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EFFECT OF WEED CONTROL TREATMENTS ON SOME BREAD WHEAT CULTIVARS PRODUCTIVITY AND ITS ASSOCIATED WEEDS

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ABSTRACT

Two field experiments were carried out during the two successive growing seasons of 2017-18 and 2018-19 at Mallawy Agricultural Research Station, Agric. Res. Center, Egypt, to study the effect of weed control treatments on yield and yield components of some Egyptian bread wheat cultivars and its associated weeds. The experiments were laid out in a randomized complete blocks design (RCBD) with split-plot arrangement with four replications. The main plots were assigned to five bread wheat cultivars Misr-1, Misr-2, Shandaweel-1, Sids-14 and Giza-171, and seven weed control treatments (Pallas 4.5 % OD, Atlantis 1.2 % OD, Broadway-star 8.5 % WG, Liprator fort 36 % SC and Onostar 75 % WF ,followed by Traxsos 5% EC), as well as hand weeding twice and unweeded check were allocated in sub-plots. The results showed that the cultivars were significantly affected the dry weight of total annual weeds. The wheat cultivars were significantly different in yield and its attributes such as number of spike/m^2, number of kernels/spike, 1000 kernels weight (g), harvest index (HI) % and grain yield (ardab/fad). The greatest value of grain yield was recorded by cv. Shandaweel-1. The highest competitive ability of cultivars (CAC%) and the least dry weight of total annual weeds was achieved by cv. Misr-2 and Giza-171. Also, the herbicides (Onostar followed Traxsos, Atlantis, Broadway star and Pallas) as well as twice hand weeding showed the highest reduction in dry weight (g) of weeds and the highest weed control efficiency (WCE%). While , the least effective herbicide was Liprator fort. The treatments of Pallas, (Onostar followed by Traxsos), Atlantis and broadway star as well as hand weeding achieved the highest increment in wheat yield and its components. The interaction effect between wheat cultivars (Shandaweel-1, Misr-2 and Misr-1) and the herbicides Pallas, Onostar followed by Traxsos showed the least dry weight of total annual weeds and gave the highest wheat grain yield followed Atlantis and Broadway star. Planting wheat cultivar Shandaweel-1 and controlling weeds by hand weeding twice at 30 and 45 days, or by using herbicides Onostar followed by Traxsos produced the highest wheat grain yield followed by Atlantis, Pallas or Broadway star.

Key words: *Bread wheat, cultivars, weed control, herbicides, hand weeding.*

1. INTRODUCTION

Bread wheat (*Triticum aestivum* L.) is an important stable food crop and serves as backbone of food security in Egypt. The wheat is cultivated on an area of 1.33 million hectares (3.17 million faddan) with grain yield average of 6.4 ton ha^{-1} (17.85 ardabab faddan^{-1}) during 2019/2020 season In Egypt. (Economic Affairs sector, 2020).

Wheat productivity depends on several factors like crop establishment techniques, irrigation, weed competition, fertilizers management, cultivars and other cultural practices (Meena *et al*., 2017). The response of wheat plants to herbicides varied among cultivars (Brar *et al*., 1997). Using high competitive cultivars can be effective for weed growth suppression (Mennan and Zandstra 2005). Weeds are the major deterrent to the development of sustainable crop production and is the key factor in decreaing yield (Lopez-Granados, 2011). Weed problem is one of the major barriers responsible for low productivity of wheat because, weed competes with the crop for essential growth factors like moisture, nutrients, space, and light etc. Moreover, they increase production cost, harbors insects and plant diseases, decrease quality of farm produce and reduce values of the land (Tesfaye *et al.*, 2014). The weed infestation is the basic and major component of low yield in crop production system and causes enormous loss of about 58.6% (Dawit *et al*. (2014) and 37 to 57.1 % due to their interference (Verma *et al*., 2015), intensity of infestation, crop species and cultivars (Atnafu ,2019).

Wheat usually suffers stress created by mixflora of weeds through competition along with interference caused by secreting toxic substances to the rhizosphere of the crop plants (Meena *et al*., 2017). Presence of weeds especially at early growth stages causes more reduction in growth and yield of wheat. Yield losses are most severe when resources are limited and weeds with crops emerge simultaneously (Hussain *et al*., 2015).

Hucl (1998) found that the less competitive genotypes suffered a 7-9% greater yield loss than that of the more competitive genotypes. The response of wheat genotypes to herbicides varied among cultivars (Abusteit *et al*., 1991). Abouziena *et al.* (2008) found that under the weed competition condition; Sids 9 cultivar produced the highest grain yield, while under unweeding treatment; Sids 7 cultivar gave the maximum yield.

Mason *et al*. (2008) reported that tallness, early heading and maturity were related to increase grain yield at the highest weed infestation. They added that greater spikes/m^2, tallness and early heading were associated with reduced weed biomass, depending on weed infestation.

Herbicides appears to be economical method of weed control (Dalley *et al.*,2006) and Bari *et al*., (2020). Herbicides are used to increase crop yield (Jabran *et al*.,2008), decrease dry weight of weed (Ahmad *et al*., 1993) and increase nutrient uptake by wheat (Bharat *et al*., 2012).

Vasudev *et al*. (2017) and Zand *et al*., (2010) concluded that the pre-mix application either of metsulfuron+sulfosulfuron or mesosulfuron+iodosulfuron as post-emergence should be used for the control of complex weed flora in wheat crop. Soltani and Saeedipour (2015) found that the application of Chevalier herbicide (Mesosulfuron-methyl plus Iodosulfuron-methyl) decreased weed dry matter by 86.2 %. The excellent control of complex weed flora in wheat was observed with the mix application of clodinafop+metsulfuron and mesosulfuron-methyl+idosulfuron-methyl sodium (Singh *et al*.,2015). Deboer *et al.*, (2006) reported that Pyroxsulam is a systemic herbicide applied in cereals at early post-emergence, its selectiveness and effectiveness to winter and spring wheat cultivars when combined with the safener cloquintocet-mexyl in commercial herbicide product formulations.

