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Evaluation of Cotton Yield and Fiber Quality Parameters under Deficit and Partial Root Zone Drying Irrigation

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Abstract: This study was conducted to observe the effects of different drip irrigation levels and traditional deficit irrigation and partial root zone drying (PRD) techniques on seed cotton yield, yield component and fibre quality parameters produced from may 505 cotton variety in the Aegean Region of Turkey during the year of 2021. The trial was designated in randomized complete block design with two factors and three replications. In the study, three different irrigation levels (100, 67 and 33%) and two different (traditional deficit irrigation (DI) and partial root zone drying (PRD)) applications were investigated. Irrigation water quantity based on cumulative evaporation from class A pan at 8 day irrigation interval was applied through drip system to full irrigation (TS-100), deficit irrigation (DI-67 and DI-33) and partial root zone drying (PRD)- PRD-100, PRD-67 and PRD-33. A total of 575 mm irrigation water was applied to TS-100 treatment, while DI-67 and DI-33 treatment plots received 383 and 189 mm; PRD-100 treatment plots received 290 mm, PRD-67 received 193 mm and PRD-33 treatment received 97 mm of irrigation water. The highest seed cotton yield was obtained from the TS-100 treatments as 511 kg/da, while DI-67 and PRD-100 treatments resulted in yields of 445 kg/ da ve 415 kg/da respectively. It was determined traditional deficit drip irrigation (DI) applications performed higher seed cotton yields than partial root zone drying (PRD) applications. The applications of different irrigation approaches and different drip irrigation levels significantly affected seed cotton yield and some crop yield components as; number of bolls per plant, boll raw cotton weight, single plant yield, 100-seed weight and lint percentage. According to the results of ANOVA of fiber quality parameters (fiber strength, fiber length, fiber fineness, uniformity and elongation), the difference between irrigation application approaches and irrigation levels were found to be significant at a level of $p<0.05$ and $p< 0.01$. Finally, it may be concluded that as cotton is a crop which is sensitive to shortages of moisture in the soil, it is necessary to fully meet its water needs throughout the growing season in order to obtain high cotton yield and good fiber quality.

Keywords: Aydın, partial root zone drying, cotton, drip irrigation, fiber quality

Introduction

Aegean Region is one of the most important agricultural and industrial region in west part of Turkey. All cotton production areas of this region receive inadequate amounts or inadequate distribution of rainfall. Decreasing ground water supplies and the high cost of energy also affect production of irrigated cotton. Turkey must take urgent action to solve the water-shortage problem for important agricultural crops including cotton, wheat, and other crops in coming years. Nowadays limited availability of irrigation water requires fundamental changes in irrigation management and urges the application of water saving methods. Under such conditions, different irrigation systems such as drip irrigation, sprinkler irrigation, subsurface drip irrigation (SDI), and low energy precision applicators (LEPA) should be considered to provide growers with high irrigation efficiency. Especially, the use of drip irrigation techniques is inevitable in the near future because of the salinity problem caused by traditional irrigation methods [1, 2]. Water saving irrigation methods should be followed in order to save water and maximize yield. Due to the severe competition in urban and rural use and other sectors, the value of the water will most probably rise shortly [3]. Thus, appropriate irrigation scheduling is required for maximizing the yield and water use. In other words, conventional deficit irrigation (DI) is one approach that can reduce water use without causing significant yield reduction [3]. Partial root zone drying (PRD) is a further development of deficit irrigation (DI). PRD is commonly applied as part of a deficit irrigation program because it does not require the application of more than 50–70% of the water used in a fully irrigated program. PRD is an irrigation technique based on alternately wetting and drying opposite parts of the surface soil under which the plant root system is thought to be located [4]. Thus, this creates the need for continuous improvement in irrigation practices, especially in the cotton production of the Aegean region. Turkey's seed cotton production meets approximately 44% of the needs of its domestic market. Turkey is among the top 11 cotton production countries in the world. In 2018/2019, seed cotton acreage and crop production of Turkey is 508 000 ha and 988 000 t, respectively. Average cotton lint yield is about 1944 kg ha-1 [5]. [6] indicated that the period from square initiation to first flower represents the most critical development period in terms of water supply affecting yield components. The peak flowering period was the most sensitive to drought and at this time water stress led to the greatest decrease in yield. Under water stress, decrease in seed cotton yield is primarily due to the reduction in number of bolls. Water stress affect lint quality; fiber length, strength and micronaire reading as well [7]. In this respect, [2] applied irrigation at five different rates (full irrigation and four deficit rates) to cotton and found that the highest application of water regime producing the highest yield, while [8] reported that no yield reduction in cotton with the deficit water.

