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Evaluation of Water Use Efficiency under Different Water Regimes in Grain Sorghum (*Sorghum bicolor*, L. Monech)

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Abstract: Two field experiments were carried out at Assiut Univ. Exp. Farm, during 2008 and 2009 seasons to evaluate water use efficiency under different water regimes for grain sorghum cultivars. The results of combined analysis showed that the tested cultivars differed significantly in all studied traits except for protein % in both seasons. Shandaweel-6 cultivar surpassed the other two cultivars in of head length, head weight, grain yield head^{-1}, grain yield plot^{-1} and straw yield plot^{-1}, while Giza-15 cultivar was the tallest cultivar <3m and possessed the greatest seed index. Sorghum cultivars which irrigated with (I_2) produced the tallest plants and, greatest seed index as well as heaviest head weight, grain yield head^{-1}, grain yield kg plot^{-1}, while plants which irrigated with (I_1) produced the highest values of head length and straw yield kg plot^{-1}. On the other hand, plants received less water supply (I_3) produced the lowest values of these traits. Regarding to the interaction, Shandaweel-6 cultivar grown under (I_1) irrigation regime gave the highest values of head length, head weight, grain yield head^{-1} and straw yield kg plot^{-1}.

Key words: Grain sorghum · Water regime · Water use efficiency

INTRODUCTION

Grain sorghum (*Sorghum bicolor*, L. Monech) is one of the most important cereal crops in Egypt and the world. It ranks the third of the world cereal crops. Sorghum is considered one of the most adapted summer grain crops to drought and heat. Therefore, more than 70% of cultivated area with sorghum is located in Upper Egypt (Assiut and Sohage) and Fayoum. In Egypt the total cultivated area is about 3.4 million hectare depends mainly upon irrigation from the Nile water which contributes about 95% of the national water supply. Sorghum cultivated area is about 158000 hectare producing 880000 tons of grains with an average of 5.7 tons ha^{-1} [1]. In addition, it is a double purpose crop and the vegetative parts are used for animal feeding in summer season where green forage crops are not quite available. However, the total production is less than the needs of the local consumption. Therefore, efforts are focused on increasing productivity of this crop by growing high yielding new varieties under the most favorable cultural treatments. Irrigation is one of the most important factors that play a great role in sorghum production. Sorghum is tolerant to water stress conditions at different stages of growth and the water deficiency may exert its effect on yield and yield components. Growth and photosynthesis are the most important processes disturbed, partially or completely, by water stress and changes in both are a major cause of decreased crop yield. Availability of adequate amount of moisture at critical stages of plant growth not only optimizes the metabolic process in plant cell but also increases the effectiveness of the mineral nutrients applies to the crop. Consequently any degree of water stress may produce deleterious effects on growth and yield of the crop. At any stage of crop growth, it is difficult to provide the exact amount of water used by the crop without inducing some degree of moisture stress. Therefore, to reduce crop stress to a minimum, it is necessary to supply more water than that actually used by the crop [2]. Egypt has a definite amount of water that can be used for irrigation. Although it may be possible to increase the water supply, it will still be finite at somewhat high used levels. So, any procedure that can maximize the use of water in agriculture is of extreme importance to the security and economic welfare of Egypt. Therefore, the purpose of the current investigation is to study the evaluation of water use efficiency under different water regimes for three grain sorghum cultivars.

