Italian Ryegrass (*Lolium perenne* L.) Control in Durum Wheat (*Triticum Durum* L.) as Affected by Herbicide Application Timing and the Addition of Mineral Oil

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ABSTRACT: Two field experiments were carried out at a farm in a newly reclaimed soil, El-Minia Governorate, Egypt during two successive winter seasons of 2018/2019 and 2019/2020 to investigate the impact of twelve weed control treatments, (Pallas at 160 cm^3/fad., Pallas at 160 cm^3/fad. +1 L mineral oil, Atlantis at 400 cm^3/fad., Atlantis at 400 cm^3/fad. +1L mineral oil, Acqopic super at 100 cm^3/fad., Acqopic super at 100 cm^3/fad. +1L mineral oil, Axial at 500 cm^3/fad., Axial at 500 cm^3/fad. +1L mineral oil, Traxos at 500 cm^3/fad., Traxos at 500 cm^3/fad. +1L mineral oil, hand weeding twice and unweeded (check) with three Application timings (2, 4 and 6 leaves stage of wheat) on controlling Italian ryegrass (*Lolium perenne* L.), yield and its components of durum wheat (*Triticum durum* L.) cv BeniSwaif 5. The findings results indicated that early application timings at 2 leaves stage surpassed the other application timing 4 and 6 leaves stage in the two seasons in decreasing Italian ryegrass and increasing spike no./m^2, grains no./spike, 1000-grain weight (g), straw and grain yields in both seasons. Pallas at 160 cm^3 /fed tank mixed with 1 L Mineral Oil recorded the best Italian ryegrass control % in both growing seasons, applied at 2 leaves stage reduced the dry weight of main predominant Italian ryegrass (*Lolium perenne* L.) and increased wheat yield and its components. Italian ryegrass dry weight and plant height correlated high significantly negative with no. spike/m^2, no. grains/spike, 1000-grain weight, straw and grain yields in both cropping seasons. Grain yield ardab/ fed. highly significant correlated with its components namely no. spike/m^2, no. grains/spike, 1000-grain weight and straw yield in the two growing seasons.

Keywords: *Grassy weeds, wheat, Herbicides, Application timing, Mineral oil, Yield, Yield components, Italian Ray grass, Lolium perenne .*

INTRODUCTION

Wheat (*Triticum durum* L.) is the most important cereal crop, in Egypt and considered the main source of protein and calories for a large section of population. It ranks the first among cereal crops. During recent years, wheat yield capacity reached 8.8 million tons, while consumption increased to 16 million ton (FAO 2018). It is the most widely cultivated cereal in the world as this crop plays a vital role in the food security of the world. According to the STATISTA (2020). Weeds are one of the major limiting factors of wheat production. According to a researcher, the global reduction in yield of wheat crops due to the weed infestation ranged 17-30% (Milberg and Hallgren, 2004; Zand *et al.*, 2007; Oerke *et al.*, 2012 ; Rao and Chauhan, 2015; Salim *et al.*, 2017 and Amita *et al.*, 2022). Grassy weeds especially ryegrass reducing wheat yield and grain quality, Wheat yield reductions have been attributed to Italian ryegrass competition during wheat tillering, severe lodging at wheat maturity, and interference with wheat harvesting due to its later maturity as compared to wheat (Justice *et al.* 1994). Due to these characteristics severely infested fields are often abandoned for small grain production (Ritter and Menbere 2002), Selective herbicide options for Italian ryegrass control in wheat are limited, Diclofop applied post (postemergence to the crop) can control Italian ryegrass 81 to 100%, and increase winter wheat yield up to 60% (Griffin 1986; Khodayari *et al. 1983*). Recently, flucarbazone sodium+chlorosulfuron has been registered for control of light to moderate populations of Italian ryegrass 1 leaf to 2 tiller. However, reports indicate that flucarbazone sodium+chlorosulfuron controlled Italian ryegrass only 76% in Oklahoma when applied in the fall of 2004 (WERA077, 2005). Mesosulfuron-methyl applied at 15 to 18 g/ha at 2 - 3 leaf and 2 - 3 tillers of Italian ryegrass, controlled it 86% and 82%, but when applied to 4 to 5 tillers ryegrass control increased to 97% in Virginia (Bailey *et al.* 2003). Therefore, the control of weeds is a basic requirement and major component of management in the wheat production system (Nazari *et al.*, 2013). Chemical control is the most commonly used and reliable method for controlling weeds in wheat. The importance of this control has been achieved by various authors (Klein *et al.*, 2006; Frihauf *et al.*, 2010; Geier *et al.*, 2011; Sheikhhasan *et al.*, 2012; Mandal *et al.*, 2014; Mehmood *et al.*, 2014; Mehmeti *et al.*, 2018).

