



Evaluation of Morphological, Quality and Yield Characteristics of Some Registered Chickpea (*Cicer arietinum* L.) Varieties in The Eastern-Mediterranean Region

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ABSTRACT

This research was conducted to evaluate regional adaptation of registered chickpea varieties, their yield and some yield related characteristics observed at trial fields under winter growth conditions in Eastern Mediterranean region of Turkey in Adana location during 2014 and 2015. Trials were conducted in fields of Eastern Mediterranean Agricultural Research Institute. In this study, 17 registered varieties and 3 control varieties in total 20 varieties were tested in trials. During this study, the varieties were evaluated in Adana location for their fitness to winter growth conditions.

The highest and the lowest yield resulted in 2014 for Adana location were 3.94 t/ha and 1.76 t/ha for Trial, and respectively. In 2015, the highest and the lowest yield resulted for Adana location were 5.08 t/ha and 0.17 t/ha for Trial, respectively.

In terms of quality values for both growing seasons of 2014 and 2015, the average protein analysis values of the Trial were 21.90% for the Hasanbey variety as the highest and 10.26% for the Hisar variety as the lowest values.

Keywords: Chickpea, registered varieties, adaptation, sowing date

Introduction

The edible grain legumes are an important source of plant-derived protein which is widely consumed in Turkey. It is an important basic nutrient in human and animal nutrition in terms of its average protein richness of 22-26%. Chickpeas are rich in nutritional value and have positive contributions to the soil due to their symbiotic lifestyle with rhizobia. In Turkey, the chickpea production was 630.000 tonnes with a sowing area of 517.785 ha while the grain yield was 122.00 kg/da (FAO, 2021). The legume industry

in Turkey gains importance every day. Legume processing, packaging industry, and the production of various chickpea-based nuts (roasted chickpea) are also developing industries that increase the importance of chickpeas.

Although the most important problem in chickpea cultivation is Ascochyta blight, it is aimed to breed for varieties that are tolerant against Ascochyta blight, suitable for mechanized cultivation and harvest, and also offer them to the farmers as promising varieties. Since the purpose of chickpea production is to obtain

grain products of high yield and quality, developing suitable varieties for target regions where they will be grown is an important factor that needs to be considered. This study aimed to develop a list of recommended chickpea varieties for different regions and will stimulate an increase in cultivation area. Studies were performed during 2013-2014 and 2014-2015 growing seasons under winter growing conditions. Yield, quality, disease, and pest tolerance parameters were examined.

Materials and Methods

Adaptation studies were carried out using 17 registered varieties in the location of Adana during the 2014 and 2015 winter growing season. In the 2014 and the 2015 growing seasons, in the field with 17 varieties and 3 control varieties registered varieties were conducted in Adana location. In this study, plantings were made in 4 rows (9 m² parcels) of 5 m length with 45 cm between rows and 8 cm above rows. Before planting, fertilization was applied at a rate of 2-3 kg N, 5-6 kg P₂O₅ per da, and disease scorings (1-9) were made to determine tolerance to Ascochyta blight disease (Şehirli, 1988). Samples for quality analysis in chickpea genotypes in both growing seasons of 2014 and 2015, were taken from the combined and thoroughly blended repetitions in the post-harvest trials.

Precipitation level in Adana location during December and January 2014 was below the average of previous years for the same period and germinated plants became susceptible to abiotic stress factors. Despite the uneven distribution of precipitation in the November-July period and the drought stress after planting, the incidence of Ascochyta blight disease was low due to rainfall and the appropriate temperature and humidity rates in March and April, which are the flowering and pod tying period. After planting in 2015, although the amount of rainfall was low compared to last years in November, December and January, there was sufficient rainfall and a decrease in germination was not observed. In this growing season, the intensity of Ascochyta blight disease has increased due to the intensity of rainfall in March (115.81 mm; flowering period). Due to the heavy rains in May (81.02 mm; the beginning of the pod tying period), disease incidence in parcels of varieties susceptible to Ascochyta blight disease increased and ended with a high plant death rate.

The uneven distribution of rainfall across the months were challenged the plants, though the temperature and the humidity values showed coherence to the previous year's average (Figure 1).