Weed problems on wheat crops is increasing and there are many options for weed control that can reduce infestation and enhance wheat quality and productivity. Hence the objectives of this study was to determine the best cultivars and weed control treatments to achieve the highest grain yield and its component of Egyptian bread wheat.

2. MATERIALS AND METHODS

Two field experiments were carried out during two successive growing seasons of 2017/2018 and 2018/2019 at Mallawy Agricultural research station, Agric. Res. Center, to study the effect of weed control treatments on yield and its yield components of some Egyptian bread wheat cultivars and its associated weeds.

The experiment included 35 treatments (5 cultivars and 7 weed treatments). The preceding summer crop was maize (*Zea mays* L.) in both seasons. The soil types of this study were silty clay loam texture with 8.99 and 8.14% sand, 53.32 and 54.35% silt and 37.69 and 37.51% clay, pH were 8.01 and 8.14 with organic matter of 1.14 and 1.18% in 2017/2018 and 2018/2019 seasons, respectively. A randomized complete blocks design (RCBD) using split-plot arrangement with four replications was used in this study and the treatments were arranged as follows:

The main plots included five wheat cultivars (names, pedigree and selection history of the studied cultivars are listed in Table (1) (Sadek, Eman *et al*.,2013) ; (Hamada *et al.*,2015). (Hamada *et al.* ,2017) and (Abdel-Majeed *et al*. ,2017)

1. Pyroxulam known commercially as Pallas 4.5% OD at rate of 160 cm^3/fad applied at 3-5 leaf stage.
2. Pyroxulam + florasulam a ready formulated herbicide known commercially as Broadway star 8.5% WG at rate of 120 g/fad applied at 3-5 leaf stage.
3. Mesosulfuron-methyl 3% + iodosulfuron-methyl sodium 0.6% a ready formulated herbicide known commercially as Atlantis 1.2% OD at rate of 400 cm^3/fad applied at 3-5 leaf stage.

Table (1): Cultivars, pedigree and selection history of the studied Egyptian bread wheat cultivars.

No.	Cultivar	Pedigree and selection history
1	Misr-1	OASIS/SKAUZ//4*BCN/3/2*PASTOR. CMSS00Y01881T -050M-030Y-030M-030WGY-33M-0Y-0EGY.
2	Misr-2	SKAUZ/BAV92. CMSS96M03611S-1M-010SY-010M-010SY-8M-0Y- EGY.
3	Shandaweel-1	SITE//MO/4/NAC/TH.AC//3*PVN/3/MIRLO/BUC. CMSS93B00567S-72Y-010M-010Y-010M- 0HTY-0SH.
4	Giza-171	Sakha 93 / Gemmiza 9 S.6-1GZ-4GZ-1GZ-2GZ-0S. Gz2003-101-1GZ-4GZ-1GZ-2GZ-0Gz.
5	Sids14	Bow"s"/Vee"s"//Bow"s"/TSI/3/Bani Sewef 1. SD293-1SD-2SD- 4SD – OSD.

A. **The sub-plots (Weed control treatments):**

4. Diflufenican + flufenacet + flurtamone a ready formulated herbicide known commercially as Liprator fort 36% SC at rate of 400 cm^3/fad applied at 3-5 leaf stage.
5. Tribenuron-methyl known commercially as Onostar 75% WF at rate of 8 g/fad applied at 2-4 leaf stage. followed by clodinafop-propargyl + pinoxadin a ready formulated herbicide known commercially as Traxos 5% EC at rate of 500 cm^3/fad applied at 30-45 days after planting.
6. Hand weeding twice at 30-45 days after planting.
7. Unweeded (check).

The experiment included 140 wheat plots (experimental unit), the plot area was 10.5 m^2 (3.5 m length × 3 m width). Seeding rate was 60 kg/fad The herbicides were applied as per treatments on the assigned plots using Cp3 knapsack sprayers with 200 litter of water/fad Wheat (*Triticum aestivum* L.) was sown on 18th and 21st of November in the first and second season, respectively; all wheat growing agricultural practices were done as recommended. The average air temperature during the growth seasons was obtained from Mallawy wheather station (Fig. 1). The harvest time was 1st and 5th of May in the first and second season, respectively·

2.1.Data recorded

The following data were recorded

2.1.I. Weed survey

The weed were hand pulled from random one square meter from each plot 75 days after sowing (DAS), then identified according to Täckholm (1974) into species and classified into annual grassy, broad-leaved and total weeds. Weed samples were air-dried and then kept in an electric oven at 65-70°C till constant weight achieved.

Weed control efficiency (WCE) has been calculated according to Meena *et al*., (2017) with the following formula:

$$\boldsymbol{WCE}\% =$$

W

$$CAC\% = \frac{\text{yield of unweeded plots}}{\text{yield of hand weeded plot}} \text{ X } 100$$

Competitive ability of cultivars (CAC%) has been calculated according to Abouziena *et al*., (2008) with the following formula:

2.1.2. Wheat yield and its components

Number of spikes/m^2 were taken after maturity. At harvest time, grain yield (ardab/fad), harvest index (HI) %, number of kernels/spike and 1000-kernels weight (g) were recorded.

***2.2.* Statistical analysis**

All data were statistically analyzed according to technique of analysis of variance (ANOVA) as mentioned by Gomez and Gomez (1984) using "MSTAT-C" (1989) computer software package and least significant differences (L.S.D.) was calculated to compare between treatments means.