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MATERIALS AND METHODS

The present study was carried out at Assiut Univ. Exp. Farm. Assiut, Egypt during 2008 and 2009 seasons to evaluate water use efficiency under three water regimes (i.e., 6240 $m^3 ha^{-1}$ (I_1), 4680 $m^3 ha^{-1}$ (I_2) and 3120 $m^3 ha^{-1}$ (I_3) which represented 100%, 75% and 50% from water consumptive (ET crop) of sorghum in Assiut region, respectively. Water requirement (amount of irrigation water $m^3 ha^{-1}$) applied for each irrigation treatment based on ET crop 10400, 7800 and 5200 $m^3 ha^{-1}$. Water requirement values were estimated from the ET crop values by using irrigation efficiency of 60% for surface irrigation system [3]. The amounts of applied water were increased gradually according to the weather condition and plant age. About 15% of seasonal ET was observed at preplant, 10% during period of emergence, about 25% occurred during panicle differentiation, 25% during flowering, 15% during milk stage and 10% during hard dough to physiological maturity Olufayo *et al.* [4]. The experimental design was randomized complete block (RCBD) in a strip- plot design with three replications. The main plots were chosen for water regime, the sub-plots were devoted for sorghum cultivars. Three grain sorghum cultivars (Dorado, Shandaweel-6 and Giza-15) were used. The irrigation system adopted in this was surface irrigation. The plots were isolated by ditches of 1.5 m in width to avoid lateral movement of irrigation water to adjacent plots. Water regimes under study were applied after the 1st irrigation through a pumping machine, water meter tubes and valves of 4-inches diameter. Superphosphate fertilizer was added at rates of 74 kg P ha^{-1} as calcium superphosphate 15% P_2O_5 during soil preparation. Nitrogen fertilizer was applied with sowing at rates of 238 kg N ha^{-1} as urea 46% N. Sowing dates were on June 20th and 25th in first and second seasons, respectively. The preceding crop was wheat in both seasons. The plot size was 10.5 m^2 containing 5 ridges 3.5 meter in length and 0.6 meter in width and 25 cm between hills. Thinning was carried out after 25 days from sowing, leaving two plants $hill^{-1}$. Before planting, soil samples were taken from the experimental site and analysed according to the procedures of Jackson [5]. Some physical and chemical properties of the soil are presented in Table 1.

All cultural practices were applied as recommended for sorghum production in Upper Egypt except the treatments under investigation. Ten plants were taken at random from each experimental unit for the determination of some yield components. Yield was estimated from the sub-plots. The following data were recorded:

Table 1: Some physical and chemical properties of a representative soil samples in the experimental site before sowing (0-30 cm depth) in 2008 and 2009 seasons

Soil properties	2008*	2009*
Particle size distribution		
Silt (%)	26.8	27.2
Sand (%)	25.7	24.3
Clay (%)	47.5	48.5
Texture	Clay	Clay
Organic matter (%)	1.77	1.82
Field capacity (%)	43.00	42.6
EC (1:1 extract) (dsm^{-1})	0.78	0.75
pH (1:1 suspension)	7.8	7.6
Total nitrogen (%)	0.68	0.70
Total $CaCO_3$ (%)	3.6	3.8
$NaHCO_3$-extractable P (ppm)	8.7	9.2
NaOAC-extractable K (ppm)	121	124

* Each value represents the mean of three replications

- Plant height (cm).
- Head length (cm).
- Head weight (g).
- Grain weight $head^{-1}$(g).
- Seed index (g).
- Straw yield (kg $plot^{-1}$).

Grain Yield (kg $plot^{-1}$): The grain yields were recorded on a plot basis.

Protein Percentage: Total nitrogen in seeds was determined using Micro-Kjeldahl method as described by A.O.A.C. [6] and protein concentration was calculated by multiplying nitrogen percentage by a factor of 6.25.

Water Use Efficiency (WUE): WUE values as kg grains/m^3 water consumed was calculated for different treatments as follows:

WUE = Grain yield (kg/ha)/water consumptive use ($m^3 ha^{-1}$), according to Vites [7].

Combined analysis of variance over years was performed on the data of two growing seasons according to Gomez and Gomez [8], after testing the homogeneity of the error according to Bartlett's test. The least significant difference (L.S.D.) test at the 5 % level of probability was used to compare the differences among means. Regression analysis was performed with the SAS software package.