Drought not only affects yield but also fiber quality. It is reported that drought in the period when the cotton fiber is beginning to grow affects fiber length, strength and maturity [7, 9, 10, 11]. It has been found that drought in the end of the flowering period affects the development of the bolls, and thus increases the proportion of low-strength and immature fibres [7]. At the head of other factors determining the yield potential of cotton in drought conditions comes the length of the growth period (early or late) of the cotton cultivar. In drought conditions, the long growth period of late cultivars may give them an advantage over early cultivars in terms of yield potential. But on the other hand, in conditions of acute or excessive drought, the yield of early cultivars may be low, but it is nevertheless higher than that of late cultivars [12, 13].

Water stress occurring during the cotton growing season may reduce final lint yield. Cotton yield is dependent on the production and retention of bolls, and both can be decreased by water stress [14]. The Aegean region is one of the most important agricultural and industrial region in Turkey. All cotton production areas of western Turkey receive inadequate amounts or inadequate distribution of rainfall. Besides different drip irrigation levels, with proper irrigation application approaches under various irrigation levels should be studied by the researchers. Therefore, limited availability of irrigation water requires fundamental changes in irrigation management or urges the application of water saving methods. The aim of this study was to investigate to research the effects of different irrigation treatments (traditional deficit irrigation-DI and partial root zone drying-PRD) on seed cotton yield components, and fiber quality parameters for May 505 cultivar of cotton in Aydın province of western Turkey.

Materials and Methods

This study were conducted during the growing seasons of 2021 at the Agricultural Research Station of Aydın Adnan Menderes University, Aydin-Turkey at 37° 51' N latitude, 27°51' E longitude. Climate in this region is semi-arid with total annual precipitation of 644.7 mm. Average seasonal rainfall is 644.7 mm, with 90% of the rain occurring between November and March. Typical Mediterranean climate prevails in the experimental area. Table 1 summarizes the monthly mean climatic data compared with the long-term mean climatic data for Aydın [15]. The growing season temperatures were typical of long term-means (1983-2020) for Aydın located in the western Aegean region of Turkey. A mean monthly temperature of 17.8 oC according to long-term meteorological data (1983-2020) in the experimental area. Total rainfall during the growing periods was 105,9 mm in 2021.

The soil type of the experimental area was loam and sandy loam in texture. For the cotton experiment area, water content at field capacity varied from 18.4 to 23.1 % and wilting point varied from 7.2 to 10,1 % on dry weight basis. The dry soil bulk densities ranged from 1.35 to 1.52 g/ cm3 throughout the 1.2 m deep profile. The total available soil water contents within the top 1.2 m of the soil profile was 221 mm. The May 505 cotton variety was planted on 27 May 2021, with 0.70 × 0.20 m spacing. Before starting the field experiment, 60 kg/ha compound fertilizer (containing 15% pure N, 15% P, and 15% K) was applied to the planting area The required remaining portion of nitrogen was followed by 82 kg/ha as ammonium nitrate 33% before first irrigation.

Table 1: Weather conditions prevailed during the experiments compared to the long- run at the experimental area

1983-2020				
Month	**Temperature (ºC)**	**Relative Humidity (%)**	**Rainfall (mm)**	**Evaporation (mm)**
May	21	55.2	37.4	161.3
June	25.6	49.3	18.3	216.5
July	28.3	46.9	6.61	255.4
August	27.7	50.7	6.01	229.5
September	23.7	54.3	16.2	160.1
2021				
Month	**Temperature (ºC)**	**Relative Humidity (%)**	**Rainfall (mm)**	**Evaporation (mm)**
May	23.6	47.3	93.2	151.9
June	26.1	47.3	1.1	204.2
July	30.9	42.2	0.1	269.5
August	30.5	40.3	0	253.6
September	25	48	0.5	151.7

The trial was designated in randomized complete block design with two factors and three replications. In the study, three different irrigation levels (100, 67 and 33%) and two different (traditional deficit irrigation (DI) and partial root zone drying (PRD)) applications were investigated. Irrigation management treatments consist of one full (TS-100), and two traditional deficit (DI-67, DI-33), and three partial root zone irrigation (PRD-100, PRD-67, and PRD-33). Irrigation water quantity based on cumulative evaporation from class A pan at 8 day irrigation interval was applied through drip system. Full (TS-100) and traditional deficit irrigation (DI-67, DI-33) treatments received 100, 67 and 50% of 8 day cumulative evaporation from Class A pan located at the experimental station, respectively. PRD-100, PRD-67 and PRD-33 received 100, 67 and 33% cumulative pan evaporation value, respectively, on one half of the plot area (Fig. 1). A wetting percentage of 100% in TS-100 and DI treatments, and 50% in PRD treatments was used in this study [16, 17, 18].