3.RESULTS AND DISCUSSION

3.1.Weed population

The main weeds in the experimental field were common wild oat (*Avena spp.* L.), canary grass (*Phalaris minor* L.) as a grassy weed and wild mustrad (*Sinapis arvensis* L.), lampsquarters (*Chenopodium album* L.), annual sowthistle (*Sonchus oleraceus L.*), sweet clover (*Melilotus indica* L.) and toothed medik (*Midicago polymorpha*) as broad-leaved weeds. Generally, the greater reduction of yield crop occurs linearly with the increment in the density

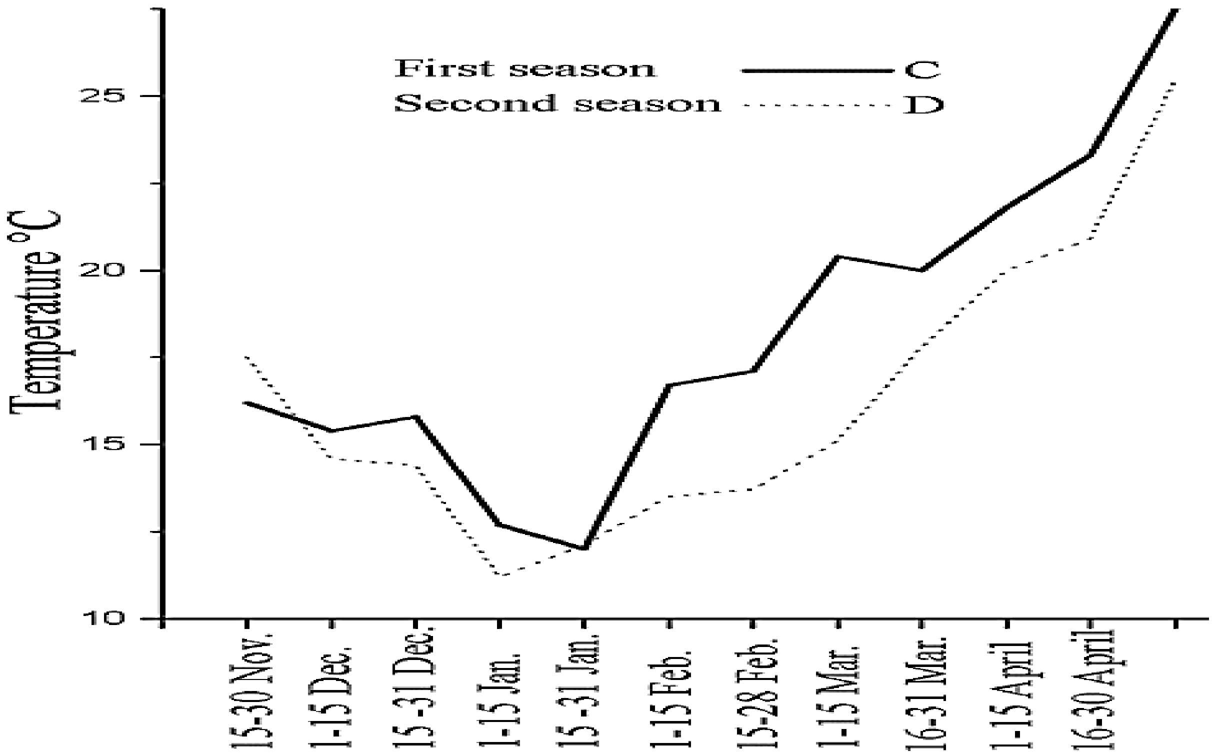

Fig. (1): Average temperature in 2017/2018 and 2018/2019 season.

of weeds. whereas, weed grow quicker than crop plants (Atnafu ,2019).

3.2. Analysis of variance

3.2.1. Weed traits

The analysis of variance in Table (2) indicated that the effect of wheat cultivars (A) on dry weight of grassy, broad-leaved and total annual weeds was significant in both seasons, except total annual weeds in the second season. Weed control treatments (B) and the interaction between wheat cultivars and weed control treatments (AB) significantly affected the dry weight of grassy, broad-leaved and total annual weeds in both seasons.

3.2.2. Wheat traits

The analysis of variance in Table (3) showed that the effects of wheat cultivars (A) and weed control treatments (B) on no. of spikes/m^2, no. of kernels/spike, 1000 kernels weight, grain yield (ardab/fad) and harvest index (%) were significant in both seasons. The interaction between cultivars and weed treatments (AB) showed significant effects on all studied wheat traits in both seasons-except- no. of kernels/spike, 1000 kernels weight and harvest index in the second season

3.3. Effect of wheat cultivars on

3.3.1. Weed dry weight (g/m^2)

Data presented in Table (4) revealed significant differences between wheat cultivars regardabing to their effects on dry weight of grassy, broad-leaved and total annual weeds (g/m^2) in both seasons-except- total annual wees in the second season. Among tested cultivars, Misr-2 showed the lowest dry weight of total annual weed in both seasons (584.18 and 509.71 g/m^2). This result may be due to the competitive ability of Misr-2 on weeds. Many authors reported that the competitive ability of wheat plants varied between cultivars Abusteit *et al.,* (1991) and Brar *et al*. (1997). These results are in harmony with that reported by Bussan *et al.* (1997) and Abouziena *et al*. (2008).

3.3.2. Wheat yield and its components

Table (5) shows that wheat cultivars were varied and showed significant differences for all studied characters (no. of spikes/m^2, no. of kernels/spike, 1000-kernels weight (g), yield (ardab/fad) and harvest index (%) in both seasons, except- 1000 kernels weight in the second season. Wheat cv. Shandaweel-1 gave the highest values for grain yield (19.28 and 21.99 ardab/fad) in the first and second seasons, respectively, and wheat cv. Giza-171 was the

Table (2): Analysis of variance for weeds dry weight (g/m^2) as affected by wheat cultivars, weed control treatments as well as their interaction in 2017/2018 and 2018/2019 seasons.