The objective of this investigation was to study the effectiveness of some herbicides with and without mineral oil for effective control of Italian ryegrass in wheat crops and, at the same time, to estimate their influence on wheat yields.

MATERIALS AND METHODS

Study area

Two field experiments were carried out at a private farm in a newly reclaimed soil in Elnasr 6 village, El-Edwa, El-Minia Governorate, Egypt (latitude of 28° 66′ 16″ N, longitude of 30° 68′17″ E and altitude of 38 m above sea level) during two successive winter seasons of 2018/2019 and 2019/2020. To study the impact of some herbicides and the addition of mineral oil as an adjuvant under different application timing on controlling wild rye grass (*Lolium perenne* L.), yield and its components of durum wheat (*Triticum durum* L.) cv Beniswaif 5. The experiment included 36 treatments (3 application timing and 12 weed control treatments). The preceding summer crop was sesame (*Sesamum inducum* L.) in both seasons. The soil properties of the experimental site such as sandy texture with 91.2 and 89.85% sand, 4.0 and 4.3% silt and 4.8 and 5.85% clay, pH were 7.8and 7.71 with organic matter of 1.78and 1.89% in 2018/2019 and 2019/2020 seasons, respectively.

Experimental design and crop management

A randomized complete block design (RCBD) was used, in a split plot arrangement and replicated four times. Application timings (2, 4 and 6 wheat leaf stage) were assigned to the main plots. The sub-plots were devoted to the twelve rey grass control treatments as follow:

1- Pyroxulam known commercially as Pallas 4.5% OD at rate of 160 cm^3/fad.
2- Pallas 4.5% OD at rate of 160 cm^3/fad tank mixed with mineral oil (known commercially Kabul oil).
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.
1.
4- Atlantis 1.2% OD at rate of 400 cm^3/fad. tank mixed with Kabul oil.
5- Clodinafop propargyl 24% known commercially as Aqopic super 24% EC at rate of 100 cm^3/fad.
6- Acqopic super 24% EC at rate of 100 cm^3/fad. tank mixed with Kabul oil.
7- Pinoxadin known commercially as Axial 5% EC at rate of 500 cm^3/fad.
8- Axial 5% EC at rate of 500 cm^3/fad. tank mixed with Kabul oil.
9- Clodinafop propargyl + pinoxadin a ready formulated herbicide known commercially as Traxos 5% EC at rate of 500 cm^3/fad.
10- Traxos 5% EC at rate of 500 cm^3/fad. tank mixed with Kabul oil.
11- Hand weeding twice at 30-45 days after sowing.
12- Unweeded (check).

The experiment included 144 plots (experimental unit), the plot area was 10.5 m^2 (3.5 m length × 3 m width). Seeding rate was 80 kg/fad. The herbicides were applied as per treatments on the assigned plots using Cp3 knapsack sprayers with 200 litter of water/fad. The durum wheat (*Triticum durum* L.) variety Beni swaif 5 was sown on 2nd and 5st of November in the first and second season, respectively; all wheat growing agricultural practices were done as recommended. The harvest time was 26th and 30th April in the first and second season, respectively·

Application of fertilizers

Throughout both seasons, potassium sulphate (K_2SO_4) was applied at a rate of 50 kg/fed during sowing. Prior to planting, a phosphorus fertilizer of 25 kg P_2O_5/fed was applied in the form of calcium superphosphate (15.5% P_2O_5). Ammonium nitrate (NH_4NO_3 - 33.50 N%) was utilized as the nitrogen source at a rate of 120 kg N/fed, administered in two equal doses: the first at sowing and the second at 21 days following sowing.