The study was designed according to randomized block trials and One Way ANOVA together with Tukey's B analyses was applied on all data at the significance level of 0.05.

Results and Discussion

The average values and groups formed from the registered varieties trial conducted in the Adana location in 2014 are given in Table 1. Although there was no statistical difference between the varieties in terms of flowering days, first pod height, plant height, and grain yield, it varied between 57-67 days, 23.3-32.7 cm, 66.6-95.5 cm, and 176-394 kg/da, respectively. Statistically significant differences between the varieties in terms of the number of days until pod tying were observed, and it varied between 72.0-76.6 days, and the highest value in terms of the mentioned feature was observed for Seğkin variety and the lowest for İzmir-92 variety. Statistically significant difference between all varieties in terms of 100 grain weight was observed, with values varying between 28.5-51.9 g, with the highest mean for Çağatay, Sezenbey, Sarı 98 and Cevdetbey 98 varieties. Yield parameters of 2014 growing season were not affected by Ascochyta blight disease. Erdemci et al. (2016), have determined negative and significant ($p < 0.05$) relationship between grain yield and 100-seed weight in different chickpea genotypes grown for winter in Diyarbakır ecological conditions in 2011 and 2012; positive and significant ($p < 0.01$) relationships between plant height, number of main branches in the plant, number of full pods per plant and the number of seeds per plant (Slim et al. 1993), (Şehirli, 1988). The average values obtained from the yield experiment registered varieties in Adana location in 2015 and the groups formed are given in Table 1. There is a significant difference between the cultivars in terms of the number of days until the flowering and the number of days for the pods tying, and the lowest and the highest values varied between 108.7-113.3 days and 112.9-133.9 days for 2014 and 2015 respectively. The highest and the lowest number of days until flowering was observed for TAEK-Sağel and Eser varieties, respectively, and days until pod tying was the highest for İnci and Cevdetbey 98 varieties and the lowest for TAEK-Sağel variety. First pod height values varied between 24.01-64.4 cm and plant height values varied between 47.47-93.3 cm, however, there was no statistically significant difference between the cultivars in terms of first pod height and plant height. Statistically significant differences were observed for the 100/grain weight and the yield values. The lowest and the highest values of the examined properties were obtained from Menemen-92 and Aksu varieties with 28.0 g and 42.3

g respectively, and Seçkin and Cevdetbey 98 varieties with 17.1 kg/da and 508.5 kg/da respectively. Gül et al. (2006) conducted a study to investigate the possibilities of growing chickpea plants under winter conditions, and reported that the resistance/tolerance to them rated as 55.42% in standard varieties and varied between 70.91 and 78.75% in other lines. In addition, they stated that many features related to the winter - grown chickpea, especially grain yield, are more advantageous than summer plantings and that winter sowing may be more advantageous in terms of its characteristics and suitability for machine harvesting.

The two-year average values were obtained from the registered varieties yield trial and the groups formed are given in Table 1. Although there is no statistically significant difference between the varieties in terms of the two-year average for flowering days, first pod height, and plant height values, they vary between 84.33-88.67 days, 26.17-48.03 cm, 63.12-93.32 cm, respectively. While Aksu, İnci-K are the varieties with the longest time until flowering, Damla and İzmir-92 varieties reached the flowering period faster than other cultivars. In terms of days until the pod tying phase, statistical differences between the varieties were found to be significant and the values according to the varieties varied between 93.42-103.67 days. While it took longer to tie pods for İnci and Cevdetbey 98 varieties, TAEK-Sağel variety tied the pods for the shortest duration. The statistically significant differences were observed in terms of 100/grain weight and the yield values. It was reported that as the number of pods increases, the pod weight decreases and both the hundred-seed weight and the yield per plant decrease (Amini et al. 2002).