SOV	d.f.	MS of grassy weeds	MS of broad-leaved weeds	MS of total annual weeds
2017/2018				
Replication	3	473.69	917.86	905.83
Factor A	4	25108.81*	21767.91*	57310.13*
Error	12	7427.91	5452.54	11154.80
Factor B	6	7623827.93**	4201178.86**	931028.01**
AB	24	25556.14**	12307.66**	35031.26**
Error	90	5871.92	4261.99	6632.27
2018/2019				
Replication	3	1966.79	317.81	3373.91
Factor A	4	20610.40**	8697.48*	7111.59
Error	12	3284.71	1816.14	6414.00
Factor B	6	4874860.25**	5030788.94**	18523914.56**
AB	24	9859.61**	5884.79**	11203.98**
Error	90	2373.83	2096.16	4216.34

(A)= cultivars, (B)= weeds control treatment, (AB)= interaction between cultivars and weed control treatments.

Table (3): analysis of variance for wheat yield and its components as affected by wheat cultivars, weed control treatments as well as their interaction in 2017/2018 and 2018/2019 seasons.

SOV	d.f.	MS of No. Spikes/m^2	MS of No. kernels /spike	MS of 1000 kernels weight	MS of Grain yield	MS of Harvest index
2017/2018						
Replication	3	259.09	29.81	1.86	0.18	5.12
Factor A	4	4725.55*	1094.06**	21.59**	13.29**	120.23**
Error	12	950.36	20.14	2.35	0.85	3.48
Factor B	6	124099.43**	752.33**	82.05**	350.18**	461.91**
AB	24	632.64*	29.01 **	6.47**	2.95**	26.05*
Error	90	363.39	25.38	2.75	1.15	15.27
2018/2019						
Replication	3	16.47	38.56	2.77	0.13	73.37
Factor A	4	3678.11**	473.92**	19.98	9.62**	178.54*
Error	12	204.97	15.70	8.02	1.09	35.92
Factor B	6	135127.53**	888.51**	107.94**	519.02**	390.25**
AB	24	829.48**	36.87	7.42	2.91**	40.79
Error	90	196.23	27.44	4.80	1.26	28.46

(A)= cultivars, (B)= weeds control treatments, (AB)= interaction between cultivars and weed control treatments.
***, **= Significant at $p \geq 0.05$, $p \geq 0.01$ level of probability respectively.**

Table (4): Effect of wheat cultivars on dry weight of grassy, broad-leaved and total annual (g/m^2) in 2017/2018 and 2018/2019 seasons.

Cultivar	Grassy weeds		Broad-leaved weeds		Total annual weeds	
	2017/2018	2018/2019	2017/2018	2018/2019	2017/2018	2018/2019
Misr-1	431.25	329.89	191.79	213.21	623.04	543.1
Misr-2	420.21	297.64	163.93	212.07	584.14	509.71
Shandaweel-1	464.57	356.07	234.25	196.11	698.82	552.18
Sids14	396.64	287.36	224.96	244.61	621.6	531.97
Giza-171	466.82	318.39	204.54	219.29	671.36	537.68
LSD	**50.19 ***	**33.37****	**43.00 ***	**24.82 ***	**61.50 ***	**NS**

***, **= Significant at $p \geq 0.05$, $p \geq 0.01$ level of probability respectively and NS = not-significant.**

Table (5): Effect of wheat cultivars on wheat yield and its components in 2017/2018 and 2018/2019 seasons.

Cultivar	No. spikes /m^2	No. kernels/spike	1000-kernel weight (g)	Grain yield (ardab/fad)	Harvest index (%)
2017/2018					
Misr-1	341.2	52.9	44.46	17.58	39.74
Misr-2	332.3	59.0	44.29	17.79	40.58
Shandaweel-1	361.0	70.1	44.75	19.28	44.95
Sids14	359.5	62.9	45.65	17.85	42.00
Giza-171	338.6	60.3	46.36	18.44	43.18
LSD 5%	**17.95**	**2.61**	**0.89**	**0.537**	**1.07**
2018/2019					
Misr-1	371.7	58.6	51.09	20.69	42.60
Misr-2	365.1	67.0	51.08	20.47	42.19
Shandaweel-1	384.1	64.4	51.46	21.99	46.07
Sids14	394.9	69.5	52.07	21.03	45.52
Giza-171	379.7	66.5	53.08	21.17	48.23
LSD 5%	**8.34**	**2.31**	**NS**	**0.608**	**3.49**

NS = not-significant

highest cultivar in 1000-kernels weight (46.36g) in the first season. Shandaweel-1 and Sids-14 gave the highest values of no. of spikes/m^2 in both seasons (361 and 359.9 in the first season and 384.1 and 394.9 in the second season, respectively). Regarding to harvest index, Shandaweel 1 gave the highest value of harvest index in the first season (44.95%), whereas, Giza 171 gave the highest value in the second season (48.23%). Also, data illustrated that the first season was lower than the second season for all studied characters. The reduction of yield and its components in the first season may be attributed to the high air temperature in the first season than the second season (Fig.1) or to other factors which may be negatively affect wheat yield and its components. These results are in harmony with those reported by Jagadish (2012). Also, the cultivar differences in grain yield may be attributed to genetical factors (Moustafa and El-Sawi , 2014) and Zeleke *et al*., 2019) and vegetative growth, tillering and response to environmental conditions (Mennan and Zandstra ,2005).

