster 4	IT177503	256	63.3	142.7	93.4	19.7	7.0	35.9	10.3	8.7	6.5	46.3	27.8	28.6	56.4	12.6860

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 4	IT177543	257	60.0	139.0	97.3	16.0	6.6	37.9	10.2	8.9	6.4	47.7	30.4	33.9	64.2	15.5711
Cluster 4	IT177549	259	63.3	151.0	93.8	19.2	8.9	39.1	10.1	8.8	6.8	46.3	27.3	29.0	56.2	15.1718
Cluster 4	IT177558	260	60.0	143.0	101.1	18.8	6.4	34.8	10.0	8.6	6.8	46.1	24.8	26.9	51.7	7.0220
Cluster 4	IT177562	261	62.7	143.7	106.3	20.0	6.2	36.3	10.6	9.0	7.0	45.5	25.2	27.1	52.2	4.2682
Cluster 4	IT177567	263	66.0	144.0	92.1	19.0	7.7	39.7	10.6	9.1	7.0	46.4	29.1	30.3	59.4	15.6544
Cluster 4	IT177609	265	62.0	141.0	100.4	19.4	7.8	38.3	10.7	9.4	6.6	47.4	23.6	28.6	52.2	6.4767
Cluster 4	IT177616	267	58.5	145.3	98.1	18.0	5.6	42.4	10.6	8.6	6.5	48.3	29.2	32.3	61.5	13.7048
Cluster 4	IT177716	270	60.0	145.5	97.8	20.0	6.0	39.5	10.4	8.8	6.7	47.5	21.5	24.8	46.3	13.6714
Cluster 4	IT177716	271	62.0	156.0	94.4	19.8	6.2	36.4	10.1	8.7	6.4	47.6	23.8	26.4	50.2	18.4378
Cluster 4	IT177778	272	61.3	150.7	96.5	18.4	6.3	32.4	9.9	8.6	6.8	48.1	23.6	27.6	51.2	13.9162
Cluster 4	IT177818	273	61.7	155.0	103.3	19.6	5.9	37.2	10.2	8.5	6.6	45.0	21.9	22.8	44.7	17.9800
Cluster 4	IT177835	275	62.7	148.0	99.0	19.0	5.5	38.6	10.1	8.7	7.2	45.8	21.7	24.1	45.8	14.1430
Cluster 4	IT177836	277	60.0	142.3	95.5	19.8	6.4	40.6	10.7	8.9	6.8	46.4	26.5	29.6	56.1	11.2045
Cluster 4	IT177857	278	60.0	142.7	96.8	19.5	5.3	35.1	10.2	8.9	7.0	45.8	28.1	31.2	59.3	11.1563
Cluster 4	IT177861	279	60.0	144.7	105.9	19.6	7.7	39.9	10.3	8.9	6.6	46.1	27.1	28.6	55.6	5.3461
Cluster 4	IT177863	280	62.0	141.7	91.7	18.8	6.3	38.4	9.8	8.7	6.5	47.2	28.2	32.3	60.4	15.7016
Cluster 4	IT177878	283	63.3	143.0	100.3	21.4	7.6	36.1	11.2	8.9	6.6	44.4	23.1	24.2	47.3	11.2460
Cluster 4	IT177897	287	60.3	140.3	104.7	19.0	6.9	38.7	10.7	9.1	6.6	46.7	29.3	33.4	62.6	10.5688
Cluster 4	IT177898	288	62.0	141.3	113.2	22.1	7.7	38.9	10.2	8.9	6.6	46.3	27.3	30.1	57.5	9.1533
Cluster 4	IT177902	289	63.7	144.7	102.2	20.2	6.2	37.4	10.4	8.8	6.5	47.3	31.2	33.7	64.9	13.3639
Cluster 4	IT177904	290	63.0	142.7	98.0	20.0	6.5	40.3	10.9	8.8	6.6	47.9	27.4	30.6	58.0	9.3277
Cluster 4	IT177907	291	64.3	144.7	92.9	18.8	7.9	40.0	10.6	9.1	6.7	46.2	27.4	30.8	58.2	14.1860
Cluster 4	IT177914	292	62.0	143.7	110.7	20.8	7.6	44.1	10.8	9.1	6.7	44.9	22.8	24.6	47.5	12.9289
