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Evaluation of Some Durum Wheat Cultivars Under Water Deficit Using Conservation and Traditional Agriculture Systems

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ABSTRACT

The presented study was carried out at Meddle Egypt (28o 54′ N, 30o 56′ E) region at Beni-Suef Governorate under clay soil conditions. To Determine the best durum wheat genotypes tolerance to water deficit under Egyptian conditions, Introduce conservation agriculture system (CA) as new technology that reduces using water in durum wheat farms and determine the best genotypes under conservation agriculture system. Therefore, seven durum wheat cultivars are evaluated under four different treatments, yield and yield components traits are recorded. The results indicated that the conservation agriculture systems conserve more soil moisture, and the new system could save more amount of water used in irrigation. The traditional tillage system contributed the highest value in both successive seasons (3.68 and 4.68 kg/plot, respectively) compared to zero- tillage (2.84 and 3.00 kg/plot, respectively). The best durum wheat cultivar under zero-tillage system is Beni-Suef 1 in both growing seasons and both irrigation regime (normal and water deficit), while the best durum wheat cultivars under traditional tillage is Beni-Suef 4 in the first season and Sohage 4 in the second season under normal irrigation and Sohage 5 under water deficit, in spite of traditional system gave the highest value, the consternation agriculture still is best system conserve the consumed water in irrigation, so wheat breeding program under conservation agriculture is very important in the future..

KEYWORDS: : Durum wheat – Water deficit – Conservation tillage – traditional tillage - cultivars

1. INTRODUCTION

Wheat crop is considered one of the most important cereal crops in the world; it is the main grain crops in the Mediterranean region and the first strategic crop in Egypt. It is the main source of 69% of their daily carbs and 9.4% of their daily protein. The grains also include trace levels of B-group vitamins, minerals, and 2.5% lipids in addition to 1.8% dietary fibres. based on the 219 million hectares of land that produce 760 million tonnes annually. It provides almost one-fifth of the protein and calories in food for 4.5 billion people in 94 different nations (Emam *et al.*, 2022) (Ahmad *et al.*, 2022). Egypt has not yet achieved wheat self-sufficiency to meet its growing food requirements due to climate change. So, Egypt is the world's top wheat importer, and through increasing production, it intends to decrease its dependency on imports (El-Hashash *et al*., 2022). According to Central Agency for Public Mobilization and Statistics (2022). The area planted during the 2019-2020 season was approximately 3.4 million feddan, with production of approximately 9.1 million tonnes. Therefore, we import over half of our wheat consumption every year.

Durum wheat (*Triticum turgidum* L. subsp. durum (Desf.)) is one of the most important cultivated crops (Urbanavičiūtė *et al*., 2022). About 8% to 10% of the wheat grown and produced worldwide is durum wheat. Most of the world's pasta, couscous, and bread are made with this grain as an industrial raw material. So, there is an urgent need to develop the varieties of wheat durum after climate change, which has recently increased.

Water deficit stress is the major effect that the world facing in the current time due to the climate change. So, there is need to increase food production because of water shortages and many regions have been exposed to drought (Duma *et al*., 2022). Egypt considered one of those regions that facing drought stress danger because of simi-arid climate in Egypt. That makes rainfall annual rate in low level. Egypt's primary source of water supply is the Nile River, which provides us with over 55.5 billion cubic metres of water each year and This water provides 97% of our needs form freshwater (Abdelhafez *et al*., 2020). The Ethiopian Renaissance Dam's filling will lower this rate. A limited amount of groundwater is present, although the most of it is concentrated in the newly reclaimed lands (Abdelhafez *et al*., 2020). Due to this causes the researchers seek to develop agricultural methods and practices that reduce water shortage, maximize use, and ratio of water consumption for the processes of vertical and horizontal expansion.

Conservation agriculture (CA) considers one of these practical methods that achieving that goal. According to FAO definition the (CA) described as practical farming that aims to rising the production and sustainable of crops via restoring soil fertility by using essential principles of retention crop residues on surface, crop rotation and minimum tillage or no-tillage. CA's fundamental goal is to enhance the usage of agricultural resources with minimum external inputs by improving the environment via integrated soil and water management (Yimam *et al*., 2020). This creating a vital role to achieve environmental and crop sustainability (Shrestha *et al*., 2020). (CA) has increased worldwide but up till now it has slowly adopted or absent in many of regions (Farooq & Siddique, 2015). most of recently studies declared that water productivity, soil health has increased without adjust crop yield, as well as more profiting to smallholder farmers by combining irrigation practices and Conservation agriculture system (Belay *et al*., 2019). The present study aims a) Determine the best durum wheat genotypes tolerance to water deficit stress under Egyptian conditions., b) Introduce conservation agriculture system (CA) as new technology that reduce using water in durum wheat farms and c) Determine the best genotypes under Conservation agriculture system.