3.4.Competitive ability of cultivars (CAC%)

Based on the decrease percent (%) in grain yield/fad, compared to weed-free (hand weeding) condition, the competitive ability of cultivars was different and arranged in descending order in Table (6) as follows: Misr-2 (58.04%) > Giza-171 (51.91%) > Sids-14 (47.44%) > Misr-1 (47.35%) and Shandaweel-1(45.74%) in first season. While, in the second season, the descending order were arranged as follows: Giza-171 (49.32%) > Shandaweel-1(48.62%)> Sids-14 (46.83%)> Misr 2 (44.71)> Misr-1 (40.44%) in this respect. The differences in competitive ability appear to be related to various attributes including environment, genetic bacground and morphological characteristics of the cultivar (Abouziena *et al*., 2008).

3.4.1. Weed dry weight (g/m^2) and weed control efficiency (WCE%)

Dry weight (g/m^2) of grassy, broad-leaved, and total annual weeds was significantly affected by different weed control treatments as listed in Table (7). The results showed that the treatments could be ordered regrinding to the reduction on dry weight of grassy, broad-leaved and total annual weeds in both seasons in descending order as follow: the sequence of Onostar and Traxos followed by Atlantis, Broadway star, Pallas and hand weeding gave the highest reduction on dry weight of grassy, broad-leaved and total annual weeds in both seasons. The reduction percentages in dry weight of weeds as affected by the application of Atlantis, the sequence of Onostar and Traxos, Broadway star, Pallas and hand weeding twice were 97.5, 97.7, 96.2, 96.5 and 92.2 % in the first season and 98.2, 97.7, 97.9, 96.5 and 95.7% in the second season, respectively, as compared with the untreated plots. The reduction in dry weight of weeds by the application of herbicides are considered a successful weed control technology as reported by Bari *et al*. (2020).

The highest efficacy of Atlantis herbicide may be due to this herbicide is a ready formulated and contained two sulfonylurea

Table (6): Competitive ability of cultivars (CAC%).

Cultivars	2017/2018			2018/2019		
	Grain yield (ardab /fad) of unweeded (check)	Grain yield (ardab /fad) of hand weeding	CAC%	Grain yield (ardab /fad) of unweeded (check)	Grain yield (ardab /fad) of hand weeding	CAC%
Misr-1	9.19	19.41	47.35	9.28	22.95	40.44
Misr-2	11.51	19.83	58.04	10.48	23.44	44.71
Shandaweel-1	10.36	22.65	45.74	12.01	24.70	48.62
Sids14	9.62	20.28	47.44	11.38	24.30	46.83
Giza-171	11.01	21.21	51.91	13.02	26.40	49.32

Table (7): Effect of weed control treatment on dry weight of grassy, broad-leaved and total annual weeds (g/m^2) and WCE% in 2017/2018 and 2018/2019season .

Weed control treatment	Grassy weeds				Broad-leaved weeds				Total annual weeds			
	2017/2018		2018/2019		2017/2018		2018/2019		2017/2018		2018/2019	
	Dry weight (g)	WCE %	Dry weight (g)	WCE %	Dry weight (g)	WCE %	Dry weight (g)	WCE %	Dry weight (g)	WCE %	Dry weight (g)	WCE %
Pallas	78.64	**94.9**	65.07	**95.0**	25.83	**97.9**	27.8	**97.9**	104.47	**96.3**	92.87	**96.5**
Atlantis	42.53	**97.3**	31.8	**97.5**	28.01	**97.7**	15.53	**98.9**	70.55	**97.5**	47.33	**98.2**
Broadway-star	69.32	**95.5**	39.13	**97.0**	35.4	**97.2**	17.2	**98.7**	104.72	**96.2**	56.33	**97.9**
Liprator fort	1079.9	**30.3**	698.3	**45.9**	47.0	**96.2**	27.6	**98.0**	1126.9	**59.6**	725.9	**72.6**
Onostar followed by Traxsos	39.65	**97.4**	24.2	**98.1**	23.27	**98.1**	37.8	**97.2**	62.92	**97.7**	62.0	**97.7**
Hand weeding Twice	192.1	**87.6**	74.6	**94.2**	24.69	**98.0**	39.27	**97.1**	216.8	**92.2**	113.9	**95.7**
Untreated	1549.1	**0.0**	1291.9	**0.0**	1243.1	**0.0**	1354.3	**0.0**	2792.2	**0.0**	2646.2	**0.0**
LSD 5%	**48.14**	-	**30.61**	-	**41.01**	-	**28.76**	-	**51.16**	-	**40.79**	-

WCE% = Weed control efficiency

active ingredients (mesosulfuron-methyl + iodosulfuron-methyl sodium). This herbicide inhibits the enzyme acetohydroxy acid synthase (AHAS). It acts via foliage and soil, effectively inhibiting the development of weeds new leaves. In addition, the target site of pyroxsulam inhibits acetolactate synthase (ALS), the key plant enzyme for the branched chain amino acids leucine, isoleucine and valine synthase. Mode of action of Onostar and Traxos. These results are in line with those obtained by Zand *et al*. (2010), Soltani and Saeedipour (2015) and Vasudev *et al*. (2017).

3.4.2. Wheat yield and its component

The results in Table (8) show significant impacts of weed control treatments on increasing wheat yield and its components in both seasons. The best treatments for increasing wheat yield and its components (no. of spikes/m^2, no. of kernels/spike, 1000 kernels weight, grain yield and harvest index) was achieved by herbicides (Pallas, Atlants, Onostar followed by Traxsos and Broadway-star) as well as hand weeding twice. The highest reduction in wheat yield and its component was recorded in unweeding (untreated).

All weed control treatments increased significantly no. of spikes/m^2. Pallas, Atlantis, Broadway-star, Onostar followed by Traxos and hand weeding twice gave the highest increment percentage in both seasons without any significant differences between these treatments. these treatments increased no, of spikes/m^2 by 93.8, 93.7, 90.1, 93.5 and 88.3, respectively, in the first season and by 86.4, 85.7, 79.72, 88.64 and 85.94 respectively, in the second seasons as compared to untreated.