Cluster 4	IT177917	293	63.0	149.3	92.3	20.0	6.9	38.5	10.3	8.9	7.0	47.0	28.0	30.0	58.0	15.6580
Cluster 4	IT177958	295	63.7	150.0	94.2	17.0	6.4	34.6	10.2	8.6	6.7	47.6	26.2	31.4	57.6	14.6976
Cluster 4	IT178031	304	62.0	138.7	93.5	20.1	7.1	41.0	10.6	9.0	6.5	45.7	27.4	28.9	56.3	13.6430
Cluster 4	IT178034	305	61.0	140.7	95.0	19.4	8.0	44.1	10.6	9.0	6.9	46.5	29.9	32.0	61.9	15.8822
Cluster 4	IT178045	306	62.0	143.0	94.4	19.0	7.4	37.3	10.3	8.9	6.7	47.2	27.2	30.5	57.7	11.8749
Cluster 4	IT178108	308	63.7	139.0	91.2	19.8	7.2	39.5	10.2	8.7	6.5	48.3	28.9	31.9	60.8	16.8611
Cluster 4	IT180856	310	63.0	143.7	91.8	19.3	7.4	40.4	10.4	9.0	6.6	46.6	27.7	30.4	58.1	14.9412
Cluster 4	IT186133	311	62.0	142.7	94.5	18.8	7.9	37.2	10.3	8.8	6.5	47.5	29.2	30.5	59.7	12.9780
Cluster 4	IT208786	312	62.0	141.0	99.8	20.4	6.4	34.4	10.2	8.6	6.2	46.0	25.2	28.3	53.5	6.7882
Cluster 4	IT208787	314	62.0	140.3	103.9	19.6	6.0	40.5	10.5	9.0	6.6	45.7	26.1	29.2	55.3	4.9804
Cluster 4	IT212805	316	61.0	143.0	91.9	20.3	6.9	39.7	10.3	9.1	6.5	47.3	30.1	31.8	61.9	16.7081
Cluster 4	IT252498	323	62.0	141.7	112.2	18.2	6.4	43.8	10.8	9.1	6.8	46.1	25.4	28.5	53.9	9.9685
Cluster 4	IT252540	325	62.0	149.0	96.5	19.4	8.2	40.1	10.2	8.8	6.6	46.8	28.2	30.3	58.5	12.7622
Cluster 4	IT262882	328	65.7	155.3	100.9	18.8	7.4	29.5	9.7	8.2	5.9	44.9	19.2	21.3	40.5	23.7206
Cluster 4	IT262882	329	68.0	151.7	102.0	20.6	7.4	34.2	10.1	8.7	6.5	44.9	21.4	22.2	43.6	18.1853
Cluster 4	IT262931	333	62.7	143.5	97.6	19.8	7.6	41.1	10.4	8.6	6.3	47.9	27.3	31.7	59.0	10.5496
Cluster 4	IT262962	336	63.0	149.0	105.2	18.4	6.2	41.4	10.1	8.7	6.7	46.6	24.5	27.1	51.6	9.0525
Cluster 4	IT263081	337	66.3	145.3	96.3	20.6	8.5	36.5	10.3	8.6	6.3	45.7	22.8	25.1	47.9	13.5450
Cluster 4	IT263100	340	61.0	143.0	90.7	19.9	8.8	39.0	10.8	9.0	6.7	47.5	30.4	33.0	63.4	18.6795
Cluster 4	IT263117	341	64.3	143.0	97.0	20.6	6.9	40.7	10.3	8.7	7.0	47.3	29.0	32.0	61.0	12.3594
Cluster 4	IT263127	342	63.0	142.0	110.0	21.6	8.5	42.9	10.7	9.1	6.7	46.7	25.4	26.9	52.4	8.5929
Cluster 4	IT263129	343	67.3	142.0	104.5	17.0	7.1	22.7	7.8	7.4	5.8	45.2	18.1	19.4	37.5	26.3125
Cluster 4	IT263130	344	63.0	142.0	100.0	20.3	8.6	40.0	10.1	8.7	6.5	44.8	21.7	22.2	43.8	15.2131
Cluster 4	IT263130	345	65.0	143.0	102.4	18.5	6.9	40.4	10.2	8.8	6.5	47.3	27.5	29.4	56.9	6.4287
Cluster 4	IT263142	346	63.7	143.0	96.4	18.8	8.3	39.0	10.3	8.8	6.5	46.4	25.2	28.3	53.5	9.8286

