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Developing confectionery sunflower hybrids and determination of their yield performances in different environmental conditions

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ABSTRACT

Confectionery type sunflower grows generally in Eastern and Middle Anatolia in Turkey but there is no certified seed in the production which have white color with grey stripe. The study covered the confectionery sunflower hybrids developed in Confectionery Sunflower Breeding Project conducted by Trakya Agricultural Research Institute, Edirne, Turkey. The candidate confectionery hybrids were tested and evaluated in the regional yield trials in Trakya Region in 2009-2010. Seed yield, 1000 seed weight, flowering and physiological maturity period, plant height, head diameter, oil content were measured. Based on trial results; some experimental hybrids exhibited higher performance than controls for both for seed yield and seed weight and promising candidate hybrids were selected to send to registration trials. From these promising hybrids, 09 TRÇ 003 and 09 TRÇ 004 confectionery hybrid were sent to registration trials in 2011 2012, respectively and production permission were obtained for them. After evaluation of candidate hybrids in these years, having higher general combining inbred lines were also sent to National Registration Office for registration too. In 2010; two female line and three restorer (male) lines were sent to registration. In 2011; one female and one male line sent for DUS tests and then registration in 2012.

Keywords: sunflower, confectionery hybrid, inbred line, seed yield, seed quality

Introduction

Although sunflower grows mainly for producing vegetable oils in the world, it is one of the most preferred confectionery seed in Turkey, in Eastern Europe, US, Canada and also in some Asian countries such China, Pakistan, Iran, Middle East countries, etc.. They generally are white color with grey stripes (however black ones are also popular in Slavic countries), and larger than the oil-type, with a lower oil percentage (Hladni et al., 2012; Kaya, 2002, 2004; Kaya et al., 2008, 2009, 2013; Gontcharov, 2011; Kholghi, 2011; Nabloussi, 2011; Crnobarac et al., 2014; Gholinezhad et al., 2014; Velasco et al., 2014). However, bigger size is the most preferable character by customers in confectionery sunflower so 1000 seed weight and seed sizes are higher interests in the confectionery breeding in addition to seed yield. In the confectionary sunflower sectors; highest quality seeds including the largest and cleanest seeds are used for snack and hulled sunflowers are seeds that are still food-grade quality, but they do not possess the characteristics to be in the food-grade category and smaller and lower quality seeds are used for birdseed (Evci et al., 2011; Nabloussi, 2011; Velasco et al., 2014).

Sunflower which is the most consuming snack in Turkey is growing both for producing vegetable oil and also for confectionery seed in manly Middle and Eastern Anatolia, Southern Marmara and Agean Regions of Turkey. However, there is

big problem on high quality seed because there is no certified seed and not more registered hybrids in the market. Turkish people prefer to consume commonly confectionery sunflower seed as bigger sizes, white color with grey stripes and the price is higher in recent years due to higher demand both for domestic market and also export potential to Europe and Middle East. Therefore Turkish confectionery sunflower production reached to 100,000 MT in recent years (Kaya et al., 2009; 2013). The aim of the study was to determine of yield and seed quality performances of hybrids in confectionery sunflower to supply promising cultivars for sector.

Materials and methods

Confectionery sunflower hybrid breeding research was started in National Sunflower Project conducted by Trakya Agricultural Research Institute, Edirne, Turkey in 2001. The experiments in the study were conducted in Lüleburgaz and Edirne locations under this project to develop confectionery sunflower hybrids and lines in 2009 and 2010. In the trials, the obtained hybrids were also tested to evaluate general and specific combining ability of inbred lines. The trials were conducted in rain fed irrigated conditions in Lüleburgaz and irrigated conditions in Edirne location. In each year and each location, two regional yield trials were conducted in the study. Total 64 candidate hybrids were included in 2009 and 56 candidates in 2010 with three controls. Suriye population- village population, Çiğdem- an open pollinated variety, Palanci-1- first registered confectionery hybrid in Turkey, and Marker -a commercial hybrid were included as controls in the yield trials.

The experimental design was a Randomized Complete Block Design with four replications. The four rows plots were 7,5 m long with the 70 x 45 cm plant spacing. The middle 2 rows were harvested and the border rows were discarded, and plot size was 4.16 m² at harvest. Trials were planted mostly in mid April and harvested mostly in mid September by hand in each year. Seed yield (kg ha^{-1}), 1000 seed weight (g), flowering and physiological maturity (days), plant height (cm), head diameter (cm), oil content (%) were measured. The data were analyzed statistically with JUMP program.