The studied characters

The following data were recorded:

Weed survey: -

A random sample of one square meter hand pulled from each plot at 75 days after sowing (DAS), then identified according to **Täckholm (1974)**. Weed samples were air-dried and then kept in an electric oven at 65-70°C till constant weight achieved, the dry weight Italian ryegrass (g/m^2) was estimated. Weed control efficiency (WCE) has been calculated according to **Meena *et al.*, (2017)** with the following formula:

$$WCE = \frac{\text{Weed dry weight of untreated} - \text{weed dry weight of treatment}}{\text{Weed dry weight in untreated}} x100$$

2. Wheat yield and its components: -

A-Befor harvest, no. of spikes/m^2 had been counted.

B-At harvest time, ten plants were taken to estimate plant height (cm), Number of grains/spike and 1000- grain weight (g). Then the whole plots were harvested to estimate straw yield (ton/fad.) and grain yield (ardab/fed.).

Statistical analysis

All data were statistically analyzed according to the 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.

RESULTS AND DISCUSSION

1- Effect of herbicides application timing on Italian ryegrass dry weight (g/m^2):

Result indicated the main grassy weed was Italian rey grass. Herbicides application timing exhibited highly significant effect on dry weight of Italian rey grass (g/m^2) as shown in Table (1). Early application timing at 2 leaf stage surpassed the other application timing 4 and 6 leaf stage in both seasons, the lowest Italian ryegrass dry weight of 119.00 and 114.00 (g/m^2) was achieved by earliest application timing at 2 leaf stage, meanwhile highest Italian ryegrass dry weight of 161.00 and 155.00 (g/m^2) detected by latest application timing at 6 leaf stage in the first and second seasons, respectively. This result may be due to the high sensitivity of lolium to herbicides during the early stages. These results are in line with those obtained by **Justice *et al.* 1994; Ritter and Menbere 2002**

Table (1) Effect of herbicides application timing on Italian ryegrass dry weight (g/m^2) in 2018/2019 and 2019/2020 seasons.

Application timing	Italian ryegrass dry weight (g/m^2)	
	2018/2019	2019/2020
2 leaf stage	**119.0**	**114.0**
4 leaf stage	**146.0**	**145.0**
6 leaf stage	**161.0**	**155.0**
F-test	**	**
LSD at $_{0.05}$	**10.2**	**10.5**

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

2- Effect of herbicides application timing on wheat yield and its components:

The effect of herbicides application timing on wheat yield and its components in 2018/2019 and 2019/2020 seasons was presented in Table (2). Wheat yield and its components were influenced highly significant by herbicides application timing in both seasons, applying herbicides at 2 leaf stage surpassed the other two applications timing for all studied traits except plant height in both seasons. This treatment increased no. spike/m^{2}by (10.31 and 15.35%), no. grains/spike by (10.41 and 13.77%), 1000-grain weight by (6.93 and 9.31%), straw yield by(4.03 and 8.12%) and grain yield by(9.71 and 14.62%) as compared with herbicides application at 4 and 6 leaf stages in the first season ,respectively, whereas in the second season increased no. spike/m^{2}by (6.55 and 15.03%), no. grains/spike by (13.53 and 17.16%), 1000-grain weight by (5.86 and 9.79%), straw yield by (4.73 and 8.58%) and grain yield by (10.23 and 14.79%) as compared with herbicides application at 4 and 6 leaf stages, respectively. On contrary, the tallest plants (100.30 and 102.84 cm.) were obtained from applying herbicides at 6 leaf stage in the first and second seasons respectively. These results may be due to decreasing weed competition earlier led to enhancement yield and yield components characteristics, while delaying weed control led to increase the competition which reflected in increase plant height and decreased yield and its components. These results are coincided with those reported by **Khodayari *et al.* (1983); Griffin (1986); Bailey *et al.* (2003) and Ritter and Menbere (2002).**

Table (2) Effect of herbicides application timing on wheat yield and its components in 2018/2019 and 2019/2020 seasons.

Application timing	Plant height (cm)	No. spike/m^2	No. grains/spike	1000-grain weight (g)	Straw yield (t/fed)	Grain yield (ardab/fed)
			2018/2019			
2 leaf stage	94.20	290.00	55.60	51.29	4.13	18.42
4 leaf stage	98.80	262.90	50.36	47.97	3.97	16.79
6 leaf stage	100.30	251.40	48.87	46.92	3.82	16.07
F-test	**	**	**	**	**	**
LSD at $_{0.05}$	0.68	6.66	1.32	1.88	0.06	0.67
			2019/2020			
2 leaf stage	96.69	316.80	58.32	52.71	4.43	19.40
4 leaf stage	99.68	297.30	51.37	49.79	4.23	17.60
6 leaf stage	102.84	275.40	49.78	48.01	4.08	16.90
F-test	**	**	**	**	**	**
LSD at $_{0.05}$	1.25	1.45	1.32	1.24	0.16	0.38