The lowest and highest values of the investigated traits were observed for Eser and Aksu varieties with 28.28 g and 42.74 g, respectively, and TAEK-Sağel and İnci varieties with 118.48 and 426.96 kg/da, respectively. According to two-year average data of registered varieties yield test, varieties İnci, Seçkin, Hasanbey, Damla, Güler, Menemen-92, Aydın-92 and Aksu showed better performance in terms of grain yield, disease tolerance and other parameters. Regional varieties (İnci, Seçkin, Hasanbey) had higher grain yield values in both years compared to other varieties. Mart et al. (2015) performed a study in order to evaluate the national and ICARDA originating chickpea lines under Çukurova region climatic conditions in terms of yield and 100/grain weight parameters. Their study was performed during 2012-2014 years and yield parameters for 2012-2013 season were 353.93 kg/da for İnci variety, 278.07 kg/da for Seçkin variety and 275.41 kg/da for FLIP 06-59C line. One hundred grain weight varied between 42.87-31.77 gr. In 2013-2014

growing season yield parameters were 362.6 kg/da for Hasanbey variety, 360.8 kg/da for İnci variety, 347.8 kg/da for EN 1820 line and 197 kg/da for EN 1685 line (Babagil, 2011; Bakoğlu, 2009; Sozen et al. 2018).

In Adana Location, no negative effect was observed since *Ascochyta* blight disease incidence was low in the first year. However, in the second year, negative effects were observed on 100 grains and yields. Anlarsal et al. (1999) studied the agricultural parameters of the chickpea population consisting of 23 lines that they cultivated for two years for winter under Çukurova (Eastern Mediterranean) regions' climatic conditions. Plant height (67.9-84.2 cm), number of pods per plant (15.8-27.3), number of seeds per plant (17.0-28.8), 100-grain weight (26.7-37.5 g), the harvest index (28.37-34.93%), the plant grain yield (5.3-8.6 g) and yield (178.6-271.9 kg/da) exhibited variation between varieties. In chickpea *Ascochyta* blight appears due to a combination of three factors i.e. susceptible host, virulence of pathogen and favourable environmental factors such as temperature and humidity. In the disease triangle, host tolerance is the most important element in the struggle against pathogens. Moderate resistance chickpea varieties under disease friendly environments produced potential yield to a certain extent. But sensitive cultivars in disease friendly environment were affected largely (Kaiser et al. 1997; Mart, 2006; Bayraktar et al. 2007; Kahraman et al. 2015).

Quality studies on registered varieties

The quality values of the seeds obtained from the registered varieties yield trial performed in Adana Location during the 2014 period were analyzed. The highest and the lowest values for all parameters analyzed were 54,51-34,21 g for dry weight, 108,8-68,57 g for wet weight, 0,54-0,34 g/grain for water intake capacity, 1,11-0,92% for water intake index, 91-76 ml for dry volume, 196-158 ml for wet volume, 0,55-0,25 ml/grain for swelling capacity and 2,44-1,76% for swelling index. Amir et al. (2006), In the years with a high amount of rainfall chickpea, lentil, and bean products grown under agro-climatic conditions of Algeria, the protein ratio and total sugar amount were higher and other parameters were higher in years when rainfall was less.

The quality values of the seeds obtained from the registered varieties yield trial performed in the Adana location during the 2015 period were analyzed. The highest and the lowest values for all parameters analyzed were 48.9-33.20 g for dry weight, 99.65-66.35 g for wet weight, 0.51-0.32 g/grain for water intake capacity, 1,11-0,94% for water intake index, 87-75 ml for dry volume, 190-160 ml for wet volume, 0.53-0.35 ml/grain for swelling capacity and 2.56-2.00% for

swelling index. Among the varieties included in the registered varieties yield trial in the Adana location, the Sezenbey variety came to the fore with the highest values in terms of dry weight, wet weight, water intake capacity, dry volume, wet volume, swelling capacity. Toğay et al. (2001), They determined that the water intake capacity of chickpea varieties registered in Turkey varied between 0.979-1.223 g/grain and the difference between varieties was significant (Table 2).

Two-years Average for quality properties from the registered varieties trial was calculated. The highest and lowest values for all parameters analyzed were 49.84-33.71 g for dry weight, 101.23-67.95 g for wet weight, 0.52-0.34 g/grain for water intake capacity, 1.08-0.94% for water intake index, 87.5-75.5 ml for dry volume, 191-160 ml for wet volume, 0.54-0.03 ml/grain for swelling capacity and 2.48-2.06% for swelling index. The highest and lowest average protein values were obtained for the Aksu variety (22.88%) and Cevdet Bey 98 variety (11.24%), respectively (Table 2). Atmaca (2008), In the doctoral study, determined that as the planting date is delayed, the average volume decreases. In addition, the dry volume values of other varieties with coarse grains are high in other varieties, and the dry volume values of small-grained species are low and which causes a decrease in wet volume values. It was observed that as the spacing between rows narrowed, the grain size increased and the grains removed more water in the future, which increased in wet volume (Mart, 2010; Özer et al. 2010; Srivastava et al. 2020; Sinem et al.2021).