Results

Many candidate confectionery sunflower hybrids exhibited higher yield and quality performances in both years and locations in the study (Tables 1 to 12).

They were analyzed not only for seed yield, but also seed weight, diameter and height and color too because Turkish market request as much as bigger size and whiter color. Based on the study results, similar performances were attained by same candidate hybrids both under irrigated and non-irrigated conditions in the regional experiments. For instance, while 09 TRC 30, 09 TRC 32, 09 TRC 36, 09 TRC 32 and 09 TRC 41 hybrids existed in first five ranks in the Edirne location and same candidates kept higher performances with ranking in top positions in Luleburgaz location too (Tables 1 and 2).

While some candidates revealed higher seed yield performance over 40% than control in the trials, many candidates had also higher 1000 seed weight than controls too. Furthermore, most of the candidates had over 100 g weights which was acceptable point for confectionery market. The study results indicated that the candidates could attain enough seed weight and higher quality for preferable level by customers and also higher seed yield potential for growers, if they could be grown in suitable conditions. On the other hand, almost all candidates had lower oil contents such as around 30% as requested for confectionery sector (less than 30%). Promisingly, many candidates had not higher plant heights which are characteristics of confectionery types and had higher head diameters than controls.

Discussion

The promising results indicated that the success of selection in the National program. After analyzing all seed yield and quality and morphological data of trials, promising hybrids were selected. From these promising hybrids, 09 TRÇ 003 (96171 A X 9892 R) (09TR51 in Tables 3 and 4) were sent in 2011 and 09 TRÇ 004 (9707 A X 9881 R) (09 TRC 30 in Tables 1 and 2) confectionery hybrid were sent registration trials in 2012 production permission were obtained for them. After evaluation of candidate hybrids in these years, hybrids involving higher general combining inbred lines as parents were also sent to National Registration Office for registration too. In 2010; 08-9322-29-A-ÇRZ female line and, 08-9640-1-R-ÇRZ, 08-9717-4-R-ÇRZ, 08-9775-23-R-ÇRZ restorer (male) lines were sent to registration. In 2011; 96171-A ÇRZ female line and 9892-R ÇRZ male line and, 9707-A female and 9881-R male lines sent for DUS tests and then registration in 2012.

Table 1. Confectionery type hybrids in Yield Trial-2 at Edirne in 2009

Hybrids	Seed Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 45	2443.0	1	140.3	29.0	97.16	70	94	152	15
09 TRC 33	2339.0	2	134.3	28.7	110.70	64	93	148	17
09 TRC 30	2325.0	3	133.5	26.7	106.40	67	100	153	15
09 TRC 41	2298.0	4	132.0	34.4	74.48	68	99	135	17
09 TRC 32	2233.0	5	128.3	30.4	85.67	69	96	149	13
09 TRC 36	2174.0	6	124.9	31.7	106.58	63	97	139	18
09 TRC 39	2158.0	7	124.0	31.4	98.87	64	93	152	16
09 TRC 27	2051.0	8	117.8	28.0	71.83	65	98	134	14
09 TRC 31	2022.0	9	116.1	32.0	92.87	68	94	153	16
09 TRC 35	2017.0	10	115.9	30.6	96.66	64	96	136	15
09 TRC 23	1976.0	11	113.5	31.1	85.13	68	95	169	17
09 TRC 25	1975.0	12	113.4	33.8	80.55	71	100	116	15
ÇİĞDEM-1(C)	1901.0	13	109.2	29.3	89.06	70	102	169	18
09 TRC 37	1886.0	14	108.3	30.2	89.44	67	92	137	18
09 TRC 24	1863.0	15	107.0	34.9	90.00	67	94	129	14
PALANCI 1(C)	1698.0	18	97.5	27.6	97.10	74	104	175	13
SURİYE NEV(C)	1626.0	19	93.4	32.2	90.52	72	99	159	14

CV (%) =10.53 LSD=287.9 kg ha^{-1} for seed yield.