2. MATRIAL AND METHODS

This current study was carried in at Beni-Suef Governorate under clay soil condition within two growing seasons (2019/2020 and 2021/2022). Seven durum wheat cultivars were used in this study, Table1 shows names, pedigree, species, and origin. Regarding treatments, four treatments were designed as following, treatment no. 1 (T_1) traditional tillage under water - deficit, treatment no. 2 (T_2) traditional tillage under normal irrigation, treatment no. 3 (T_3) conservative tillage under water -deficit and treatment no. 4 (T_4) conservative tillage under normal irrigation. Five irrigations were applied for normal irrigation treatment and three irrigations were applied for water-deficit treatment. Concerning experimental design, split-split plot design was applied as following system, main plot (tillage system), Sub-plot (irrigation regime) and Sub-sub plot (durum wheat cultivars), Plot size was 6 m^2 (1.5 m width × 4 m long), The applied irrigation water was measured using water meter equipment. Table2 shows quantity of water that was measured regarding collected data, grain yield (kg/plot), number spikes/m^2, number of kernel/spike and 1000-kernel weight, analysis of collected data is computed using GenStat program version (2019).

Table 1. Name, pedigree, and origin of seven durum wheat cultivars used in the study.

No.	Name	Pedigree & selection history	Origin
1	BENI-SUEF 1	Jo"S" / AA//g "S"	CIMMYT
2	BENI-SUEF 4	RoK"S"/Mexi 75/a/"S"//Ruff"S"/FG"S"/3/Mexi 75 SDD1462-2sd-1sd-0sd	CIMMYT
3	BENI-SUEF 5	Dipperz / bushen3 CDSS92B128-1M-0Y-0M-0Y-3B-0Y-0SD	CIMMYT
4	BENI-SUEF 6	Boomer-21/Busca-3 CDSS95Y001185-8Y-0M-0Y-0B-1Y-0B-0SD	CIMMYT
5	BENI-SUEF 7	CBC 509 CHILE// SOOTY-9/RASCON_37/9/USDA595/3/D67.3/RABI//CRA/4/ALO/5/HUI/YAV_1/6/ARDENTE/7/HUI/YAV79/8/POD_9	CIMMYT
6	SOHAG 4	Ajaia-16//Hora/Jro/3/Gan/4/Zar/5/Suok-7/6/Stot//Altar84/Ald CDSS99B00778S -OTOPY- 0M-0Y-129Y-0M-0Y-1B-0SH	CIMMYT
7	SOHAG 5	TRN//21563/AA/3/BD2080/4/BD2339/5/Rascon37//Tarro2 //Ra con3/6/Auk/Gull//Green. CDSS00B00364T-0T0PB -0B- 2Y-0M-oY-1B-0Y-0SH.	CIMMYT

Table 2. quantity of used water/ha under conservation and traditional agriculture system

Irrigation no.	Conservation Agricultural	Traditional Agricultural
Irrigation no. 1	Not measured	
Irrigation no. 2	196.46 m^3	392.92 m^3
Irrigation no. 3	588.00 m^3	785.85 m^3
Irrigation no. 4	785.84 m^3	982.31 m^3
Irrigation no. 5	687.62 m^3	884.08 m^3
Total amount	2257.92 m^3	3045.16 m^3

3. RESULTS AND DISSCUSION

Traits of grain yield and its components were discussed using analysis of variance (table 3) and mean performance for studied traits that presented in tables 4, 5, 6 and table 7.