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

3- Effect of weed control treatments on Italian ryegrass dry weight (g/m^2):

Data in table (3) clear the influence of weed control treatments on dry weight of Italian ryegrass (g/m^2) in 2018 /2019 and 2019 /2020 seasons. Weed control treatments had high significant effect on dry weight of Italian ryegrass in both seasons, the lowest dry weight of Italian ryegrass was recorded by Pallas + Mineral Oil alone (49.00 and 46.00 g/m^2) followed by Hand Weeding (76.00 and 65.00 g/m^2), Pallas alone (78.00 and 67.00 g/m^2) , Atlantis (84.00 and 72.00 g/m^2) , Atlantis + Mineral Oil (102.00 and 95.00 g/m^2) and Traxos+ Mineral Oil (105.00 and 99.00 g/m^2) in the first and second seasons, respectively, and weed control efficiency for these treatment was (88.20,81.70,81.30,79.80 ,75.50 and 74.80%) in the first season, (88.50,83.80,83.30,82.00,76.30 and 75.30%) in the second season , respectively as compared with un-weeded (control) treatment. this may be due to the inhibition role of weed control treatments on Italian ryegrass growth ,the effect of mineral oil as an adjuvant in enhancing herbicides efficacy and weed susceptibility to Pallas and Atlantis herbicides. These results are in a good line with those obtained by **Bailey *et al.* (2003); Nazari *et al.*, (2013) and Amita *et al.*, (2022).**

Table (3) Effect of weed control treatments on Italian ryegrass dry weight (g/m^2) in 2018-2019 and 2019-2020 seasons.

Treatments		Seasons			
Weed control treatments	Rate cm^3/fed	2018-2019		2019-2020	
		Dry weight (g/m^2)	% Control	Dry weight (g/m^2)	% Control
Pallas	**160**	78.00	81.30	67.00	83.30
Pallas + Mineral Oil	**160 + 1L**	49.00	88.20	46.00	88.50
Atlantis	**400**	84.00	79.80	72.00	82.00
Atlantis + Mineral Oil	**400 + 1L**	102.00	75.50	95.00	76.30
Acopik super	**100**	190.00	54.30	188.00	53.10
Acopik super + Mineral Oil	**100 + 1L**	180.00	56.70	181.00	54.90
Axial	**500**	154.00	63.00	164.00	59.10
Axial+ Mineral Oil	**500 + 1L**	148.00	64.40	153.00	61.80
Traxos	**500**	122.00	70.70	124.00	69.10
Traxos+ Mineral Oil	**500 + 1L**	105.00	74.80	99.00	75.30
Hand Weeding	**Twice**	76.00	81.70	65.00	83.80
UnWeeded	-	416.00	0.00	401.00	0.00
F-test		**	-	**	-
-LSD at $_{0.05}$		12.50	-	15.10	-

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

4-Effect of weed control treatments on wheat yield and its components:

The effect of weed control treatments on wheat yield and its components in 2018/2019 and 2019/2020 seasons was shown in table (4).

Weed control treatments exhibited highly significant effect on wheat yield and its components in both seasons, Pallas + Mineral surpassed all weed control treatments for most studied traits of wheat yield and its components except plant height in both seasons. Pallas + Mineral Oil , hand weeding, Pallas alone , Atlantis, Atlantis + Mineral Oil and Traxos+ Mineral Oil gave the highest values for no. spike/m^2 of (343.70, 317.20, 312.60, 309.20, 286.90 and 289.60), no. grains/spike of (67.00, 61.67, 61.96, 59.69, 55.29 and 55.19), 1000-grain weight of (63.45, 60.07, 61.75, 59.53, 49.51 and 45.83g.) , straw yield of (5.04, 4.79, 4.69, 4.61, 4.26 and 4.30 ton/fed.) and grain yield of (20.73, 19.67, 19.90, 19.62, 18.28 and 18.52 ardab/fed.),respectively in the first season as well as in the second season for no. spike/m^2 of (364.80, 347.30, 346.60, 341.00, 323.2 and 324.80), no. grains/spike of (69.27, 63.90, 64.87, 61.60, 57.43 and 57.97), 1000-grain weight of (63.36, 62.72, 61.81, 60.09, 53.22 and 49.34 g.) , straw yield of (5.35, 5.00, 5.00, 4.91, 4.57 and 4.64 ton/fed.) and grain yield of (21.80, 20.70, 20.90, 20.60, 19.20 and 19.30 ardab/fed.), respectively. On contrary the shortest plants of (87.90 and 89.39cm) were cleared by application of Pallas + Mineral on the other hand the un-weeded (control) recorded the tallest plants (108.80 and 110.71cm) in the first and second seasons, respectively. Such effect may be attributed to decreased weed competition by