Conclusions

In this study, the regional adaptations of registered chickpea (*Cicer arietinum* L.) varieties under different climatic conditions and their tolerance/resistance to Ascochyta blight were investigated. In the Adana location, negative effects of Ascochyta blight disease on the 100/grains and the yields were observed. Among the registered varieties, regional varieties İnci, Hasanbey and Seçkin exhibited the highest performance.

In terms of grain yield, disease tolerance, and other traits according to two-year averages, yield values were found to vary between 426.96-118.48 kg/da; İnci, Seçkin, Hasanbey, Damla, Gülümser, Menemen-92, Aydın-92, and Aksu varieties come to the fore in the registered varieties yield test. Regional varieties had higher grain yield values in both years compared to other varieties.

In both growing seasons, the average protein values were the highest for the Aksu variety (22.88%) and the lowest for the Cevdetbey 98 cultivar (11.24%). İnci variety had higher grain yield values in both years

compared to other varieties. In this trial, in terms of quality values, the Sezenbey variety came to the fore with higher values compared to other varieties in terms of dry weight, wet weight, water intake capacity, wet volume, and swelling capacity.

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Table 1. Results of registered varieties trial performed during 2014-2015 period performed in Adana location.

No	Varieties	Days Until Flowering (day)		Ascochyta Blight (1-9)		Days Until Pod Tying (day)		Height of First Pod (cm)		Plant Height (cm)		100 Grain Weight (gr)		Yield (kg/da)							
		2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.					
1	İnci	60,67	113,0A	86,83	1-1	3	75,3 AB	132,0A	103,6A	27,77	45,53	36,65	67,22	81,63	74,43	32,6 F-H	31,9AB	32,29E-H	394	459,8A	426,96A
2	Seçkin	61,33	110,7A-C	86,00	1-2	3	76,0 AB	130,0A-C	103,0A	26,11	41,13	33,62	66,66	71,10	68,88	37,4 D-G	40,1A	38,76A-E	285	508,5A	396,59AB
3	Hasanbey	57,33	112,0A-C	84,67	1-2	3	74,0 AB	131,0AB	102,5A	31,11	61,07	43,86	76,11	74,4	75,27	41,5 B-E	40,5A	41,01AB	344	289,7A-F	317,04A-F
4	Damla	57,67	111,0A-C	84,33	1-3	4	75,6 AB	130,0A-C	102,8A	26,66	37,77	30,55	75,55	77,1	76,36	32,5 F-H	28,2B	30,36G-H	354	313,4A-E	333,52A-E
5	Güllümser	58,67	111,7A-C	85,17	1-3	6	73,3 AB	130,7A-C	102,0A	23,33	36,67	31,67	74,44	83,3	78,87	35,9 D-H	36,9AB	36,47A-G	369	208,3B-G	288,67A-H