3.1. Grain yield

Based on Bartlett test for the two growing seasons (2019/2020 and 2021/2022), the results of two growing seasons will be discussed separately, and there is no combined analysis will be handled. The data presented in table 4 indicate that highly significant illustrated by (water deficit and normal irrigation) for two seasons. Also, highly significant appeared by the interaction between (tillage systems) and in the first season (durum wheat cultivars) but there is no significant for the same component in the second growing season, indicating that there is one or mor factor effect on performance of durum wheat cultivars, according to Hui *et al*. 2022, the soil compaction effect on grain yield of wheat depends on the weather conditions. there is no significant for main plot, main plot × sub-plot, sub-sub-plot and sub-plot × sub-sub-plot in the first season while highly significant for grain yield affected by main plot, sub-plot, sub-sub-plot and interaction between sub-plot and sub-sub-plot in the second season due to changing in soil properties and weather conditions, according to Teodore 2011 and Luis 2022, the conservative tillage effect on soil temperature, soil compaction, water dynamic and production on wheat crop. Regarding mean performance of durum wheat cultivars under the studied treatments, the highest value is caused by treatment no. 2 which symbolled as T_2 in the second season (4.678 kg/plot) and also the same treatment is the highest value in the first season (3.845 kg/plot) while the lowest value is obtained from treatment no. 3 (water deficit under zero-tillage) in both growing season (2.55 and 2.3 kg/plot, respectively) this results indicated that the penetration of wheat roots is easy under conventional tillage and it difficult

Table 3. Analysis of variance (ANOVA) for traits under study.

Analysis of variance		First season				Second season			
Source of variation	**d.f**	**M S**				**M S**			
		GY	**TKW**	**NK/S**	**NSP**	**GY**	**TKW**	**NK/S**	**NSP**
REP.	2	0.166	25.94	81.7	2770	2.6286	7.86	27.11	16.5
tillage system	1	15.122	1432.12*	1266.7	319187*	45.5864*	237.62	0.01	1530
Error (a)	2	2.915	64.55	96	9552	1.2866	24.21	0.56	249
Irrigation regime	1	4.048*	906.99*	650.7*	25795	17.1769*	355.92*	258.83*	936.7*
tillage system× irrigation	1	0.285	25.08	50.9	10076	4.599	4.39	137.7	127.5
Error (b)	4	0.197	63.93	40.7	8106	1.5533	26.3	20.86	83.3
cultivars	6	0.445	54.85	333.9	22857**	0.503**	43.63**	34.94	479*
tillage system × cultivars	6	3.313**	41.67	235.4	4377	0.1365	11.25	13.81	323.3
irrigation regime× cultivars	6	1.053	12.37	131.5	8959*	0.2732*	13.41	40.24	586.7**
tillage system× irrigation regime× cultivars	6	2.277	19.21	488	8043	0.1357	8.38	40.43	556.6**
Error (c)	48	1.015	34.18	170	3702	0.1134	11.76	29.14	172.4
Total	83								

GY= Grain Yield, TKW= 1000-kernel weight, NK/S= number of kernels/spike and NSP= number of spikes/m^2

Table 4. Mean performance of grain yield (kg/plot) for Tillage system, Irrigation and Cultivars

Ser #	Treatment	First season (2019-2020)				Second season (2021-2022		
		Cultivar Name	cultivar	Irrigation	Tillage system	cultivar	Irrigation	Tillage system
1	T1	BENI-SUEF 1	3.21	3.52	3.68	4.35	4.24	4.46
2		BENI-SUEF 4	3.96			4.195		
3		BENI-SUEF 5	2.94			3.94		
4		BENI-SUEF 6	4.24			3.99		
5		BENI-SUEF 7	3.24			4.775		
6		SOHAGE 4	3.66			4.43		
7		SOHAGE 5	3.41			4.01		
1	T2	BENI-SUEF 1	4.33	3.85		4.79	4.68	
2		BENI-SUEF 4	4.86			4.145		
3		BENI-SUEF 5	4.12			4.405		
4		BENI-SUEF 6	3.84			4.935		
5		BENI-SUEF 7	4.52			4.54		
6		SOHAGE 4	2.16			4.815		
7		SOHAGE 5	3.09			5.115		
1	T3	BENI-SUEF 1	3.40	2.56	2.84	2.582	2.30	3.00
2		BENI-SUEF 4	1.40			1.911		
3		BENI-SUEF 5	3.08			2.286		
4		BENI-SUEF 6	1.66			2.387		
5		BENI-SUEF 7	2.12			2.511		
6		SOHAGE 4	2.96			2.434		
7		SOHAGE 5	3.27			1.989		
1	T4	BENI-SUEF 1	3.57	3.11		4.123	3.70	
2		BENI-SUEF 4	2.58			3.332		
3		BENI-SUEF 5	2.66			3.549		
4		BENI-SUEF 6	3.40			3.695		
5		BENI-SUEF 7	2.76			3.513		
6		SOHAGE 4	4.56			3.993		
7		SOHAGE 5	2.26			3.503		

(T_1) traditional tillage under water deficit stress, (T_2) traditional tillage under normal irrigation, (T_3) conservative tillage under water deficit stress and (T_4) conservative tillage under normal irrigation.