RESULTS AND DISCUSSION

Yield and Yield Component Traits: Data in Tables 2 and 3 revealed that growth traits were significantly affected by sorghum cultivars in both seasons and their combined effect. Shandaweel-6 cultivar recorded the highest values of head length (32.28 cm), head weight (96.53 g) and straw yield (26.11 kg plot^{-1}) while Giza-15 was the tallest cultivar (309.12 cm). Plants received (I_2) irrigation regime recorded the highest values of plant height (213.28 cm) and head weight (87.15 g). The interaction between water regime and sorghum cultivars in Table 4 revealed that the highest value of head length (32.55 cm) and head weight (104.0 g) were obtained by Shandweel-6 plants irrigated with (I_1) water regime, while the highest value of plant height (323.34 cm) was obtained by Giza-15 plant irrigated with (I_2) water regime. The superiority of Shandweel-6 cultivar may be due to its genetic basis. Also, higher availability of moisture might have helped in better nutrient removal by the crop which in turn resulted in assimilation of more photosynthates. Mourad and Anton [9] reported that Shandaweel-6 hybrid plants were the tallest whereas, those of Dorado variety were the shortest. Yield and their components scored significant differences for all genotypes, the highest values of green weight plant^{-1}, head weight plant^{-1}, grain weight plant^{-1} as well as fodder and grain yield ha^{-1} were obtained from Shandweel-6 hybrid. The maximum fodder yield was obtained Dorado variety received the wet treatment (namely wet 25-30%). Whereas, the highest grain yield ha^{-1} was obtained from Shandaweel-6 hybrid irrigated at 45- 50% (medium treatment). Water is generally considered as one of the limiting factors which affects the physiological and biochemical processes affecting crop productivity. Water provides turgidity to the cell while water stress causes dehydration, reducing the enlargement and expansion of the cell, resulting in a reduction in leaf area. The reduction in leaf area certainly affects the overall growth of the crop [10]. Farah [11] reported that grain yield components and straw yield were significantly affected by irrigation treatments. Water deficits affected grain yield primarily through effect on number of grain when it occurred during the period from emergence to time after floral initiation. The second effect was on grain size when the deficit occurred during heading and flowering stages. Olufayo *et al.* [4] reported that about 15% seasonal ET was observed during period of emergence to 5th leaf, about 65% occurred during panicle differentiation to flowering and 20% during hard dough to physiological maturity. El-Sarag and Abu Hashem [12] found that water stressed plants not suffered from low water supply only, but also reduction in nutrient supply and photosynthetic area which reflected on decreasing light interception and in turn decreased dry matter accumulation. This stressed reduction in dry matter affected negatively forage and protein yields. Beheshti and Behboodi [13] showed that water stress significantly increased amounts of remobilized dry matter, remobilization efficiency, remobilization percentage by 11.21%, 32.37 % and 14.20%, respectively, compared with normal condition over all treatments. However it significantly decreased biological and grain yield. Disturbance in current photosynthesis caused 57.79 % and 21.20 % increase in remobilization percentage and remobilization efficiency compared to non disturbance status across all treatments. M5 genotype had the highest remobilization percentage and remobilization efficiency as compared with the two other genotypes in all experimental plots. Data in Tables 2 and 3 showed that yield traits were significantly affected by water regime and sorghum cultivars in both seasons and their combined effect. Shandaweel-6 cultivar recorded the highest value of grain yield head^{-1} (59.94 g), grain yield plot^{-1} (7.44 kg) and straw yield plot^{-1} (26.04 kg). Sorghum plants which received (I_2) water regime produced the greatest grain yield head^{-1} (55.45 g), seed index (32.91 g) and grain yield plot^{-1} (7.59 kg), while plants which irrigated with (I_1) recorded the highest value of straw yield (26.12 kg plot^{-1}). On the other hand plants received less water supply (I_3) water regime reported the lowest values of these traits. The interaction between water regime and sorghum cultivars (Table 4) revealed that the highest grain yield head^{-1} (65.50 g) and straw yield plot^{-1} (31.91 kg) were obtained by Shandweel-6 when irrigated with (I_1) water regime, while the highest value of grain yield plot^{-1} (8.07 kg) was obtained by Shandaweel-6 plant irrigated with (I_2) water regime. A significant improvement in plant and dry matter formation measured as grain and straw yields was recorded with the increasing levels of irrigation. It was found that irrigating sorghum at two weeks interval increased significantly its plant growth and grain yield [14]. These results are in agreement with those obtained by Ibrahim [15] and Yousef *et al.* [16].

Protein Percentage: Data in Tables 2 and 3 revealed that protein% was not significantly affected by different cultivars, while it was significantly affected by water regime in both seasons and their combined effect.