herbicides improving the growth of wheat plants, which reflected on increase yield and yield components. These results are in line with those obtained by **Milberg and Hallgren, (2004); Zand *et al.*, (2007); Oerke *et al.*, (2012) ; Rao and Chauhan, (2015); Salim *et al.*, (2017) and Amita *et al.*, (2022).**

Table (4) Effect of weed control treatments on wheat yield and its components in 2018/2019 and 2019/2020 seasons.

Weed control treatments	Rate cm^3/fed	Plant height (cm)	No. spike/m^2	No. grains/spike	1000-grain weight (g)	Straw yield (t/fed)	Grain yield (ardab/fed)
2018-2019							
Pallas	160	91.10	312.60	61.96	61.75	4.69	19.90
Pallas + Mineral Oil	160 + 1L	87.90	343.70	67.00	63.45	5.04	20.73
Atlantis	400	91.80	309.20	59.69	59.53	4.61	19.62
Atlantis + Mineral	400 + 1L	95.00	286.90	55.29	49.51	4.26	18.28
Acopik super	100	106.70	207.50	39.67	41.53	3.13	14.15
Acopik super +	100 + 1L	103.80	219.20	41.62	41.80	3.28	14.70
Axial	500	102.80	245.70	45.72	43.51	3.52	15.27
Axial+ Mineral Oil	500 + 1L	101.00	253.90	48.19	43.33	3.69	16.22
Traxos	500	95.60	273.20	51.93	42.67	3.99	17.47
Traxos+ Mineral Oil	500 + 1L	96.30	289.60	55.19	45.83	4.30	18.52
Hand Weeding	Twice	92.00	317.20	61.67	60.07	4.79	19.67
UnWeeded	-	108.80	158.90	31.40	31.75	2.35	10.62
F-test		**	**	**	**	**	**
LSD at 0.05		**2.12**	**10.33**	**2.08**	**2.87**	**0.12**	**0.66**
2019-2020							
Pallas	160	92.6	346.6	64.87	61.81	5.00	20.90
Pallas + Mineral Oil	160 + 1L	89.39	364.8	69.27	63.36	5.35	21.80
Atlantis	400	94.62	341	61.60	60.09	4.91	20.60
Atlantis + Mineral	400 + 1L	96.92	323.2	57.43	53.22	4.57	19.20
Acopik super	100	107.49	239.2	41.30	42.18	3.37	15.20
Acopik super +	100 + 1L	105.13	247.7	43.07	42.89	3.53	15.60
Axial	500	104.56	262.8	45.57	44.80	3.78	16.20
Axial+ Mineral Oil	500 + 1L	102.84	279.5	49.13	45.15	4.02	17.00
Traxos	500	100.88	303.2	52.43	46.73	4.28	17.90
Traxos+ Mineral Oil	500 + 1L	98.64	324.8	57.97	49.34	4.64	19.30
Hand Weeding	Twice	93.01	347.3	63.90	62.72	5.00	20.70
UnWeeded	-	110.71	177.8	31.37	29.81	2.46	11.40
F-test		**	**	**	**	**	**
LSD at 0.05		**3.36**	**9.95**	**2.08**	**2.43**	**0.19**	**0.56**

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

5 -Effect of interaction between herbicides application timing and weed control treatments on Italian ryegrass dry weight (g/m^2):

The Effect of interaction between herbicides application timing and weed control treatments on Italian ryegrass dry weight (g/m^2) in 2018/ 2019 and 2019/ 2020 seasons, is shown in Table (5).

Table (5): Effect of interaction between herbicides application timing and weed control treatments on Italian ryegrass dry weight (g/m^2) in 2018-2019 and 2019-2020 seasons.