LSD at 5% and 1% for tillage system = 1.6030 and 3.6977, irrigation regime= 0.2692 and 0.4465, cultivars = 0.8268 and 1.1029, tillage × irrigation regime= 1.4786 and 3.1294, tillage × cultivars = 1.3870 and 1.9101, irrigation regime× cultivars = 1.0985 and 1.4643 and tillage × irrigation regime× cultivars= 1.7383 and 2.3373.

under conservative tillage, in spite of the conventional tillage gave the highest value, the effect of durum wheat cultivars is different significantly in the second season indicating that the growth of durum wheat cultivars is differ from one to another, so wheat breeding program under zero-tillage may be introduce suit genotypes will be adapted to this system. The best durum wheat cultivar under zero-tillage system is Beni-Suef 1 in both growing season and both irrigation regime (normal and water deficit stress), while the best durum wheat cultivars under traditional tillage is Beni-Suef 4 in the first season and Sohage 4 in the second season under normal irrigation regime and Sohage 5 under water deficit. According to the data presented in table 4, the conservative tillage conserve the water used in irrigation regime and reduce the total amount of water compare to traditional agriculture.

3.2. Number of spikes/m^2

The analysis of variance in table 3 indicated that a significant effect demonstrated by sub plot (water deficit and normal irrigation) for first and second seasons. There is no significant appeared in Main plot (tillage systems) but, there is highly significant in sub-sub plot (durum wheat cultivars) at the first season and significant effect in the second season. In the interaction there is significant for irrigation regime× Cultivars in the first seasons and was highly significant in second season while was found highly significant for Number of Spikes /plots affected by main plot × sub-plot × sub-sub-plot in only second season. This result indicated that water deficit had direct effect on number of spikes /plots. Concerning mean performance of durum wheat cultivars under the studied treatments the result showed in table 5, the highest value is caused by T_2 in the first and second season (309.5 and 168.1 sp/m², respectively) while the lowest value is found in T_3 in both growing season (151.2 and 151.7 sp/m², respectively) this results showed that the water deficit stress had direct effect on decreasing the number of spikes/m². according to (Desta *et al*., 2021) tillage system did not have significant effects on Number of tillers per plant and Number of spikes /m², conservation tillage not beneficial at clay soil due to the high clay content and the soil proprieties. The best durum wheat cultivar under zero-tillage system is Beni-Suef 6 in both growing season and both irrigation regime (normal and water deficit stress), while the best durum wheat cultivars under traditional tillage is Beni-Suef 6 in the first season and Beni-suef 1 in the second season under normal irrigation regime and Beni-suef 6 under water deficit stress.

3.3. 1000-kernel weight

The analysis of variance (table 3) indicated that significant effect due (water deficit stress and normal irrigation) for two seasons. Also, there is significant effect appeared by the Tillage system in only first season. According to Calzarano et al., 2018 the changeability of climatic conditions made it tough to discriminate a clear tendency for Thousand Kernels Weight trait. some of the previous studies reported that There were no significant variations in TKW between zero and conventional tillage. (Van Kessel et al., 1992), (Cox, D.J. et al., 2000) and (Calzarano et al., 2018). While others indicated there was effects on this trait by tillage system and that agreed with (De Vita et al.,2007) and (Di Fonzo et al., 2001). But Carr et al. 2003, was declared that tillage systems had no effect on the solo grain weight. The effect of sub-sub plot in the second season (durum wheat cultivars) is highly significant. The result between interaction showed there is no significant for main plot × sub-plot, sub-plot × sub-sub-plot and main plot × sub plot × sub-sub plot in the first and second season. The table 6 of mean performance of durum wheat cultivars under the studied treatments showed that, the highest value is caused by T2 in the first and second season (58.3 and 54.6 respectively) while the lowest value is found in T3 in both growing season (43.5 and 47.2 respectively). The result showed that water deficit stress reduced TKW in cultivars. According to Royo et al. (2000), water shortage during the reproduction stage lowers both the length and rate of grain filling, and it also affects the mean grain weight .The best durum wheat cultivar under zero-tillage under normal irrigation regime and water deficit stress is sohage 4, beni-suef 4 respectively in first growing season and both irrigation regime (normal and water deficit stress) in tillage system (sohage 4 and sohage 5), while in second

Table 5. Mean performance of number of spikes/m^2 for Tillage system, Irrigation regime and Cultivars.