Table 2. Confectionery type hybrids in Yield Trial-2 at Lüleburgaz in 2009

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 42	3118.0	1	121.9	30.7	125.49	65	106	174	21
09 TRC 32	3093.0	2	120.9	28.3	137.36	67	108	170	17
09 TRC 30	3063.0	3	119.8	31.3	130.15	67	102	150	18
09 TRC 29	3050.0	4	119.3	24.0	138.90	66	104	-	21
09 TRC 41	3036.0	5	118.7	30.3	106.40	65	104	177	22
09 TRC 36	2966.0	6	116.0	29.4	127.88	60	103	150	20
09 TRC 45	2919.0	7	114.1	27.7	130.33	66	109	164	20
09 TRC 33	2909.0	8	113.7	29.6	141.76	59	109	192	20
09 TRC 23	2876.0	9	112.5	28.8	108.5	68	107	183	16
09 TRC 34	2838.0	10	111.0	32.0	126.44	59	106	163	19
SURİYE NEV(C)	2803.0	11	109.6	30.9	96.92	67	105	183	17
09 TRC 44	2714.0	12	106.1	32.6	95.38	62	107	163	20
09 TRC 37	2622.0	13	102.5	29.0	121.04	64	107	136	19
PALANCI 1(C)	2534.0	16	99.1	28.4	103.98	67	104	170	22
ÇİĞDEM-1(C)	2336.0	20	91.3	31.6	82.49	65	105	164	17

CV (%) =7.35 LSD=274.0 kg ha-1 for seed yield.

Table 3. Confectionery type hybrids in Yield Trial-3 at Edirne in 2009

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 51	2556.0	1	115.2	29.9	111.80	69	100	181	17
09 TRC 54	2422.0	2	109.1	30.6	95.18	67	106	164	16
09 TRC 62	2401.0	3	108.2	33.2	97.75	65	93	143	14
09 TRC 57	2371.0	4	106.8	31.3	99.66	67	94	166	13
ÇİĞDEM-1(C)	2314.0	5	104.3	29.1	94.66	70	102	169	14
09 TRC 55	2313.0	6	104.3	32.5	107.91	63	98	160	15
09 TRC 52	2310.0	7	104.1	31.1	106.71	63	104	159	14
09 TRC 64	2307.0	8	104.0	29.0	97.78	69	102	174	15
09 TRC 49	2249.0	9	101.4	28.6	115.89	68	107	169	15
09 TRC 60	2248.0	10	101.3	27.3	122.62	67	103	164	14
09 TRC 56	2246.0	11	101.2	31.7	102.70	66	94	123	14
09 TRC 58	2184.0	12	98.4	30.9	84.85	68	104	168	15
SURİYE NEV(C)	2178.0	13	98.2	29.7	115.45	69	102	169	12
09 TRC 68	2169.0	14	97.8	32.1	96.48	62	103	161	16
PALANCI 1(C)	2165.0	15	97.6	27.7	102.81	74	94	161	14
09 TRC 65	2156.0	16	97.1	32.9	98.40	64	97	154	17

CV (%) =7.39 LSD=225.2 kg ha-1 for seed yield.

Table 4. Confectionery type hybrids in Yield Trial-3 at Lüleburgaz in 2009

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 54	3075.0	1	139.3	27.8	155.42	64	106	182	13
09 TRC 64	3027.0	2	137.1	28.2	111.54	63	104	163	17
09 TRC 55	3022.0	3	136.9	28.9	145.85	59	102	150	17
09 TRC 51	2953.0	4	133.7	28.3	109.02	61	106	179	19
09 TRC 49	2905.0	5	131.6	30.3	121.06	58	105	168	19
09 TRC 62	2903.0	6	131.5	32.8	119.24	58	106	133	15
09 TRC 59	2886.0	7	130.7	25.0	165.90	57	105	170	20
09 TRC 58	2884.0	8	130.6	29.3	127.39	63	104	187	18
09 TRC 53	2855.0	9	129.3	28.1	147.45	65	108	190	20
09 TRC 60	2850.0	10	129.1	27.2	139.73	61	106	160	20
09 TRC 48	2816.0	11	127.5	27.6	136.16	62	107	170	17
09 TRC 57	2813.0	12	127.4	30.5	126.47	62	105	180	21
09 TRC 66	2792.0	14	126.4	30.9	121.65	62	100	166	17
SURİYE NEV(C)	2581.0	21	116.9	27.3	136.14	65	104	179	23
ÇİĞDEM-1(C)	2033.0	24	92.1	31.9	105.77	66	106	173	20
PALANCI 1(C)	2012.0	25	91.1	25.3	130.38	66	105	185	15

CV (%) =10.15 LSD=385.8 kg ha^{-1} for seed yield.