Application timing	Weed control treatments	Rate cm^3/fed	Italian ryegrass dry weight (g/m^2)	
			2018-2019	2019-2020
2 leaf stage	**Pallas**	160	61.00	45.00
	Pallas + Mineral Oil	160 + 1L	35.00	23.00
	Atlantis	400	51.00	29.00
	Atlantis + Mineral Oil	400 + 1L	78.00	63.00
	Acopik super	100	157.00	163.00
	Acopik super + Mineral Oil	100 + 1L	139.00	150.00
	Axial	500	125.00	138.00
	Axial+ Mineral Oil	500 + 1L	115.00	121.00
	Traxos	500	101.00	111.00
	Traxos+ Mineral Oil	500 + 1L	91.00	86.00
	Hand Weeding	Twice	69.00	53.00
	UnWeeded	-	411.00	384.00
4 leaf stage	**Pallas**	160	77.00	60.00
	Pallas + Mineral Oil	160 + 1L	52.00	41.00
	Atlantis	400	96.00	76.00
	Atlantis + Mineral Oil	400 + 1L	106.00	101.00
	Acopik super	100	199.00	203.00
	Acopik super + Mineral Oil	100 + 1L	194.00	200.00
	Axial	500	160.00	181.00
	Axial+ Mineral Oil	500 + 1L	154.00	175.00
	Traxos	500	120.00	125.00
	Traxos+ Mineral Oil	500 + 1L	106.00	94.00
	Hand Weeding	Twice	81.00	68.00
	UnWeeded	-	406.00	414.00
6 leaf stage	**Pallas**	160	97.00	96.00
	Pallas + Mineral Oil	160 + 1L	61.00	74.00
	Atlantis	400	104.00	110.00
	Atlantis + Mineral Oil	400 + 1L	121.00	121.00
	Acopik super	100	213.00	198.00
	Acopik super + Mineral Oil	100 + 1L	206.00	194.00
	Axial	500	177.00	174.00
	Axial+ Mineral Oil	500 + 1L	174.00	163.00
	Traxos	500	146.00	136.00
	Traxos+ Mineral Oil	500 + 1L	119.00	118.00
	Hand Weeding	Twice	79.00	74.00
	UnWeeded	-	431.00	406.00
F-test			*	*
LSD at $_{0.05}$			**22.2**	**26.4**

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

Pallas + Mineral Oil applied at 2 leaf stage recorded the lowest Italian ryegrass dry weight of (35.00 and 23.00 g/m^2) in the first and second seasons, respectively, meanwhile the highest plots Italian ryegrass dry weight (431.00 and 414.00 g/m^2) was recorded in the un-weeded (control) with 6 leaf stage application timing in the first season and with 4 leaf stage application timing in the second season, respectively. These results are in agreement with those reported by **WERA077, (2005).**

Concerning, the effect of interaction between herbicides application timing and weed control treatments on wheat yield and its components in 2018/2019 and 2019/ 2020 seasons was presented in Table (6). It could be decided that, no. spike/m^2 and no. grains/spike as well as grain yield differed significantly in both seasons, whereas, 1000-grain weight and straw yield had a high significant and significant different in the first and second seasons ,respectively, meanwhile plant height differed high significantly in the first season only. Pallas + Mineral Oil applied at 2 leaf stage cleared the favorite values for all studied traits except plant height in both seasons which recorded the highest no. spike/m^2 (365.50 and 389.50), no. grains/spike (70.40 and 74.90), 1000-grain weight (66.40 and 65.22 g.), straw yield (5.20 and 5.58 ton) and grain yield (22.17 and 23.30 ardab) in the first and second seasons, respectively, on contrary, recorded the lowest values of plant height (85.5 and 84.8cm) in the

first and the second seasons ,respectively in spite plant height not differ significantly in 2nd season. Whereas, un-weeded (control) with 6 leaves stage application timing recorded the lowest no. spike/m^2 (152.20 and 169.20) , 1000-grain weight (31.61 and 28.48g.) and grain yield (9.87 and 10.90 ardab) in the first and second seasons respectively, as well as no. grains/spike of 30.90 in the second season. However, un-weeded (control) with 2 leaf stage application timing showed unfavorable values for no. grains/spike of 30.90 and straw yield of 2.27 ton in the 1st season, as well as un-weeded (control) with 4 leaf stage application timing showed the lowest straw yield of 2.36 ton in the 2nd one. These results are in a good line with obtained by those, **Griffin (1986) and Khodayari *et al.* (1983)**.