Supplementary Table 1. Continued

Group	IT number	Entry number	Flowering	Harvesting	Plant height	Number of nodes	Number of branches	Seed weight	Seed length	Seed width	Seed thickness	lutein (µg/g)	chlorophyll b (µg/g)	chlorophyll a (µg/g)	Total chlorophyll (µg/g)	DISTANCE
Cluster 4	IT263144	347	63.0	142.0	96.3	17.6	6.6	45.0	10.0	8.8	6.8	45.5	23.7	26.2	49.9	13.9383
Cluster 4	IT263148	348	63.0	141.0	95.1	20.1	6.0	39.6	10.4	8.9	6.8	47.7	28.2	29.9	58.1	11.8522
Cluster 4	IT263149	349	63.0	142.0	110.9	21.4	6.6	41.0	10.2	8.7	6.6	46.5	27.9	30.1	57.9	8.1741
Cluster 4	IT263227	351	61.7	138.0	151.6	21.6	6.4	28.2	9.6	8.2	5.7	46.9	25.3	26.9	52.2	47.2904
Cluster 4	IT263271	359	65.0	148.0	102.6	19.6	6.3	38.7	10.4	8.9	6.9	45.4	24.9	26.1	51.0	8.8035
Cluster 4	IT263274	360	64.3	150.0	99.4	19.0	8.0	39.0	10.1	8.8	6.9	44.5	24.9	25.1	50.0	12.3815
Cluster 4	IT263284	363	65.0	144.3	103.0	18.5	6.9	31.2	9.6	8.4	6.5	47.7	30.5	33.4	63.9	13.5123
Cluster 4	IT263284	364	66.0	143.3	102.7	19.6	8.2	38.5	10.4	8.6	6.1	44.0	22.0	24.5	46.5	11.6975
Cluster 4	IT263285	365	64.3	143.3	109.7	20.8	5.4	31.1	9.6	8.0	6.3	48.4	28.7	29.6	58.3	9.2892
Cluster 4	IT263294	366	65.0	145.0	102.6	19.8	9.7	32.3	9.4	8.3	6.5	46.8	28.1	32.0	60.1	9.9047
Cluster 4	IT263294	367	70.5	144.3	104.4	20.8	9.1	31.8	9.6	8.4	6.5	45.0	22.7	23.1	45.8	15.1978
Cluster 4	IT263319	369	61.0	145.3	100.2	19.2	5.2	42.7	10.4	9.0	6.6	47.0	28.8	32.0	60.8	11.5418
Cluster 4	IT263319	370	65.0	144.7	115.3	20.8	4.2	41.0	10.0	8.6	6.4	44.5	23.5	24.9	48.4	14.1379
Cluster 4	IT263324	372	63.0	141.0	99.2	18.8	6.6	38.5	10.5	8.6	6.5	45.5	26.8	29.9	56.8	7.5549
Cluster 4	IT263373	386	61.0	145.7	111.0	20.0	7.4	39.0	9.9	8.8	7.2	43.9	18.9	20.3	39.2	20.5006
Cluster 4	IT263378	392	61.0	142.0	96.9	18.8	5.8	38.8	9.8	8.4	6.5	46.2	26.9	27.3	54.1	9.5872
Cluster 4	IT263379	393	61.0	138.0	104.8	19.9	6.6	31.9	9.7	8.4	6.7	47.7	29.3	31.6	60.8	10.4210