Ser #	Treat.	First season (2019-2020)				Second season (2021-2022)		
		Cultivar Name	cultivar	Irrigation	Tillage system	cultivar	Irrigation	Tillage system
1	T1	BENI-SUEF 1	288	252.6	281	160	164.1	166.1
2		BENI-SUEF 4	223			164		
3		BENI-SUEF 5	195			178		
4		BENI-SUEF 6	359			189		
5		BENI-SUEF 7	196			168		
6		SOHAGE 4	184			136		
7		SOHAGE 5	324			154		
1	T2	BENI-SUEF 1	208	309.5		190	168.1	
2		BENI-SUEF 4	287			159		
3		BENI-SUEF 5	368			150		
4		BENI-SUEF 6	473			168		
5		BENI-SUEF 7	288			165		
6		SOHAGE 4	309			174		
7		SOHAGE 5	233			171		
1	T3	BENI-SUEF 1	164	151.2	158	156	152.7	157.4
2		BENI-SUEF 4	146			152		
3		BENI-SUEF 5	162			152		
4		BENI-SUEF 6	184			166		
5		BENI-SUEF 7	127			138		
6		SOHAGE 4	124			150		
7		SOHAGE 5	151			155		
1	T4	BENI-SUEF 1	147	164.3		152	162.1	
2		BENI-SUEF 4	163			159		
3		BENI-SUEF 5	148			164		
4		BENI-SUEF 6	240			176		
5		BENI-SUEF 7	163			154		
6		SOHAGE 4	117			178		
7		SOHAGE 5	172			152		

(T_1) traditional tillage under water deficit stress, (T_2) traditional tillage under normal irrigation, (T_3) conservative tillage under water deficit stress and (T_4) conservative tillage under normal irrigation.

LSD 5% and 1% For tillage = 91.77and211.67, irrigation regime= 54.55 and 90.46, cultivars = 49.94 and 66.62, tillage × irrigation regime=74.43 and 116.62 , tillage × cultivars = 81.69 and 111.91, irrigation regime× cultivars = 77.18 and 103.59 and tillage × irrigation regime× cultivars = 110.13 and 147.56.

Table 6. Mean performance of 1000-kwrnel weight (gm) for Tillage system, Irrigation regime and Cultivars.

Ser #	Treat.	First season (2019-2020)				Second season (2021-2022)		
		Cultivar Name	cultivar	Irrigation	Tillage system	cultivar	Irrigation	Tillage system
1		BENI-SUEF 1	44.02			54.91		
2		BENI-SUEF 4	51.03			49.62		
3		BENI-SUEF 5	50.43			49.41		
4	T1	BENI-SUEF 6	52.43	50.7		52.66	51.0	
5		BENI-SUEF 7	54.4			49.37		
6		SOHAGE 4	49.06			50.92		
7		SOHAGE 5	53.25		54.5	49.99		52.8
1		BENI-SUEF 1	58.61			57.3		
2		BENI-SUEF 4	58.39			56.58		
3		BENI-SUEF 5	56.61			54.21		
4	T2	BENI-SUEF 6	59.25	58.3		55.78	54.6	
5		BENI-SUEF 7	56.67			52.93		
6		SOHAGE 4	61.67			52.87		
7		SOHAGE 5	57.06			52.81		
1		BENI-SUEF 1	42.52			52.12		
2		BENI-SUEF 4	48.24			49.99		
3		BENI-SUEF 5	40.45			45.59		
4	T3	BENI-SUEF 6	37.62	43.5		47.31	47.2	
5		BENI-SUEF 7	46.35			43.96		
6		SOHAGE 4	46.5			44.7		
7		SOHAGE 5	42.78		46.2	46.46		49.4
1		BENI-SUEF 1	46.55			52.5		
2		BENI-SUEF 4	52.27			53.68		
3		BENI-SUEF 5	47.2			52.35		
4	T4	BENI-SUEF 6	43.05	49.0		52.27	51.7	
5		BENI-SUEF 7	52.56			53.66		
6		SOHAGE 4	52.59			45.09		
7		SOHAGE 5	48.6			52.6		

(T_1) traditional tillage under water deficit stress, (T_2) traditional tillage under normal irrigation, (T_3) conservative tillage under water deficit stress and (T_4) conservative tillage under normal irrigation.

LSD at 5% and 1% For tillage = 7.543 and 17.400 , irrigation regime= 4.844 and 8.033 , cultivars = 4.799 and 6.402 , tillage × irrigation regime= 6.246 and 9.675 , tillage × cultivars = 7.387 and 10.003 irrigation regime× cultivars = 7.245 and 9.704 and tillage × irrigation regime× cultivars= 10.208 and 13.637.

growing season the best durum wheat cultivars under traditional tillage is Beni-Suef 1 in T1 and T2 and sohage 4 in T4.