Results revealed that Onostar followed by Traxos, Pallas, Atlantis, hand weeding twice and Broadway star increased no. of kernels/ spike by 32.9, 30.1, 29.9, 28.7 and 25.9% in the first season and by 34.2, 301, 29.5, 27.6 and 25.9% in the second season, respectively, compared with unweeded check. Whereas, these treatments increased 1000-kernal weight by 12.6, 12.5, 10.0, 12.6 and 11.2% in the first season and by 12.6, 12.5, 11.2, 12.6 and11.2% in the second season, respectively, compared

Table (8): Effect of weed control treatments on wheat yield and its components in 2017/2018 and 2018/2019 seasons.

Weed control treatments	No. Spikes / m^2	No. kernels / spike	1000-kernel weight (g)	Grain yield (ardab/fad)	Harvest index %
2017/2018					
Pallas	395.3	64.8	46.54	21.04	42.91
Atlantis	395.2	64.7	45.49	20.58	46.65
Broadway-star	387.8	62.6	46.00	19.40	43.89
Liprator fort	264.5	55.1	43.24	14.37	38.37
Onostar followed by Traxsos	394.7	66.2	46.44	20.89	44.11
Hand weeding Twice	384.2	64.0	46.65	20.68	45.71
Untreated	204.0	49.9	41.37	10.34	32.99
LSD 5%	**11.89**	**3.2**	**1.04**	**0.67**	**2.46**
2018/2019					
Pallas	428.5	69.2	53.37	24.56	45.82
Atlantis	426.8	69.0	52.51	23.96	44.78
Broadway-star	413.0	67.1	52.91	22.88	42.82
Liprator fort	294.9	58.5	49.38	16.73	41.86
Onostar followed by Traxsos	433.6	71.4	53.08	24.31	49.42
Hand weeding Twice	427.3	67.9	53.48	23.76	51.29
Untreated	229.8	53.3	47.57	11.31	38.47
LSD 5%	**8.80**	**3.3**	**1.38**	**0.71**	**3.35**

with unweeded check. Concerning the grain yield, all weed control treatments enhanced wheat grain yield in both seasons. Pallas, Onostar followed by Traxos, hand weeding twice and Atlantis increased wheat grain yield by 103.5, 102.0, 100.0, and 99.0% in the first season and by 117.2, 114.9, 110.1 and 111.8 % in the second season, respectively, compared with unweeded check.

The results showed the beneficial effect of herbicides when added alone or in combination for weed control and enhancement of wheat yield and its component. These results are in harmony with those reported by Atnafu (2019). Also, the increases in wheat grain yield and its components by weed control treatments may be due to the role of these treatments in reducing wheat-weed competition by reducing weed density and dry matter with higher weed control efficiency which results in lesser removal of nutrients by weeds and ultimately crop might be benefited the productivity of wheat crop. The results are in line with those obtained by Deboer *et al*. (2006), Dawit *et al*. (2014) and Vasudev *et al*. (2017).

3.5. Effect of interaction between wheat cultivars and weed control treatments on

3.5.1. Weed dry weight (g/m^2)

Data in Table (9) clearly showed that the interaction between wheat cultivars and weed control treatments significantly affected the dry weight of grassy weeds, broad-leaved weeds and total annual weeds in both seasons. The interaction between cv. Misr-2 × Atlantis in the first season and cv. Misr-2 × Broadway-star in the second season gave the lowest values of dry weight of total annual weeds (35.3 and 23.3g) in the first and second season, respectively. whereas the highest values of total annual weeds was recorded in untreated with Shandaweel-1 cv. (2990 g/m^2) in the first season and Sids 14 (2762 g/m^2) and second seasons respectively. These results are in line with those reported by Bari *et al*. (2020).

3.5.2. Wheat yield and its components

Data in Table (10) shows the effect of interaction between weed control treatments and wheat cultivars on wheat yield and its components. Data revealed that the interaction effect between weed control treatments and wheat cultivars significantly affected on no. of spikes/m^2. Among the different treatments, the maximum no. of spikes/m^2 (416.8 and 455.3) was recorded with treatment of (Onostar followed by Tarxsos) with cv. Sids-14 in both seasons. The lowest no. of spikes/m^2 was recorded with unweeded treatments with all tested wheat cultivars. Alivi *et al*. (2004) and Bari *et al*. (2020) reported that the increase in number of tillers might be due to better weed control and the eradication of weeds eliminated the competition for moisture, light and nutrients and utilization of available source to the crop.

Table (9): Dry weight (g/m²) of grassy, broad-leaved and total annual weeds as affected by interaction between bread wheat cultivars and weed control treatments in 2017/2018 and 2018/2019 seasons.