Equation (1) was used to calculate the irrigation water amount for two approaches;

$$\mathbf{V = P \times A \times Epan \times WL} \quad (1)$$

Where V is the volume of irrigation water (L), P wetting percentage (taken as 100 % for row crops), A is plot area (m2), Epan is the amount of cumulative evaporation during a 8-day irrigation interval (mm), WL represents irrigation levels (0.33, 0.67 and 1.00).

Drip laterals were placed at the center of adjacent crop rows 0.70 m apart in the experimental plots. Experimental plots were 5 m long and 5 crop rows wide (3.5 m). Irrigation water was used from a deep well located near the experimental site. The control unit consisted of screen filter with 10 L/s capacity, control valves, manometers mounted on the inlet and outlet of each unit. Distribution lines consisted of PVC pipe manifolds for each plot. The diameters of the laterals were 16 mm PE and each lateral irrigated one plant row. The inline emitters were used with a discharge rate of 4 L/h above 10 m operating pressure. In the system, emitter and the lateral spacing were chosen as 0.20 and 0.70 m, respectively.

Crop water consumption under varying irrigation regimes was calculated using the soil water balance equation [19] as;

$$\mathbf{ET = R + I - D \pm \Delta W} \quad (2)$$

Where, ET is the water use (mm), R is the rainfall (mm), I is the depth of irrigation (mm), D is the depth of drainage (mm), and ΔW is the change of soil water storage in the measured soil depth.

Seed cotton yield was determined by hand harvesting in the three center rows of each plot on November 16, 2021 (Fig.1). At harvest time, the plants in the three middle rows were harvested by hand and weighed, and the cotton yield of the plot was found. At the same time, a sample of 500 g of raw cotton was taken from each plot and sent to the Fiber Quality Laboratory of the Nazilli Cotton Research Institute-Aydın/TURKEY for determination of fiber strength, fiber length, fiber fineness, uniformity and elongation. Fiber characteristics were determined using an HVI (High Volume Instrument) from fiber taken from each plot. The yield components examined in this study are; number of bolls per plant (no/plant), boll raw cotton weight (g), single plant yield (g /plant), 100-seed weight (g) and lint percentage (%). In order to determine the differences between irrigation treatments, the data relating to all the parameters described above were subjected to variance analysis. The Least Significant Differences (LSD) test was used for comparing and ranking the treatments. Differences were declared significant at $p < 0.05$. Variance analysis and LSD tests were carried out with the use of the TARİST program, which was developed for this purpose [20].

Figure 1: Appearance from cotton harvest plot

Results & Discussion

The total irrigation water amounts applied, seasonal water use and average seed cotton yield data were presented in Table 2. Altogether 7 treatment irrigations varying from 59 to 165 mm in TS-100 plots were practiced. The first irrigation was applied on July 29 and irrigations were lasted on September 11, in 2021, respectively. Treatments received irrigation water varying from low of 97 mm in PRD-33 plots to high 575 mm in full irrigation plots (TS-100). A total of 290 mm was applied to PRD-100 treatment plots.

Table 2: Seasonal irrigation water, water use and average seed cotton yield data for different treatments

Irrigation treatment	Seasonal irrigation water (mm)	Seasonal water use (mm)	Average seed cotton yield (kg/da)
TS-100	575	666	511
DI-67	383	528	445
DI-33	189	344	365
PRD-100	290	426	415
PRD-67	193	385	345
PRD-33	97	220	285