3.4. Number of kernels/spikes

The result showed that there is no effect significantly for two seasons. While there is effect significantly noticed by sub plot in two seasons. the interaction between was not significant in second seasons. Also, there is no significant for the same component in the first growing season. The result indicated that there is no significant was affected by irrigation regime× cultivars and cultivars in second growing season. That due to water deficit stress was affected on Number of Kernels / spikes. there is no significant for any of other components in second season and there was no effect for same components in first season, this results maybe due to the studied durum wheat cultivars have same gene action for number of kernels/spike and they have high yield potential for this trait . Table 7 shows mean performance of durum wheat cultivars under the studied treatments. the highest value is caused by $T_{٤}$ in the first season and treatment no. two (T_2) gave the highest value In the second season (68.70 and 62.10, respectively) while the lowest value is obtained by T_1 and T3 in both growing season (59.80 and 57.14, respectively) .The best durum wheat cultivar under zero-tillage system is Beni-Suef 1 in the first growing season and both irrigation regime, normal and water deficit stress (82.2 and 66.9 kernels/spike, respectively), also the best durum wheat cultivars under traditional tillage is Beni-Suef 1 in the first season and the second season in both of normal and water deficit stress, indicated that Beni-Suef 1 is more adapted under different conditions.

4. CONCLUSION

Conservation agriculture system conserve more soil moisture and it can reduce amount of irrigation water compared to traditional agriculture system, however not all durum wheat cultivars fit to conservation agriculture system, so it is very important to establish wheat breeding program under conservation agriculture system for releasing new varieties adapted under conservation agriculture system.

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6. REFFRENCES

Abdelhafez AA, Metwalley SM and Abbas HH (2020). Irrigation: Water Resources, Types and Common Problems in Egypt. In Springer Water. Springer International Publishing. https://doi.org/10.1007/978-3-030-30375-4_2

Ahmad, A., Aslam, Z., Javed, T., Hussain, S., Raza, A., Shabbir, R., Mora-Poblete, F., Saeed, T., Zulfiqar F, Ali MM, Nawaz M, Rafiq M, Osman HS, Albaqami M, Ahmed MAA and Tauseef M (2022). Screening of Wheat (*Triticum aestivum* L.) Genotypes for Drought Tolerance through Agronomic and Physiological Response. Agronomy, 12(2). https://doi.org/10.3390/agronomy12020287

Belay SA, Schmitter P, Worqlul AW, Steenhuis TS, Reyes MR and Tilahun SA (2019). Conservation agriculture saves irrigation water in the dry monsoon phase in the Ethiopian highlands. Water (Switzerland), 11(10), 1–16. https://doi.org/10.3390/w11102103.

Calzarano F, Stagnari F, Egidio SD, Pagnani G, Galieni A, Marco SDi, Metruccio EG and Pisante M (2018). Durum Wheat Quality , Yield and Sanitary Status under Conservation Agriculture. 1–13. https://doi.org/10.3390/agriculture8090140.

Carr PM, Horsley RD and Poland WW (2003). Tillage and seeding rate effects on wheat cultivars. Crop Sci., 43, 202–209.

Table 7. Mean performance of number of kernels/spikes for Tillage system, Irrigation regime and Cultivars.

Ser #	Treat.	First season (2019-2020)				Second season (2021-2022		
		Cultivar Name	cultivar	Irrigation	Tillage system	cultivar	Irrigation	Tillage system
1		BENI-SUEF 1	56.0			56.6		
2		BENI-SUEF 4	53.1			58.1		
3		BENI-SUEF 5	70.5			57.6		
4	T1	BENI-SUEF 6	50.7	55.79		52.4	56.03	
5		BENI-SUEF 7	53.5			53.9		
6		SOHAGE 4	55.9			56.2		
7		SOHAGE 5	50.8		57.80	57.4		59.05
1		BENI-SUEF 1	63.8			75.4		
2		BENI-SUEF 4	54.5			61.5		
3		BENI-SUEF 5	59.3			68.4		
4	T2	BENI-SUEF 6	59.9	59.81		54.6	62.07	
5		BENI-SUEF 7	54.6			57.6		
6		SOHAGE 4	63.5			59.2		
7		SOHAGE 5	63.1			57.8		
1		BENI-SUEF 1	66.9			56.4		
2		BENI-SUEF 4	61.8			51.4		
3		BENI-SUEF 5	62.7			59.6		
4	T3	BENI-SUEF 6	49.3	62.00		54.1	57.14	
5		BENI-SUEF 7	65.5			55.1		
6		SOHAGE 4	68.6			60.8		
7		SOHAGE 5	59.2		65.35	62.6		58.32
1		BENI-SUEF 1	82.2			65.6		
2		BENI-SUEF 4	75.9			58.7		
3		BENI-SUEF 5	65.8			64		
4	T4	BENI-SUEF 6	45.2	68.70		58.4	59.50	
5		BENI-SUEF 7	66.4			53.8		
6		SOHAGE 4	69.5			58		
7		SOHAGE 5	75.9			58		