Table 5. Confectionery type hybrids in Yield Trial-5 at Edirne in 2009

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 93	3037.0	1	116.2	34.5	96.8	62	100	159	22
09 TRC 97	2969.0	2	113.6	41.2	70.8	62	103	146	18
09 TRC 95	2919.0	3	111.7	40.6	68.4	62	101	154	19
09 TRC 87	2910.0	4	111.4	32.8	78.5	56	99	145	20
PALANCI 1(C)	2863.0	5	109.6	30.6	117.0	67	106	160	21
ÇİĞDEM-1(C)	2841.0	6	108.7	33.0	79.10	68	108	135	18
09 TRC 92	2695.0	7	103.1	31.1	74.6	59	102	156	22
09 TRC 88	2671.0	8	102.2	29.6	81.3	56	96	143	20
09 TRC 86	2629.0	9	100.6	31.4	87.7	57	97	172	19
09 TRC 96	2615.0	10	100.1	40.0	83.3	61	104	142	20
09 TRC 89	2436.0	11	93.2	28.2	80.30	58	97	139	18
09 TRC 94	2337.0	12	89.4	40.1	80.7	62	99	163	23
09 TRC 90	2257.0	13	86.4	35.4	76.0	60	106	153	22
09 TRC 85	2158.0	14	82.6	31.1	81.4	56	96	160	18
SURİYE NEV(C)	2136.0	15	81.7	28.3	102.6	62	102	180	23

CV (%) =8.46 LSD=263.8 kg ha-1 for seed yield.

Table 6. Confectionery type hybrids in Yield Trial-5 at Lüleburgaz in 2009

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
09 TRC 96	3191.0	1	108.5	33.9	110.50	65	106	176	24
SURİYE NEV(C)	3135.0	2	106.6	28.3	103.24	66	104	189	20
09 TRC 93	3050.0	3	103.7	27.1	141.76	59	105	163	18
09 TRC 87	3043.0	4	103.4	28.6	118.13	58	105	178	22
ÇİĞDEM-1(C)	2990.0	5	101.6	29.8	93.16	67	105	141	19
09 TRC 92	2949.0	6	100.2	28.9	89.68	58	106	172	17
09 TRC 85	2883.0	7	98.0	26.3	121.60	58	101	147	20
09 TRC 94	2878.0	8	97.8	35.3	107.87	66	104	169	15
09 TRC 86	2871.0	9	97.6	27.1	111.14	57	104	165	21
PALANCI 1(C)	2702.0	10	91.8	27.7	133.74	68	105	154	18
09 TRC 91	2624.0	11	89.2	24.1	130.30	59	103	180	26
09 TRC 88	2597.0	12	88.3	30.4	119.09	57	104	181	24
09 TRC 97	2577.0	13	87.6	36.7	102.84	64	104	171	20
09 TRC 89	2570.0	14	87.4	29.4	114.23	57	103	150	25
09 TRC 95	2556.0	15	86.9	36.1	108.28	66	105	179	22
09 TRC 90	2497.0	16	84.9	27.7	115.74	57	101	156	27

CV (%) =10.83 LSD=434.7 kg ha-1 for seed yield.

Table 7. Confectionery type hybrids in Yield Trial-1 at Edirne in 2010

Hybrids	S Yield (kg ha^{-1})	Rank	Rate to Std (%)	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
10-TR-Ç-015	2930.0	1	126.5	35.2	129.3	71	116	154	21
MARKER (C)	2774.0	2	119.7	27.8	140.8	71	132	165	21
10-TR-Ç-011	2597.0	3	112.1	37.5	107.2	70	117	143	20
10-TR-Ç-004	2503.0	4	108.0	36.9	111.3	70	123	155	20
10-TR-Ç-009	2396.0	5	103.4	26.2	142.8	68	131	164	16
10-TR-Ç-007	2365.0	6	102.1	26.5	143.6	67	124	102	15
10-TR-Ç-002	2333.0	7	100.7	30.0	138.1	68	120	167	19
10-TR-Ç-010	2295.0	8	99.1	29.8	138.6	70	121	146	18
10-TR-Ç-005	2286.0	9	98.7	26.7	142.2	67	130	180	19
10-TR-Ç-012	2256.0	11	97.4	30.7	136.4	65	117	129	20
10-TR-Ç-006	2255.0	12	97.3	29.4	137.9	66	119	135	17
ÇİĞDEM-1(C)	2234.0	13	96.4	32.5	156.5	66	122	156	18
10-TR-Ç-014	2160.0	14	93.2	36.0	124.7	66	119	123	19
PALANCI 1(C)	1942.0	16	83.8	30.4	119.9	69	121	176	20

CV (%) =12.23 LSD=384.4 kg ha^{-1} for seed yield.