Seasonal plant water use values varied in connection with the irrigation water applied to the treatments and the amount of moisture at planting and harvest. At the same time, although it has a great effect on plant water consumption, there was 105,9 mm rain on the experimental area during the growing season. Plant water use was higher at full irrigation level (TS-100) than in the deficit (DI) and PRD irrigation plots. Water use values increased with increasing irrigation levels in each irrigation approaches. Seasonal water use varied from 220 to 666 mm among the different treatments. The highest water use was observed in TS-100 treatment as 666 mm, and the lowest water use was measured in PRD-33 treatment as 220 mm. This was followed by PRD-67 and DI-67 treatments, 385 and 528 mm in the growing season, respectively (Table 2). The seasonal water use values was obtained from treatments PRD-100 as 426 mm. Seasonal water use in the full irrigation treatment S1, was in agreement with results obtained by [21] in the Aydın plain with the drip system and who determined water use values as 800 mm. Seasonal water use of cotton under the same region has been reported as 899 mm by

[22]; as 855-882 mm by [23] under furrow irrigation system; as 265-753 mm by [2] and as 268-754 mm by [24] under drip irrigation system.

Seed cotton yields varied from 285 to 511 kg/da among the treatments (Table 2). The highest average seed cotton yield was observed in TS-100 treatment as 511 kg/da and the lowest yields were found in PRD-33 treatment as 285 kg/da. PRD-100 and DI-67 treatments resulted in nearly the same cotton yields (415 and 445 kg/da, respectively). On the other hand, the response of seed cotton yield to different irrigation treatments (variance analyze) are given in Table 3. Data obtained from study showed that seed cotton yield was significantly affected by irrigation levels and irrigation application methods ($p< 0.01$). There was no interactions between irrigation application methods (App.) and irrigation levels (IL) were observed for any investigated parameters in year. Traditional full and deficit irrigation (TS-100; DI) methods resulted in higher yield than partial root zone drying (PRD) applications. Seed cotton yield was found to increase with irrigation water levels. Examining these results from the point of view of irrigation levels (IL), three groups formed in year. The first group consisted of the 100% treatments where no water restriction had been applied in the whole growing season, treatments in which water had been applied at the 67 % level were second, and treatments which had received water at the 33 % level formed the third group. Especially, as the irrigation level increased, seed cotton yield were increased in all applications. The highest average yield was obtained from IL-100 treatment as 463.1kg/da, followed by IL-67 treatment as 395.0 kg/da. The lowest yield was obtained from IL-33 treatment as 325.0 kg/da.

Table 3: Seed cotton yield (kg/da) as influenced by irrigation applications and irrigation levels

Irrigation application methods (App.)	Traditional full and deficit irrigation (TS-100; DI)	440.4a
	Partial root zone drying (PRD)	348.3b
F value (App.)		**
LSD $_{\%5}$		13.632
Irrigation levels (IL)	IL-100%	463.1a
	IL-67%	395.0b
	IL-33%	325.0c
F value (IL)		**
LSD $_{\%5}$		16.696
App. x IL		ns

*P< 0.05; **P< 0.01; ns: not significant

In a column values with a common letter are not significantly differ from one another using LSD$_{\%5}$

A significant decline in seed cotton yield under deficit irrigation treatment is reported in many previous researches.

According to the results of a study conducted on drip irrigated cotton in Aydın area, the highest cotton yield was achieved from a treatment in which 100 % of the amount of evaporation from a class A-pan was applied at 8-day irrigation interval [25]. On the other hand, the highest seed cotton yield (5870 kg/ha) was reported in the Harran plain from the full irrigation treatment (100%) with 6-day irrigation interval using drip irrigation method [1]. The average seed cotton yield was obtained as 5760 kg/ha under drip irrigated treatment in western Turkey [24]. Another Aydın plain conditions the highest average raw cotton yield was obtained from S1 treatment (Carisma-V1) as averaging 6300 kg/ha. It was determined Carisma (V1) cultivar performed higher yields than Candia (V2) and Gloria (V3) [26]. Similar results were obtained by [21] as 5985 kg/ha at the same conditions. The results observed in this research were in agreement with the others given above. In evaluations conducted previously, it has been found that irrigation level have significant effect on seed cotton yield. It has been concluded that the most proper irrigation programme suggested for achieving highest cotton yield would be using the delinted seed applications under water abundant conditions in which the crop water requirements were fully met by IL-100 treatment (treatment D1).