(T_1) traditional tillage under water deficit stress, (T_2) traditional tillage under normal irrigation, (T_3) conservative tillage under water deficit stress and (T_4) conservative tillage under normal irrigation.

LSD at 5% and 1% For tillage = 9.198 and 21.217, irrigation regime= 3.864 and 6.408, cultivars = 10.701 and 14.275, tillage × irrigation regime= 7.297 and 12.369, tillage × cultivars = 14.660 and 19.561 irrigation regime× cultivars = 14.266 and 19.015 and tillage × irrigation regime× cultivars = 20.430 and 27.2 .

Central Agency for Public Mobilization and Statistics (https://www.capmas.gov.eg/, accessed on 19 October 2022).

Conservation Agriculture Food and Agriculture Organization of the United Nations. Available online: https://www.fao.org/conservation-agriculture/en/ (accessed on 5 December 2022).

Cox DJ and Shelton DR (1992). Genotipe-by-tillage interactions in hard red winter wheat quality evaluation. Agron. J.84, 627–630.

Desta BT, Gezahegn AM and Tesema SE (2021). Impacts of tillage practice on the productivity of durum wheat in Ethiopia. Cogent Food & Agriculture, 7(1). https://doi.org/10.1080/23311932.2020.1869382

De Vita P, Di Paolo E, Fecondo G, Di Fonzo N and Pisante M (2007). No-tillage and conventional tillage effects on durum wheat yield, grain quality and soil moisture content in southern Italy. Soil Tillage Res. 92, 69–78.

Di Fonzo N, De Vita P, Gallo A, Fares C, Paladino O and Trocoli A (2001). Crop management efficiency as a tool to improve durum wheat quality in Mediterranean areas. In Durum Wheat, Semolina and Pasta Quality. Recent Achievements and New Trends; Abecassis, J., Autran, J.C., Feillet, P., Eds.; INRA: Paris, France,; Le Colloques n. 99, pp. 67–82.

Duma S, Shimelis H and Tsilo TJ (2022). Response of Bread Wheat Genotypes for Drought and Low Nitrogen Stress Tolerance. Agronomy, 12(6), 1384. https://doi.org/10.3390/agronomy12061384

Eduardo L, Sanches A, Jos D, Alves MC and Reichert M (2022). Medium-Term No-Tillage , Additional Compaction , and Chiseling as Affecting Clayey Subtropical Soil Physical Properties and Yield of Corn , Soybean and Wheat Crops.

El-Hashash EF, Abou El-Enin MM, Abd El-Mageed TA, Attia MAE-H, El-Saadony MT, El-Tarabily KA and Shaaban A (2022). Bread Wheat Productivity in Response to Humic Acid Subply and Subplementary Irrigation Mode in Three Northwestern Coastal Sites of Egypt. Agronomy, 12(7), 1499. https://doi.org/10.3390/agronomy12071499

Emam MA, Abd El-Mageed AM, Niedbała G, Sabrey SA, Fouad AS, Kapiel T, Piekutowska M, and Mahmoud SA (2022). Genetic Characterization and Agronomic Evaluation of Drought Tolerance in Ten Egyptian Wheat (*Triticum aestivum* L.) Cultivars. Agronomy, 12(5), 1–14. https://doi.org/10.3390/agronomy12051217

Farooq M and Siddique KHM (2015). Conservation Agriculture: Concepts, Brief History, and Impacts on Agricultural Systems. Conservation Agriculture, 1–660. https://doi.org/10.1007/978-3-319-11620-4

Liu H, Colombi T, Jäck O, Keller T and Weih M (2022). Science of the Total Environment Effects of soil compaction on grain yield of wheat depend on weather conditions. Science of the Total Environment, 807, 150763. https://doi.org/10.1016/j.scitotenv.2021.150763

Royo C, Abaza M, Blanco R and del Moral LFG (2000). Triticale grain growth and morphometry as affected by drought stress, late sowing and simulated drought stress. Aust. J. Plant Physiol., 27, 1051–1059.