Table 2: Main effects of cultivars on sorghum traits in 2008 and 2009 seasons and their combined values

	Plant height (cm)			Head length (cm)			Head weight (g)		
Cultivars	2008	2009	Comb.	2008	2009	Comb.	2008	2009	Comb.
Dorado	126.10	122.99	124.55	21.37	20.76	21.07	59.73	57.84	58.79
Giza-15	309.12	305.61	307.37	20.29	19.81	20.05	85.62	84.80	85.21
Shandaweel-6	171.97	174.27	173.12	32.28	27.36	29.82	96.53	93.73	95.13
LSD 0.05	18.45	16.53	10.24	1.85	1.64	1.21	4.24	4.65	2.31
Cultivars	Grain yield (g head^{-1})			Seed index (g)			Grain yield (kg plot^{-1})		
Dorado	43.61	42.23	42.92	24.96	23.65	24.31	6.67	6.52	6.60
Giza-15	49.66	49.18	49.42	41.10	39.48	40.29	6.52	6.43	6.48
Shandaweel-6	60.82	59.05	59.94	28.36	27.13	27.75	7.50	7.39	7.44
LSD 0.05	2.67	1.28	1.65	1.64	1.47	1.24	0.52	0.43	0.35
Cultivars	Protein %			Straw yield (kg plot^{-1})			Water use efficiency		
Dorado	9.07	9.02	9.04	22.91	23.97	23.44	1.591	1.462	1.527
Giza-15	9.08	9.21	9.15	18.16	19.41	18.79	1.481	1.436	1.458
Shandaweel-6	9.13	9.22	9.18	26.11	25.97	26.04	1.588	1.482	1.535
LSD 0.05	-	-	-	1.52	1.24	1.32	0.021	0.015	0.011

- = indicate insignificant

Table 3: Main effects of irrigation regime on sorghum traits in 2008 and 2009 seasons and their combined values

	Plant height (cm)			Head length (cm)			Head weight (g)		
Irrigation regime	2008	2009	Comb.	2008	2009	Comb.	2008	2009	Comb.
I_1	202.58	201.88	202.23	27.11	24.25	25.68	83.11	81.37	82.24
I_2	214.44	212.12	213.28	24.99	24.77	24.88	88.39	85.92	87.16
I_3	190.17	188.87	189.52	21.84	21.91	21.88	70.39	69.09	69.74
LSD 0.05	12.65	14.52	9.45	1.12	1.52	1.34	3.52	2.64	2.51
Irrigation regime	Grain yield (g head^{-1})			Seed index (g)			Grain yield (kg plot^{-1})		
I_1	53.04	51.94	52.49	31.41	30.00	30.71	7.02	6.91	6.96
I_2	56.25	54.64	55.45	33.66	32.16	32.91	7.63	7.54	7.59
I_3	44.79	43.88	44.34	29.35	28.11	28.73	6.05	5.89	5.97
LSD 0.05	2.24	1.85	1.24	2.02	1.85	1.33	0.41	0.53	0.23
Irrigation regime	Protein %			Straw yield (kg plot^{-1})			Water use efficiency		
I_1	8.35	8.40	8.38	26.32	25.91	26.12	1.137	1.040	1.088
I_2	8.67	8.77	8.72	23.40	25.14	24.27	1.617	1.520	1.568
I_3	10.26	10.27	10.27	17.45	18.31	17.88	1.907	1.820	1.864
LSD 0.05	1.26	1.23	1.12	1.35	1.65	1.24	0.22	0.19	0.14

Table 4: Effects of interaction between cultivars and irrigation regime (I) on sorghum traits in 2008 and 2009 seasons and their combined values

		Plant height (cm)			Head length (cm)			Head weight (g)		
Irrigation	Cultivars	2008	2009	Comb.	2008	2009	Comb.	2008	2009	Comb.
I_1	Dorado	128.10	124.10	126.10	24.27	22.87	23.57	64.43	62.00	63.22
	Giza-15	307.73	305.23	306.48	21.47	20.37	20.92	95.03	93.47	94.25
	Shandaweel- 6	171.90	176.30	174.10	35.60	29.50	32.55	105.70	102.30	104.00
I_2	Dorado	134.77	130.87	132.82	20.77	20.10	20.44	62.63	61.77	62.20
	Giza-15	325.60	321.07	323.34	20.97	20.15	20.56	84.43	82.50	83.47
	Shandaweel- 6	182.97	184.43	183.70	33.23	27.83	30.53	102.27	99.83	101.05
I_3	Dorado	115.43	114.00	114.72	19.07	19.30	19.19	52.13	49.77	50.95
	Giza-15	294.03	290.53	292.28	18.44	18.92	18.68	77.40	78.43	77.92
	Shandaweel- 6	161.03	162.07	161.55	28.00	24.73	26.37	81.63	79.07	80.35
LSD 0.05		21.24	33.52	25.42	1.25	2.63	1.34	9.25	7.67	8.24