Cultivar	Weed control treatment	Grassy weeds (g/m²)		Broad-leaved weeds (g/m²)		Total annual weeds (g/m²)	
		2017/18	2018/19	2017/18	2018/19	2017/18	2018/19
Misr-1	Pallas	46.8	56.0	6.0	34.8	52.8	90.8
	Atlantis	26.0	17.8	20.8	21.3	46.8	39.0
	Broadway-star	26.8	55.0	44.0	28.0	70.8	83.0
	Lipràtor fort	961.3	770.8	26.8	7.3	988.0	778.0
	Onostar followed by Traxsos	45.3	11.8	39.8	37.3	85.0	49.0
	Hand weeding Twice	186.8	67.8	26.0	44.8	213.0	112.3
	Untreated	1726.0	1330.3	1179.3	1319.3	2905.3	2649.8
Misr-2	Pallas	107.8	62.3	14.0	17.3	121.8	79.8
	Atlantis	32.0	26.3	3.3	16.3	35.3	42.8
	Broadway-star	38.8	8.8	8.0	14.8	46.8	23.3
	Lipràtor fort	1118.3	702.8	35.3	40.0	1153.8	742.8
	Onostar followed by Traxsos	27.3	35.8	15.8	48.3	43.0	84.0
	Hand weeding Twice	148.8	56.8	34.3	32.8	183.0	89.3
	Untreated	1468.8	1191.0	1037.0	1315.3	2505.8	2506.3
Shandweel1	Pallas	102.0	85.8	48.8	8.3	150.8	94.0
	Atlantis	39.0	44.0	43.3	6.0	82.3	50.0
	Broadway-star	128.5	62.0	43.0	6.3	171.5	68.3
	Lipràtor fort	1049.8	772.8	39.8	28.8	1089.3	801.3
	Onostar followed by Traxsos	89.3	22.0	16.3	40.3	105.8	62.3
	Hand weeding Twice	284.3	49.3	18.0	30.0	302.3	79.3
	Untreated	1559.3	1456.8	1430.8	1253.3	2990.0	2710.0
Sids14	Pallas	106.8	59.3	22.0	49.0	128.8	108.3
	Atlantis	67.0	29.8	39.3	9.8	106.3	39.3
	Broadway-star	68.0	22.0	46.3	23.8	114.3	45.8
	Lipràtor fort	952.8	610.3	71.0	32.8	1023.8	643.0
	Onostar followed by Traxsos	18.3	10.3	25.8	35.3	44.0	45.8
	Hand weeding Twice	162.3	40.3	37.3	39.0	199.5	79.3
	Untreated	1401.5	1239.8	1333.3	1522.8	2735.0	2762.3
Giza-171	Pallas	30.0	62.0	38.3	29.8	68.3	91.8
	Atlantis	49.0	41.3	33.3	24.3	82.3	65.8
	Broadway-star	85.0	48.0	35.8	13.3	120.8	61.3
	Lipràtor fort	1317.3	635.3	62.3	29.3	1379.8	664.8
	Onostar followed by Traxsos	18.0	41.3	18.8	27.8	36.8	69.0
	Hand weeding Twice	178.3	159.0	8.3	50.0	186.5	209.0
	Untreated	1590.3	1242.0	1235.3	1360.8	2825.8	2602.8
LSD 5%		**107.6**	**68.44**	**91.71**	**64.32**	**114.4**	**91.22**

Regardabing to the effect of interaction between weed control treatments and wheat cultivars on no. of kernels/spike, it was significant in the first season only. Maximum no. of kernels/spike was recorded with the herbicide treatment (Onostar followed by Traxsos) × Shandaweel-1 (77.0). The unweeded treatment (untreated) with all tested cultivars showed the lowest values no. of kernels/spike. These results were in harmony with Baldha *et al.* (1998). Data in Table (10) also showed that the interaction effect of bread wheat cultivars and weed control treatments had a significant effect on 1000-kernel weight (g) in the first season only. The highest 1000-kernel weight was measured in herbicide treatment of Broadway star and hand weeing treatments (51.2 and 50.98g) with Shandaweel 1 cultivar. The maximum 1000 kernels weight might be due to severe competition and strong interaction of weeds that caused reduction in the photosynthetic activity that have caused reduction in weed free crop resulted in high 1000-kernels weight Ahmad *et al*. (2001).

The data given in Table (10) showed that the interaction between wheat cultivars and weed control treatments had a significant effect on grain yield (ardab/fad) in both seasons. The maximum grain yield was obtained from the interaction effect of cv. Shandweel1×hand weeding in the first season (22.65 ardab/fad) and Shandweel1×Pallas in the second season (25.20

Table (10): Wheat grain yield and its components as affected by interaction between bread wheat cultivars and weed control treatments in 2017/2018 and 2018/2019 seasons.

Cultivars	Weed control treatments	No. of spikes/m^2		No. of kernels/ spike	Grain yield (ardab/fad)		1000-kernel weight (g)	Harvest index (%)
		2017/18	2018/19	2017/18	2017/18	2018/19	2017/18	2017/18
Misr-1	Pallas	393.3	417.0	56.3	20.51	24.24	40.43	40.43
	Atlantis	386.8	429.3	52.8	20.90	24.70	45.23	45.23
	Broadway-star	389.0	402.3	54.0	19.73	23.31	43.90	43.90
	Liprator fort	276.8	307.0	47.8	12.83	16.16	35.98	35.98
	Onostar f.b Traxsos	370.0	410.8	55.5	20.46	24.18	42.60	42.60
	Hand weeding Twice	372.8	413.8	57.3	19.41	22.95	41.25	41.25
	Untreated	200.0	222.0	46.8	9.19	9.28	28.80	28.80
Misr-2	Pallas	383.3	425.8	61.0	21.40	24.62	44.50	44.50
	Atlantis	380.0	406.3	64.3	19.93	23.56	46.78	46.78
	Broadway-star	363.3	392.3	62.0	19.00	22.47	42.23	42.23
	Liprator fort	249.3	277.0	53.5	13.03	14.89	32.18	32.18
	Onostar f.b Traxsos	390.0	417.8	61.0	19.84	23.45	43.08	43.08
	Hand weeding Twice	383.3	425.3	67.3	19.83	23.44	43.48	43.48
	Untreated	176.8	211.3	44.0	11.51	10.84	31.83	31.83
Shandweel1	Pallas	410.0	417.8	73.3	22.08	25.20	42.63	42.63
	Atlantis	409.3	420.3	74.8	22.05	24.88	47.58	47.58
	Broadway-star	400.0	408.8	69.3	20.70	24.23	51.20	51.20
	Liprator fort	273.3	308.8	63.5	15.13	17.88	44.28	44.28
	Onostar f.b Traxsos	406.8	451.3	77.0	21.98	25.06	43.20	43.20
	Hand weeding Twice	404.8	449.0	74.0	22.65	24.70	50.98	50.98
	Untreated	223.3	233.3	58.8	10.36	12.01	34.80	34.80
Sids14	Pallas	393.3	436.8	67.8	21.28	25.15	43.90	43.90
	Atlantis	406.8	441.3	66.8	19.49	23.04	46.18	46.18
	Broadway-star	400.0	431.0	64.3	17.85	21.10	39.10	39.10
	Liprator fort	260.0	289.0	57.0	15.46	17.49	39.70	39.70
	Onostar f.b Traxsos	416.8	455.3	71.8	20.94	24.75	44.98	44.98
	Hand weeding Twice	393.3	436.8	61.3	20.28	24.30	47.10	47.10
	Untreated	246.8	274.0	51.8	9.62	11.38	33.03	33.03
Giza-171	Pallas	396.8	445.0	65.8	19.94	23.57	43.10	43.10
	Atlantis	393.3	436.8	65.0	20.54	23.61	47.50	47.50
	Broadway-star	386.8	430.8	63.3	19.70	23.28	43.03	43.03
	Liprator fort	263.3	292.8	53.8	15.40	17.21	39.73	39.73
	Onostar f.b Traxsos	390.0	432.8	65.8	21.24	24.11	46.68	46.68
	Hand weeding Twice	366.8	411.8	60.3	21.21	23.40	45.73	45.73
	Untreated	173.3	208.3	48.0	11.01	13.02	36.48	36.48
LSD		**26.8**	**19.7**	**7.1**	**1.51**	**1.58**	**5.49**	**5.49**