Table 8. Confectionery type hybrids in Yield Trial-1 at Lüleburgaz in 2009

Hybrids	S Yield (kg ha^{-1})	Rate to Std (%)	Rank	Oil C (%)	1000 S. W. (g)	Flower (Day)	P M (day)	P Hgt (cm)	HD (cm)
10-TR-Ç-017	3626.0	128.5	1	37.3	156.5	66			
10-TR-Ç-015	3614.0	128.1	2	33.7	119.9	67			
10-TR-Ç-004	3266.0	115.8	3	34.6	140.8	75			
MARKER (C)	3103.0	110.0	4	27.5	126.1	67			
10-TR-Ç-014	3095.0	109.7	5	35.0	138.1	68			
ÇİĞDEM-1(C)	3045.0	107.9	6	31.2	112.4	68			
10-TR-Ç-010	3027.0	107.3	7	28.0	111.3	68			
10-TR-Ç-016	2966.0	105.1	8	35.2	142.2	70			
10-TR-Ç-008	2940.0	104.2	9	27.9	137.9	65			
10-TR-Ç-002	2890.0	102.4	10	28.8	143.6	70			
10-TR-Ç-005	2867.0	101.6	11	23.4	110.5	68			
10-TR-Ç-006	2855.0	101.2	12	32.2	142.8	74			
10-TR-Ç-007	2834.0	100.5	13	27.3	138.6	72			
10-TR-Ç-009	2810.0	99.6	14	25.6	107.2	68			
10-TR-Ç-012	2709.0	96.0	15	32.0	136.4	65			
10-TR-Ç-001	2433.0	86.2	16	31.2	134.6	64			
PALANCI 1(C)	2315.0	82.1	17	28.5	124.7	67			

CV (%) =11.00 LSD=457.4 kg ha^{-1} for seed yield.

Table 9. Confectionery type hybrids in Yield Trial-2 at Edirne in 2010

Hybrids	S Yield (kg ha^{-1})	Rate to Std (%)	Rank	Oil C (%)	1000 S.W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
10-TR-Ç-041	2648.0	121.5	1	28.5	153.2	66	120	166	22
10-TR-Ç-037	2577.0	118.3	2	27.7	156.4	67	122	153	19
MARKER (C)	2332.0	107.1	3	28.8	145.4	71	129	168	24
10-TR-Ç-033	2312.0	106.1	4	26.4	174.5	66	124	147	20
10-TR-Ç-032	2301.0	105.6	5	38.3	116.4	69	115	137	19
10-TR-Ç-039	2291.0	105.2	6	29.7	131.8	67	126	143	21
10-TR-Ç-030	2278.0	104.6	7	39.4	104.8	66	116	150	18
10-TR-Ç-035	2276.0	104.5	8	27.6	165.6	65	127	151	19
ÇİĞDEM-1(C)	2261.0	103.8	9	31.1	155.2	65	116	141	16
10-TR-Ç-029	2195.0	100.7	10	25.8	159.1	67	120	140	18
10-TR-Ç-027	2188.0	100.5	11	25.0	151.4	67	118	-	-
10-TR-Ç-031	2167.0	99.5	12	26.9	163.6	65	120	159	21
10-TR-Ç-042	2130.0	97.8	13	27.6	149.0	69	127	-	-
10-TR-Ç-040	2124.0	97.5	14	35.8	124.4	68	121	127	20
10-TR-Ç-038	2072.0	95.1	15	31.5	135.3	68	118	133	20
10-TR-Ç-026	1944.0	89.3	17	29.1	146.4	67	120	134	22
PALANCI 1(C)	1942.0	89.1	18	31.6	120.2	69	118	164	21

CV (%) =14.00 LSD=436.4 kg ha^{-1} for seed yield.