Cluster 4	IT263504	394	63.0	141.0	87.4	19.6	6.3	37.8	9.9	8.6	6.6	48.0	34.6	37.7	72.2	28.2612
Cluster 4	IT263511	395	63.0	141.0	100.7	19.4	6.4	38.1	10.1	8.7	6.3	46.6	30.2	33.0	63.2	11.8109
Cluster 4	IT263517	397	60.0	132.0	133.3	23.5	5.9	34.1	9.8	8.2	6.3	45.4	23.6	26.9	50.4	30.6224
Cluster 4	IT263733	402	63.0	142.3	95.1	18.8	7.0	42.5	9.9	8.5	6.8	47.5	24.9	29.7	54.5	11.8942
Cluster 4	IT263745	403	64.7	145.3	109.6	20.4	7.9	30.7	9.6	7.9	6.0	46.1	24.6	25.6	50.1	10.4125
Cluster 4	IT263749	407	63.0	139.0	93.5	18.9	3.8	29.2	9.1	7.9	6.1	50.1	31.1	35.0	66.0	20.7834
Cluster 4	IT263753	412	66.0	145.7	94.4	17.2	8.4	28.1	8.7	8.1	6.3	47.6	27.6	30.1	57.8	15.9718
Cluster 4	IT263767	419	57.7	129.3	149.3	23.2	7.0	22.5	7.8	6.8	5.6	50.9	26.7	28.6	55.3	48.5532
Cluster 4	IT263811	423	63.0	143.3	95.2	17.9	7.4	29.5	10.5	9.1	6.7	45.6	26.2	28.9	55.1	13.1641
Cluster 4	IT263811	424	63.0	143.3	99.4	18.5	7.1	30.4	10.0	8.9	6.8	47.4	27.0	30.5	57.5	9.8611
Cluster 4	IT263825	434	62.0	147.3	95.0	20.4	5.9	40.2	10.2	8.8	6.9	46.2	26.4	27.9	54.3	12.3099
Cluster 4	IT263826	436	63.0	141.3	99.0	19.4	9.5	42.1	10.6	9.0	6.6	46.9	24.9	27.7	52.6	9.2958
Cluster 4	IT263832	438	63.0	138.0	104.8	20.3	5.6	37.8	9.9	8.7	5.9	45.6	26.4	29.4	55.8	5.3234
Cluster 4	IT263842	444	52.3	125.0	114.6	23.6	5.4	9.1	7.1	5.5	4.4	54.0	33.1	32.2	65.3	39.1727
Cluster 4	RCS619	452	58.0	140.0	97.6	19.0	5.2	33.8	10.0	8.7	6.8	45.8	23.1	27.1	50.2	11.5759
Cluster 4	RCS633	455	57.5	141.5	109.0	21.2	3.3	37.5	11.0	8.9	6.9	43.4	8.8	43.1	51.9	22.9625
Cluster 4	RCS636	456	59.5	140.0	101.0	20.2	5.1	16.1	6.9	6.4	5.4	47.7	27.5	29.1	56.6	22.3482
Cluster 4	RCS637	457	59.5	136.0	106.2	21.0	5.5	16.2	6.9	6.3	5.4	50.6	34.9	38.0	72.9	31.8513

Flowering: flowering days from planting (about 50% of flowering)

Harvesting: harvesting days from planting

Seed weight: weight of 100 seeds

Lutein ~ Total chlorophyll: contents in cotyledon removed seed coats