Table 4: Continued

Irrigation	Cultivars	Grain yield head^{-1}			Seed index (g)			Grain yield (kg plot^{-1})		
I_1	Dorado	47.04	45.26	46.15	24.49	23.53	24.01	6.65	6.47	6.56
	Giza-15	55.12	54.21	54.67	41.58	40.14	40.86	6.52	6.53	6.53
	Shandaweel- 6	66.60	64.40	65.50	28.16	26.33	27.25	7.88	7.72	7.80
I_2	Dorado	45.72	45.09	45.41	26.44	24.61	25.53	7.63	7.50	7.57
	Giza-15	48.97	47.85	48.41	43.04	41.24	42.14	7.18	7.07	7.13
	Shandaweel- 6	64.40	62.90	63.65	31.50	30.64	31.07	8.08	8.06	8.07
I_3	Dorado	38.06	36.33	37.20	23.94	22.82	23.38	5.73	5.60	5.67
	Giza-15	44.89	45.49	45.19	38.68	37.07	37.88	5.87	5.68	5.78
	Shandaweel- 6	51.40	49.80	50.60	25.42	24.43	24.93	6.54	6.38	6.46
LSD 0.05		4.16	5.23	4.13	3.24	2.84	3.25	0.65	0.54	0.43
Irrigation	Cultivars	Protein (%)			Straw yield (kg plot^{-1})			Water use efficiency		
I_1	Dorado	8.37	8.32	8.35	26.19	25.83	26.01	1.160	1.027	1.094
	Giza-15	8.39	8.50	8.45	20.34	20.52	20.43	1.030	1.037	1.034
	Shandaweel- 6	8.30	8.39	8.35	32.44	31.37	31.91	1.220	1.056	1.138
I_2	Dorado	8.69	8.61	8.65	24.01	25.77	24.89	1.680	1.580	1.630
	Giza-15	8.57	8.77	8.67	18.49	20.64	19.57	1.550	1.460	1.505
	Shandaweel- 6	8.75	8.93	8.84	27.70	29.00	28.35	1.620	1.520	1.570
I_3	Dorado	10.14	10.13	10.14	18.52	20.30	19.41	1.933	1.780	1.857
	Giza-15	10.29	10.35	10.32	15.65	17.07	16.36	1.863	1.810	1.837
	Shandaweel- 6	10.35	10.33	10.34	18.19	17.55	17.87	1.925	1.870	1.898
LSD 0.05		1.16	1.14	1.05	2.42	2.15	2.34	0.42	0.33	0.22

Table 5: Correlation coefficient between grain yield and certain traits of sorghum crop grown in 2008 and 2009 seasons

	1	2	3	4	5	6	7	8	9
1-Plant height	-	0.789**	0.773**	0.804**	- 0.048	0.500**	- 0.022	0.358**	0.007
2-Head length		-	0.660**	0.837**	- 0.161	0.683**	- 0.199	0.701**	0.334*
3-Head weight			-	0.935**	0.495**	0.579**	- 0.310*	0.396**	0.408**
4-Grain yield head^{-1}				-	0.213	0.744**	- 0.396	0.661**	0.517**
5-Seed index					-	- 0.008	- 0.110	- 0.282*	0.230
6-Grain yield g plot^{-1}						-	- 0.422**	0.754**	0.469**
7-Protein %							-	- 0.539**	- 0.814**
8-Straw yield								-	0.657**
9-Water consumption									-

*, ** and indicate significant, highly significant at 0.05, 0.01 respectively

The highest protein value (10.27%) was obtained when sorghum plants were irrigated with the lowest water supply (I_3), while the lowest one (8.38%) was obtained from plants irrigated with high water supply (I_1). The maximum value of protein (10.34%) was obtained from Shandweel-6 cultivar under (I_3) water regime. It seems that the water regime forced the plant metabolism to increase the protein synthesis in seeds. El-Bagoury *et al.* [17] reported that the crude protein% of grain sorghum was significantly increased from 9.38% to 10.63%, 11.28% and 11.88% when irrigation interval increased from 4 to 8, 12 and 16 days, respectively. Abdalla *et al.* [18] showed that grain protein content was increased when sorghum plants were water stressed at flowering stage, or at grain filling stage or at physiological maturity. On contrast other results were reported by Abdel Rehim *et al.* [14] who found that crude protein was increased as irrigation frequency increased, while ash percentage tended to increase as irrigation frequency decreased.