Table 10. Confectionery type hybrids in Yield Trial-2 at Lüleburgaz in 2010

Hybrids	S Yield (kg ha^{-1})	Rate to Std (%)	Rank	Oil C (%)	1000 S.W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
10-TR-Ç-031	3112.0	115.1	1	30.0	113.9	65			
10-TR-Ç-029	3033.0	112.2	2	29.1	108.4	66			
10-TR-Ç-027	3020.0	111.7	3	29.0	113.0	67			
MARKER (C)	2915.0	107.9	4	25.3	119.5	73			
10-TR-Ç-033	2892.0	107.0	5	29.8	113.8	65			
ÇİĞDEM-1(C)	2787.0	103.1	6	30.9	125.6	65			
10-TR-Ç-034	2787.0	103.1	7	30.2	91.00	64			
10-TR-Ç-038	2757.0	102.0	8	31.2	102.6	66			
10-TR-Ç-041	2756.0	102.0	9	31.1	108.3	66			
10-TR-Ç-037	2754.0	101.9	10	29.9	101.4	67			
10-TR-Ç-039	2740.0	101.4	11	32.9	93.20	68			
10-TR-Ç-042	2725.0	100.8	12	27.1	102.0	68			
10-TR-Ç-035	2707.0	100.2	13	29.3	113.5	67			
10-TR-Ç-026	2704.0	100.0	14	30.3	117.0	66			
PALANCI 1(C)	2406.0	89.0	16	29.1	85.72	67			

CV (%) =10.06 LSD=380.8 kg ha^{-1} for seed yield.

Table 11. Confectionery type hybrids in Yield Trial-8 at Edirne in 2010

Hybrids	S Yield (kg ha^{-1})	Rate to Std (%)	Rank	Oil C (%)	1000 S. W. (g)	Flower (Day)	P M (day)	P Hgt (cm)	H D (cm)
10-TR-Ç-025	4189.0	139.8	1	34.6	134.7	68	119	155	20
10-TR-Ç-019	3918.0	130.7	2	35.7	114.6	68	120	141	18
10-TR-Ç-045	3737.0	124.7	3	31.9	122.6	67	117	152	18
10-TR-Ç-020	3730.0	124.5	4	30.5	139.1	69	118	120	23
10-TR-Ç-021	3698.0	123.4	5	27.2	132.6	68	117	143	19
10-TR-Ç-044	3678.0	122.7	6	36.9	115.7	68	124	151	19
10-TR-Ç-287	3675.0	122.6	7	31.6	140.6	70	118	155	23
10-TR-Ç-049	3653.0	121.9	8	27.8	152.4	67	120	123	21
10-TR-Ç-050	3551.0	118.5	9	23.4	156.2	69	120	164	19
10-TR-Ç-023	3499.0	116.8	10	32.7	136.2	67	117	137	20
PALANCI 1(C)	3266.0	109.0	11	31.5	113.7	69	119	176	24
08-TR-Ç-001	3231.0	107.8	12	30.0	133.1	69	119	154	19
MARKER (C)	3230.0	107.8	13	27.2	140.0	71	127	146	23
08-TR-Ç-002	3167.0	105.7	14	28.2	159.9	68	118	158	22
10-TR-Ç-048	3047.0	101.7	15	21.5	144.8	69	126	137	21
10-TR-Ç-046	3033.0	101.2	17	25.6	150.7	68	121	136	20
10-TR-Ç-047	2917.0	97.3	18	25.6	146.2	67	120	138	21
ÇİĞDEM-1(C)	2495.0	83.3	21	32.4	158.6	67	118	132	22

CV (%) =13.60 LSD=626.9 kg ha^{-1} for seed yield.

Table 12. Confectionery type hybrids in Yield Trial-8 at Lüleburgaz in 2010

Hybrids	S Yield (kg ha^{-1})	Rate to Std (%)	Rank	Oil C (%)	1000 S. W. (g)	Flower (Day)	PM. (day)	P Hgt (cm)	HD (cm)
10-TR-Ç-046	3069.0	115.7	1	27.6	106.3	68			
10-TR-Ç-021	2987.0	112.6	2	30.7	98.72	73			
10-TR-Ç-048	2782.0	104.9	3	26.9	98.72	70			
10-TR-Ç-023	2765.0	104.2	4	31.6	101.6	65			
ÇİĞDEM-1(C)	2726.0	102.8	5	31.6	103.6	65			
MARKER (K)	2718.0	102.5	6	28.1	96.44	74			
08-TR-Ç-002	2713.0	102.3	7	28.5	97.44	68			
10-TR-Ç-025	2707.0	102.0	8	32.3	93.52	69			
08-TR-Ç-001	2701.0	101.8	9	32.4	97.20	65			
10-TR-Ç-044	2682.0	101.1	10	34.1	86.08	69			
10-TR-Ç-050	2650.0	99.9	11	27.1	87.44	69			
10-TR-Ç-043	2644.0	99.7	12	30.2	86.36	64			
10-TR-Ç-047	2573.0	97.0	13	28.6	82.68	64			
PALANCI 1(C)	2514.0	94.8	15	29.9	79.84	69			

CV (%) =13.00 LSD=471.8 kg ha^{-1} for seed yield.

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