6	Çağatay	60,33	111,7A-C	86,00	1-3	7	74,6 AB	131,3A	103,0A	26,66	54,97	40,54	72,22	80,5	76,38	45,5 A-C	35,9AB	40,73AB	211	89,6F-G	150,22E-H
7	Sezenbey	58,67	111,3A-C	85,00	1-3	7	73,3 AB	130,7A	102,00A	26,11	36,10	33,33	82,22	72,7	77,48	46,2 AB	38,0AB	42,13A	272	156,3D-G	213,93B-H
8	Zuhal	59,0	112,3AB	85,67	1-2	6	74,0 AB	131,3A	102,67A	30,55	48,87	38,60	73,33	78,8	76,10	42,6 B-E	37,7A	40,17A-C	273	126,2E-G	199,70C-H
9	İzmir-92	58,0	111,0A	84,50	2-3	6	72,0 B	131,0A	101,50	28,33	34,97	32,48	73,33	74,9	74,15	40,2 B-F	38,5A	39,34A-D	297	166,1C-G	231,74B-H
10	Menemen-92	59,67	112,0A-C	85,83	1-2	6	74,0 AB	131,0AB	102,50A	30,00	40,77	36,77	85,00	78,7	81,87	38,7 B-G	28,0B	33,39D-H	369	161,2C-G	265,22A-H
11	Aydın-92	59,33	112,3AB	85,83	1-2	4	75,3 AB	131,3AB	103,33A	32,77	47,20	39,16	92,78	71,07	81,92	34,7 E-H	32,6AB	33,69C-H	377	362,4A-D	369,85A-D
12	Sarı 98	59,0	112,7AB	85,88	1-2	8	72,6 AB	130,0A-C	101,3A	31,11	24,01	26,17	78,78	47,47	63,12	51,9 A	---	---	176	17,8G	---
13	Cevdetbey 98	60,0	112,7AB	86,33	1-2	8	73,3 AB	133,9A	103,6A	28,33	25,83	27,36	86,11	63,03	74,57	44,8 A-C	30,6AB	37,7A-E	260	17,1G	138,63F-H
14	Aziziye	58,33	111,7A-C	85,00	1-2	7	73,3 AB	131,3AB	102,36A	28,89	27,47	26,23	81,11	69,60	75,36	38,9 B-G	34,8AB	38,07A-F	213	116,5E-G	164,67E-H
15	TAFK-Sağel	59,0	113,3A	86,17	1-3	9	74,0 AB	112,9D	93,42 B	25,00	48,60	38,47	88,77	86,93	87,85	38,3 B-G	28,8AB	33,91B-H	198	38,6G	118,48GH
16	Aksu	66,67	110,7A-C	88,67	1-2	5	72,6 AB	130,0A-C	101,33A	28,33	64,40	48,03	91,66	83,20	87,43	43,2 B-D	42,3A	42,74A	328	311,1A-E	319,41A-F
17	Eser	61,33	108,7C	85,00	1-2	6	75,3 AB	127,3C	101,33A	31,66	32,20	28,32	83,88	70,5	77,21	28,5 H	28,0B	28,28H	179	198,7B-G	188,67D-H
18	HasanBey-K	61,33	110,3A-C	85,83	1-2	4	73,3 AB	130,0A-C	101,67A	24,44	38,83	34,97	95,55	84,73	90,14	36,3 D-H	40,5A	38,4A-E	239	378,4A-C	308,63A-G
19	Seçkin-K	62,33	109,7B-C	86,00	1-2	4	76,6 A	128,3BC	102,50A	31,66	48,30	39,98	93,33	93,30	93,32	38,0 C-G	40,6A	39,3A-D	212	398,1AB	305,07A-H
20	İnci-K	61,33	112,7AB	87,00	1-2	4	76,0 AB	131,3AB	103,67A	24,44	45,00	34,72	83,33	81,07	82,20	31,4 GH	31,4AB	31,41F-H	324	440,2A	382,26A-C
F		---	**	---	**	**	**	**	**	---	---	---	---	---	---	**	**	**	---	**	**
CV (%)		5,82	0,9	2,21			1,96	0,8	1,30	16,89	43,9	4,79	17,14	18,8	11,08	6,93	10,3	1,18	35,54	29,6	1,30

Ave=Average, The F values were obtained based on the Tukey test, CV=Variation of coefficient, **=Significant level

Table 2. Results of quality traits analysis from registered variety trial performed during 2014-2015 period