Water Use Efficiency: The combined analysis of the data presented in Tables 2 and 3 show that water use efficiency was significantly affected by sorghum cultivars and irrigation regime. Shandweel-6 cultivar recorded the highest value of water use efficiency (1.535 kg grains/m^3 water) compared to the other cultivars. Sorghum plants which received fewer water supplies (I_3) produced the highest value of water use efficiency (1.864 kg grains/m^3 water), while the lowest one (1.088 kg grains/m^3 water) was obtained from plants irrigated with high water supply (I_1). The maximum value of water use efficiency (1.898 kg grains/m^3 water) was obtained from Shandaweel-6 under (I_3) water regime. Numerous studies pointed out to the importance of water use efficiency (WUE) to crops and most of them on a grain yield basis, but few on a photosynthesis and biomass basis. Doorenbos *et al.* [19] found that water use for sorghum is between 450-650 mm, depending on climate, available moisture and growing season duration.

Gad El-Rab *et al.* [20] found that maximum water use efficiency (0.830 kg grains/m^3 water) was obtained from intermediate intervals and 5395 m^3 water ha^{-1}. Bashir and Yousef [21] concluded that seasonal ET by grain sorghum was 52.5, 47.7 and 43.5 cm by irrigation at 75, 50 and 25% available soil moisture. Mastrorilli *et al.* [22] revealed that grain sorghum is highly sensitive to water stress during the flowering stage. Water stress at flowering or at seed setting gave seasonal evapotranspiration of 369 mm and 360 mm, respectively. Under well water condition, seasonal ET was 420 mm. Water use efficiency values were 0.67, 1.59, 1.41 and 1.51 for sorghum plants, subjected to water stress during flowering, seed-setting, seed ripening stages and non stressed plants, respectively. El-Koliey *et al.* [3] estimated the seasonal water requirement for sorghum under surface, sprinkler and drip irrigation system in Assiut region. The water requirement was 12080, 8054 and 7107 m^3 ha^{-1}. Water requirement values were estimated from the ET crop values by using irrigation efficiency of 50% for surface irrigation, 75% sprinkler irrigation and 85% for drip irrigation. Mohamed [23], found that the seasonal ETc in Assiut region, for sunflower crop, values were 4790, 4570 and 4143 m^3 ha^{-1} at 13, 50 and 75% soil moisture depletion from available water (SMD), respectively under flooding irrigation.

Correlation Coefficient: Data in Table 5 showed that the positive rank correlation coefficient between water consumption and head length (0.334), head weight (0.408), grain yield head (0.517), grain yield plot (0.469) and straw yield (0.657). There is negative rank correlation between water consumption and protein % (-0.814). In this respect Latif *et al.* [24] reported that, there is negative rank correlation between irrigation intervals and both plant height (-0.535) and LAI (0.361) and attributed such values to the adverse effect of water stress on growth of the plants. Miseha [25] found that growth and development of plants depend on cell division and elongation. These results are in agreement with obtained by Yousef *et al.* [16] and Latif [26]. Though sorghum has been considered as drought-resistant crop due to its deep rooted system, it responds to higher levels of irrigation. The reduction in water supply forced the plant metabolism to increase the protein synthesis in seeds.

CONCLUSION

According to the aforementioned results of this investigation, it can be concluded that adding water values 7800 m^3 ha^{-1} (I_2) of water requirement of sorghum in Assiut region which equal to 75% of the control treatment received (10400 m^3 ha^{-1} (I_1) and hence about 2600 m^3 ha^{-1} could be saved. This amount of water 7800 m^3 ha^{-1} (I_2) produced as much grain and straw yields ha^{-1}, so it seems to be better adapted and could be recommended to produce a high grain and straw yields ha^{-1} with high water use efficiency and more crop per drop of water could be achieved at Assiut region. Significant differences on yield, its contributing traits and water use efficiency were found between the three studied sorghum varieties. Shandaweel-6 variety surpassed Dorado and Giza-15 varieties in the response to irrigation regime.

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