Number of bolls per plant significantly ($p<0.01$) increased with increasing the rate of irrigation water applied. The IL-100% plots showed the highest number of bolls, the lowest one was determined from the IL-33% plots, respectively. In general, the amount of irrigation water tended to increase bolls production per plant for growing seasons. Similar trend have been reported for cotton [27, 11, 28, 14]. Considering boll raw cotton weight, the irrigation application methods and different irrigation levels ($p<0.0$) had a significant impact on cotton yield (Table 4). In study year, an increase in irrigation water levels caused an important improve in the weight of seed cotton. The treatments with the highest irrigation water levels produced the most substantial seed cotton, whereas the treatments with the lowest irrigation water levels produced the lowest weight seed cotton. The determination of seed cotton weight in previous studies was established as 6.32-6.36 g [29], 2.60-3.35 g [30]. In a study in which the drip irrigation method was applied under Aydın plain conditions, boll weights varied on average between 3.51 and 6.18 g; between 5.4 and 6.6 g; between 4.6 and 6.0 g according to different irrigation applications and cotton varieties, respectively [24, 18, 31, 32]. The differences may be due to the preferred variety [33], the amount of irrigation water [30].

The single plant yield values varied from 45.48 to 64.88 g/plant in relation to the irrigation applications and irrigation levels. Examining single plant yield values in the Table 4, it is seen that the irrigation application methods and different irrigation levels (p<0.0) had a significant impact on cotton yield. Traditional full and deficit irrigation (TS-100; DI) treatments produced more single plant yields than partial root zone drying (PRD) treatments. On the other hand, the first group was formed from treatments which received full (100%) irrigation water, and the last group was formed from the treatments which received 33 % irrigation water. Under Aydın conditions, the average single plant yields varied between 75 and 111 g and between 58 and 82 g in relation to the cultivars and irrigation programmes [34, 18, 31, 32].

Examining 100-seed weight in Table 3, it is seen that the difference both application methods (Traditional full and deficit irrigation (TS-100; DI) and partial root zone drying (PRD) and irrigation levels were insignificant (ns). The highest value was obtained from the treatments which received the full amount of water (100%). Similar to the other quality characteristics, 100-seed weight values in all irrigation treatments showed a decline in relation to irrigation water restriction. In three different experiments in Aydın conditions, researchers determined different 100-seed weight values with an average of 9.80-11.24 g by [22]; 9.31-11.20 g by [21]; and 9.91-13.13 g by [38] in connection with different irrigation methods and irrigation programmes. The observed differences in the 100 seed weights between the current investigation and the prior study could potentially be attributed to varietal distinctions [11].

Examining lint percentage values, it is seen that there were a significant difference between application methods and irrigation levels. These values varied from 41.21 to 42.55 % in growing season. The study showed an increase in ginning yield with an increase in the amount of irrigation water in studt year. The highest ginning yield was determined in the FI-D1 application, while the lowest yield was obtained in the PRD applications. In a study carried out on the Nazilli 84 cultivar of cotton under Antalya conditions using furrow and drip irrigation methods, and reported of 41.42% with furrow irrigation and 42.06% with drip irrigation [39]. In the same way, values of 43-44% reported by [40]. In a study applying surface irrigation methods values of 44-45% and 41.6-44.3% were reported by [38] and [39]. In another study in the same region, using the drip irrigation method lint percentage values of 39.96-40.02% were determined by [35]. Also, in a study under restricted irrigation conditions, lint percentage values varied between 43% and 45% according to irrigation levels [40]. Another researcher in the same region reported these values as 39.8-41.7% [22].

Table 4: Yield components of seed cotton data for different treatments

		Number of bolls (number)	**Boll raw cotton weight (g)**	**Single plant yield (g)**	**100-seed weight (g)**	**Lint percentage (%)**
Irrigation application methods (App)	Traditional full and deficit irrigation (TS-100; DI)	10.44	5.92a	61.73a	10.76	42.52a
	Partial root zone drying (PRD)	10.66	4.60b	48.75b	8.92	41.61b
LSD%5		-	0.397	1.933	-	0.584
Irrigation Level (IL)	% 100	12.33a	5.81a	64.88a	10.66	42.65a
	% 67	10.33b	5.41b	55.36b	10.45	42.33a
	% 33	9.00b	4.55b	45.48c	8.41	41.21b
LSD%5		1.815	0.486	2.368	-	0.715
	App	ns	**	**	ns	**
	IL	**	**	**	ns	**
	App x IL	ns	ns	ns	ns	ns

*P< 0.05; **P< 0.01; ns: not significant

Table 5 shows the values relating to cotton fiber quality obtained in the study, and also same table gives the results of variance and the LSD tests of this research. In study year, the irrigation application methods ($p<0.05$) and different irrigation levels ($p<0.01$) had a significant impact on fiber fineness. However, the interaction between irrigation application methods and irrigation water level did not show a significant effect on fiber fineness. The effect of water deficit on fiber fineness was not consistent throughout the year. Fiber fineness values varied from 5.74 (IL-%100) to 5.48 (IL-%33). These results were in agreement with the results reported by [2]; [24] and [41]. On the other hand, in Aydın conditions, reported fiber fineness values varied from 4.28 to 4.76 micronaire [21].