ardab/fad). The increment in grain yield might be due to eradication of weeds and find amount of N which aid to produce larger number of spikes/m^2 and number of kernels per spike. These results are in agreement with those of Shahid *et al.* (2005).

Data also indicated that the interaction effect between weed control practices and wheat cultivars on harvest index (%) was significant in the first season only. The highest harvest index (51.20% and 50.98%) was achieved with the treatment of Shandaweel-1× Broadway-star and Shandaweel-1× hand weeding twice treatments, respectively. The results of increasing in HI% with chemical and hand weeding treatment are in agreement with those reported by Tesfay *et al*. (2014).

Conclusion

From this study it could be concluded that to obtain the maximum grain yield of wheat cultivar Shandaweel-1 should be planted and weeds should be controlled by hand twice at 30 and 45days or by using herbicides Onostar followed by Traxsos, Atlantis, Pallas or Broadway.

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تأثير معاملات الحشائش على إنتاجية بعض أصناف قمح الخبز والحشائش المصاحبة له

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ملخص

أجريت تجربتين حقليتين خلال الموسمين الزراعيين 2018/2017 و2019/2018 بمحطة البحوث الزراعية بملوى- مركز البحوث الزراعية- مصر، لدراسة تأثير معاملات مكافحة الحشائش على محصول القمح ومكوناته لبعض أصناف قمح الخبز باستخدم تصميم القطاعات الكاملة العشوائية (RCBD) فى توزيع القطع المنشقه مرة واحده فى أربعة مكرارات. وضعت الأصناف (مصر1، مصر2، شندويل1، سدس 14 وجيزة 171) فى القطع الرئيسية ووضعت معاملات مكافحة الحشائش (بلاس4,5%، أطلنتس 1,2%، برودواى ستار 8,5%، لبيراتور فورت 36%، أونوستار75% متبوعاً بتراكسوس 5%) بالإضافة إلى إزالة الحشائش يدوياً مرتين بعد 30و45 يوم من الزراعة والمعاملة القياسية (بدون معاملة) بالقطع الشقية. أوضحت النتائج: أن الحشائش الرئيسية التى تم حصرها بالتجربة هى عدد نوعين من الحشائش النجيلة وخمسة أنواع من الحشائش عريضة الأوراق. أظهر تحليل التباين تأثيراً معنوياً للأصناف تحت الدراسة على الوزن الجاف للحشائش وكذلك الصفات المحصولية للقمح (عدد السنابل/م2 – محصول الحبوب – عدد حبوب السنبلة – وزن 1000 حبة- معامل الحصاد%). وقد تم تسجيل أعلى القيم لمحصول الحبوب مع الصنف شندويل 1 كما سجلت الأصناف مصر2 وجيزة171 أعلى قدرة تنافسية (CAC%) وأقل وزن جاف للحشائش. سجلت مبيدات الحشائش (أونوستار75% متبوع بتراكسوس5%، أطلنتس 1,2%، بودواي ستار 8,5% وبلاس 4,5%) وكذلك عملية إزالة الحشائش مرتين يدوياً أعلى إنخفاض فى الوزن الجاف للحشائش وأعلى زيادة فى كفاءة مكافحة الحشائش (WCE%) وأعلى زيادة فى محصول القمح ومكوناته. بينما سجلت أقل القيم مع مبيد الحشائش (لبيراتور فورت36%). أدى التفاعل المشترك بين أصناف القمح (شندويل1، مصر2 ومصر1) مع مبيدات الحشائش (بالاس 4.5%، أونوستار75% متبوع بتراكسوس5%، أطلنتس 1,2% وبودواي ستار 8,5%) وكذلك النقاوة اليدوية إلى الحصول على أعلى محصول حبوب وأقل وزن جاف للحشائش. لذلك فإنه يمكن الحصول على أعلى إنتاجية لمحصول القمح في ملوي من زراعة الصنف شندويل1 ومكافحة الحشائش يدويا أو بإستخدام مبيدات الحشائش أونوستار75% متبوع بتراكسوس5% أو أطلنتس 1,2% أو بالاس 4.5% أو برودواي ستار 8.5%.

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