Rusu T, Moraru PI, Ranta O, Drocas I, Bogdan I, Pop AI and Sopterean ML (2011). No-Tillage and Minimum Tillage – their Impact on Soil Compaction , Water Dynamics , Soil Temperature and Production on Wheat , Maize and Soybean Crop No-Tillage and Minimum Tillage – their Impact on Soil Compaction , Water Dynamics , Soil Temperature and. *March*. https://doi.org/10.15835/buasvmcn-agr

Shrestha J, Subedi S, Timsina K and Kandel M (2020). Conservation agriculture as an approach towards sustainable crop production : A Review. Farming &

Management, 5(1). https://doi.org/10.31830/2456-8724.2020.002

Urbanavičiūtė I, Bonfiglioli L and Pagnotta MA (2022). Diversity in Root Architecture of Durum Wheat at Stem Elongation under Drought Stress. Agronomy, 12(6), 1329. https://doi.org/10.3390/agronomy12061329

Van Kessel C and Hartley C (2000). Agricultural management of grain legumes: Has it led to an increase in nitrogen fixation? Field Crops Res., 65, 165–181.

Yimam AY, Assefa TT, Adane NF, Tilahun SA, Jha MK and Reyes MR (2020). Experimental Evaluation for the Impacts of Conservation Agriculture with Drip Irrigation on Crop Coefficient and Soil Properties in the Sub-Humid Ethiopian Highlands. Water, 12(4), 947. https://doi.org/10.3390/w12040947

الملخص العربى

تقييم بعض أصناف قمح المكرونة تحت ظروف نقص مياه الرى بإستخدام نظامى الزراعة المحافظة والتقليدى

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نفذت هذة الدراسة فى منطقة مصر الوسطى بمحافظة بنى سويف (28° 54′ N, 30° 56′ E). وتهدف الدراسة الى تقييم نظام الزراعة المحافظة كنظام جديد تحت ظروف الاراضى الطينية بمنطقة مصر الوسطى و تحديد أفضل الأصناف تحملا لظروف نقص المياه و تحديد أفضل الأصناف التى تناسب نظام الزراعة المحافظة. تم دراسة وتقييم سبعة أصناف من قمح المكرونة تحت أربعة معاملات مختلفة على النحو الأتى ١– المعاملة الاولى: عبارة عن تقييم الأصناف تحت نظام الزراعة التقليدى وظروف نقص مياه الرى ، ٢– المعاملة الثانية: عبارة عن تقييم الأصناف تحت نظام الزراعة التقليدى وظروف الرى الطبيعية ، ٣– المعاملة الثالثة: عبارة عن تقييم الأصناف تحت نظام الزراعة المحافظة وظروف نقص المياه، ٤– المعاملة الرابعة: عبارة عن تقييم الأصناف تحت نظام الزراعة المحافظة وظروف الرى الطبيعية. تم دراسة صفة الحبوب ومكوناته واوضحت النتائج أن نظام الزراعة المحافظة يوفر كميات مياه الرى بالمقارنة بنظام الزراعة التقليدى. أعطى نظام الزراعة التقليدى أعلى قيمة للمحصول (٣,٦٨ و ٤,٦ كجم/الوحدة التجريبية) وذلك للموسم الأول والثانى على التوالى مقارنة بنظام الزراعة المحافظة (٢,٨٤ و ٣كجم/الوحدة التجريبية) للموسم الاول والثانى على التوالى. وأوضحت النتائج أن أفضل صنف تحت نظام الزراعة المحافظة وتحت ظروف الرى الطبيعى وكذلك ظروف نقص مياه الرى هو بنى سويف ١ وذلك فى الموسمين بينما كان أفضل الأصناف تحت نظام الزراعة التقليدى هو بنى سويف ٤ فى الموسم الأول والصنف سوهاج ٤ فى الموسم الثانى تحت ظروف الرى الطبيعى والصنف سوهاج ٥ تحت ظروف نقص مياه الرى. وبالرغم من أن نظام الزراعة التقليدى أعطى أعلى قيمة للمحصول الحبوب مقارنة بنظام الزراعة المحافظة إلا أن نظام الزراعة المحافظة مازال أفضل من حيث توفير مياه الرى ولذلك لابد من تصميم برامج تربية فى المستقبل لإستبناط أصناف من القمح تتناسب مع نظام الزراعة المحافظة.