Examining fiber length in Table 5, it is seen that the difference between the irrigation approaches were insignificant, while the difference between irrigation levels were significant at the $p<0.01$ level. The highest fibre length (30.50 mm) was obtained from the IL-%100 irrigation level and occurred in the first group (a) (Table 5). IL-%100 treatment resulted in highest fiber length in the study and followed by IL-%67 and IL-%33 as shown in Table 5. The findings obtained in the study were similar to most of the previous research into determining the effects of different irrigation level on cotton cultivars [2, 24, 41, 37].

Examining fibre strength in Table 5, it is seen that the both the irrigation application methods and irrigation levels were not significant in the study. The highest value was obtained from the IL-%100 irrigation level as 33.94 g/tex and followed by IL-%67 and IL-% 33 as shown in Table 5. Studies of gene action suggest that, within upland cotton genotypes there is little non-additive gene action in fiber strength [35]; that is, genes determine fiber strength. These results were in agreement with the results reported by [2, 24, 41, 42]. In addition, under Aydın conditions fiber strength values varied between 29.96 and 31.2 g/tex in 2018 according to drip irrigation treatments [21].

The effects on fiber elongation and uniformity index of the study treatments, from the point of view of the irrigation levels and irrigation approaches were found to be significant at the $p<0.05$ and p<0ç01 levels. In the year of the study, these values varied from 7.11% to 7.54% and varied from 83.92% to 85.24%. These results were in agreement with the results reported by [21] in Aydın province.

Table 5: Cotton fiber quality data for different treatments

		Fiber fineness (micronaire)	Fiber length (mm)	Fiber strength (g/tex)	Uniformity percentage (%)	Fiber elongation (%)
Irrigation application approaches (App)	Traditional full and deficit irrigation (TS-100; DI)	5.66a	30.25a	33.61	85.24	7.44a
	Partial root zone drying (PRD)	5.55b	29.27b	31.72	84.93	7.28b
$LSD_{\%5}$		0.083	0.644	-	-	0.102
Irrigation	% 100	5.74a	30.50a	33.94	86.19a	7.54a
Level	% 67	5.61b	30.17b	32.77	85.15b	7.39b
(IL)	% 33	5.48c	28.61c	31.29	83.92c	7.11c
$LSD_{\%5}$		0.102	0.789	-	0.578	0.125
	App	*	**	ns	ns	*
	IL	**	**	ns	**	**
	App x IL	ns	ns	ns	ns	ns

*P< 0.05; **P< 0.01; ns: not significant

In a column values with a common letter are not significantly differ from one another using $LSD_{\%5}$

Conclusion

In this study, we evaluated the effects of partial root zone drying (PRD) and deficit irrigation (DI) strategies on yield, yield components and fiber quality of the drip irrigated cotton crop under Aegean semi-arid climatic conditions in western Turkey in 2021. According to the results obtained from the study, the highest seasonal plant water use value was obtained from IL-100 irrigation treatment for all application approaches. Seasonal water use varied from 220 to 666 mm in growing season. Irrigation levels (IL) had significant effects on seed cotton yield at a $p<0.01$ level. The highest average yield was obtained from TS-100 treatment as 511 kg/da, followed by PRD-33 treatment as 285 kg/da. Regarding the yield components (number of bolls per plant, boll raw cotton weight, single plant yield, 100-seed weight and lint percentage) the difference between irrigation application methods (traditional full and deficit irrigation (TS-100; DI) and partial root zone drying (PRD) and different irrigation levels were significant at a level of $p<0.05$ and $p<0.01$. According to the results of ANOVA of fiber quality parameters (fiber strength, fiber length, fiber fineness, uniformity index and elongation), both irrigation application approaches and irrigation levels were found to be significant. Finally, it may be concluded that as cotton is a crop which is sensitive to shortages of moisture in the soil, it is necessary to fully meet its water needs throughout the growing season in order to obtain high seed cotton yield and good fiber quality. However, if water resources in the area are limited, then restricting water to a level of only 33 % may produce acceptable results.

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