No	Varieties	Dry Weight (100 grain) (g)			Wet Weight (g)			Water Intake Capacity (g/grain)			Water Intake Index (%)		
		2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.
1	İnci	39,13	38,14	38,64	75,99	74,05	75,02	0,37	0,36	0,37	0,94	0,94	0,94
2	Seçkin	42,10	40	41,05	87,33	81,69	84,51	0,45	0,42	0,44	1,07	1,04	1,06
3	Hasanbey	44,48	42,77	43,63	90,49	84,53	87,51	0,46	0,42	0,44	1,03	0,98	1,01
4	Damla	35,52	35,11	35,32	70,03	70,22	70,13	0,35	0,35	0,35	0,97	1,00	0,99
5	Gülümser	39,67	39,86	39,77	76,72	80,65	78,69	0,37	0,41	0,39	0,93	1,02	0,98
6	Çağatay	50,68	42,84	46,76	102,3	90,38	96,34	0,52	0,48	0,50	1,02	1,11	1,07
7	Sezenbey	50,69	48,99	49,84	102,8	99,65	101,23	0,52	0,51	0,52	1,03	1,03	1,03
8	Zuhal	48,24	43,25	45,75	96,93	91,35	94,14	0,49	0,48	0,49	1,01	1,11	1,06
9	İzmir-92	45,37	40,18	42,78	87,07	79,19	83,13	0,42	0,39	0,41	0,92	0,97	0,95
10	Menemen-92	43,84	38,32	41,08	86,32	80,04	83,18	0,42	0,42	0,42	0,97	1,09	1,03
11	Aydın-92	39,64	37,32	38,48	77,10	73,53	75,32	0,37	0,36	0,37	0,95	0,97	0,96
12	Sarı 98	54,51	---	---	108,8	---	---	0,54	---	---	1,00	---	---
13	Cevdetbey 98	48,43	---	---	96,16	---	---	0,48	---	---	0,99	---	---
14	Aziziye	49,4	46,79	48,10	96,62	95,06	95,84	0,47	0,48	0,48	0,96	1,03	1,00
15	TAEK-Sağel	41,16	---	41,16	82,77	---	82,77	0,42	---	0,42	1,01	---	1,01
16	Aksu	47,35	44	45,68	95,74	89,96	92,85	0,48	0,46	0,47	1,02	1,04	1,03
17	Eser	34,21	33,21	33,71	68,57	67,33	67,95	0,34	0,34	0,34	1,00	1,03	1,02
18	Hasan Bey-K	43,44	40,42	41,93	88,99	81,85	85,42	0,46	0,41	0,44	1,05	1,02	1,04
19	Seçkin-K	41,91	39,79	40,85	88,23	81,21	84,72	0,46	0,41	0,44	1,11	1,04	1,08
20	İnci-K	38,17	33,97	36,07	74,84	66,35	70,60	0,37	0,32	0,35	0,96	0,95	0,96

performed in Adana location.

Continuing Table 2

Dry Volume (ml)			Wet Volume (ml)			Swelling Capacity (ml/tane)			Swelling Index (%)			Protein (%)		
2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.	2014	2015	Ave.
79	79	79,0	166	166	166	0,37	0,37	0,37	2,28	2,28	2,28	22,40	19,33	20,87
82	80	81,0	178	172	175	0,46	0,42	0,44	2,44	2,40	2,42	25,19	18,55	21,87
84	83	83,5	180	176	178	0,46	0,43	0,45	2,35	2,30	2,33	23,79	19,06	21,43
76	77	76,5	162	164	163	0,36	0,37	0,37	2,38	2,37	2,38	23,70	19,70	21,70
79	81	80,0	168	174	171	0,39	0,43	0,41	2,34	2,39	2,37	22,62	18,54	20,58
89	83	86,0	192	182	187	0,53	0,49	0,51	2,36	2,48	2,42	22,74	19,73	21,24
88	87	87,5	192	190	191	0,54	0,53	0,54	2,42	2,43	2,43	21,98	20,22	21,10
86	82	84,0	186	182	184	0,5	0,50	0,50	2,39	2,56	2,48	22,80	18,10	20,45
84	81	82,5	176	170	173	0,42	0,39	0,41	2,24	2,26	2,25	22,13	18,95	20,54
83	80	81,5	176	170	173	0,43	0,40	0,42	2,30	2,33	2,32	22,91	19,24	21,08
80	79	79,5	168	166	167	0,38	0,37	0,38	2,27	2,28	2,28	21,63	19,58	20,61
91	---	---	196	---	---	0,55	-0,50	0,03	2,34	2,00	2,17	24,13	0,00	12,07
86	---	---	186	---	---	0,5	-0,50	0,00	2,39	2,00	2,20	22,47	0,00	11,24
88	85	86,5	186	184	185	0,48	0,49	0,49	2,26	2,40	2,33	21,60	17,68	19,64
82	---	82,0	172	---	172	0,4	-0,50	-0,05	2,25	2,00	2,13	24,62	0,00	12,31
86	83	84,5	184	180	182	0,48	0,47	0,48	2,33	2,42	2,38	26,67	19,09	22,88
76	75	75,5	160	160	160	0,34	0,35	0,35	2,31	2,40	2,36	22,34	18,49	20,42
83	81	82,0	158	173	165	0,25	0,42	0,34	1,76	2,35	2,06	24,73	18,93	21,83
82	80	81,0	178	172	175	0,46	0,42	0,44	2,44	2,40	2,42	23,14	18,68	20,91
79	75	77,0	166	160	163	0,37	0,35	0,36	2,28	2,40	2,34	25,74	17,85	21,80

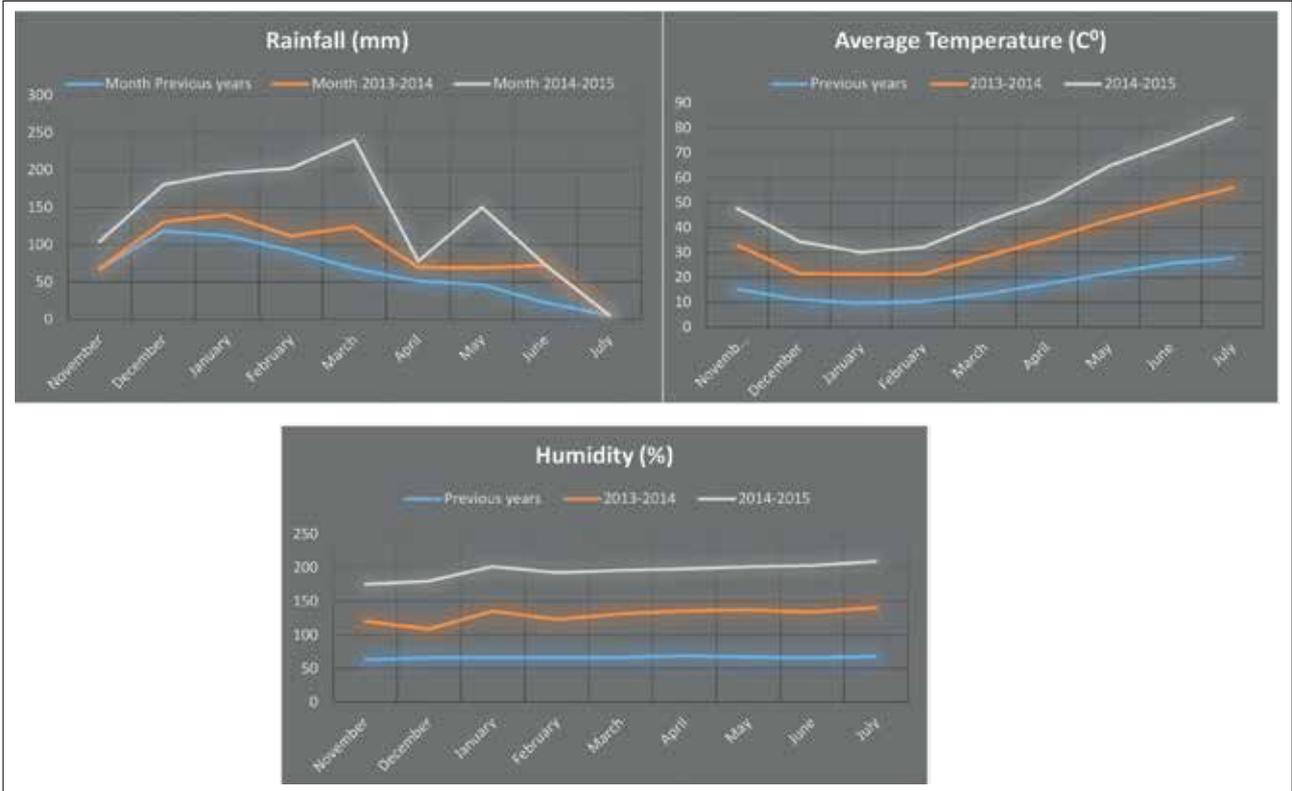


Figure 1. Environmental conditions of Adana location during 2013-2014 and 2014-2015 periods together with previous years average.

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