Table (6) Effect of interaction between herbicides application timing and weed control treatments on wheat yield and its components in 2018-2019 and 2019-2020 seasons.

Appl. timing	Weed control treatments	Rate cm^3/fed	Plant height (cm)		No. spike/m^2		No. grains/spike		1000-grain weight (g)		Straw yield (t/fed.)		Grain yield (ardab/fed.)	
			2018/19	2019/20	2018/19	2019/20	2018/19	2019/20	2018/19	2019/20	2018/19	2019/20	2018/19	2019/20
2 leaf stage	Pallas	160	87.4	89.0	321.0	371.0	63.30	67.30	64.51	62.91	4.82	5.15	21.55	22.60
	Pallas + Mineral Oil	160 + 1L	85.5	84.8	365.5	389.5	70.40	74.90	66.40	65.22	5.20	5.58	22.17	23.30
	Atlantis	400	86.8	88.3	343.0	376.8	67.50	70.30	64.71	63.37	4.95	5.35	21.82	22.80
	Atlantis + Mineral Oil	400 + 1L	90.1	90.4	315.0	351.8	61.30	65.20	58.60	59.49	4.50	4.99	19.87	21.10
	Acopik super	100	103.9	105.3	232.0	252.2	45.40	46.10	42.46	46.28	3.35	3.51	15.90	16.70
	Acopik super + Mineral Oil	100 + 1L	100.9	102.4	242.0	265.2	46.50	49.30	42.18	46.80	3.54	3.84	16.47	17.20
	Axial	500	99.8	102.7	274.5	274.5	50.10	50.20	46.04	47.43	3.72	3.94	16.90	17.80
	Axial+ Mineral Oil	500 + 1L	98.4	100.1	287.8	298.5	54.80	57.20	48.05	47.59	3.87	4.24	17.37	18.30
	Traxos	500	85.8	99.1	298.3	322.2	56.40	57.90	44.13	49.71	4.21	4.50	18.25	19.10
	Traxos+ Mineral Oil	500 + 1L	94.1	96.7	311.0	348.8	58.10	63.70	46.06	52.29	4.35	4.70	19.55	20.60
	Hand Weeding	Twice	90.1	90.0	331.8	365.8	62.50	66.50	60.45	60.06	4.73	4.90	20.25	21.40
	UnWeeded	-	107.0	111.5	158.8	185.0	30.90	31.30	31.88	31.43	2.27	2.42	10.97	11.80
4 leaf stage	Pallas	160	91.0	93.5	318.5	353.7	63.30	65.30	62.80	61.19	4.75	5.05	19.47	20.50
	Pallas + Mineral Oil	160 + 1L	88.6	90.5	342.5	365.7	66.30	68.50	62.47	62.84	5.01	5.35	20.25	21.30
	Atlantis	400	92.7	95.1	297.0	337.5	56.40	57.90	57.51	59.43	4.56	4.70	18.87	19.90
	Atlantis + Mineral Oil	400 + 1L	95.6	97.5	278.5	320.0	53.20	54.50	45.50	50.65	4.32	4.50	18.05	18.80
	Acopik super	100	107.6	107.3	199.0	238.5	37.20	39.30	41.30	41.46	3.11	3.38	14.05	15.00
	Acopik super + Mineral Oil	100 + 1L	104.4	105.8	212.5	243.0	39.90	40.20	42.02	43.52	3.21	3.49	14.22	15.20
	Axial	500	103.6	104.2	235.8	266.0	43.20	42.00	42.59	44.74	3.42	3.77	14.80	15.70
	Axial+ Mineral Oil	500 + 1L	101.6	102.0	243.0	287.0	45.10	44.80	43.62	45.24	3.65	4.02	15.70	16.50
	Traxos	500	99.8	100.5	265.3	311.5	51.20	52.30	41.39	45.99	3.95	4.31	17.60	17.50
	Traxos+ Mineral Oil	500 + 1L	96.5	97.3	286.2	324.2	54.40	55.80	45.87	48.22	4.43	4.75	18.07	19.00
	Hand Weeding	Twice	93.6	94.1	311.0	341.2	62.10	64.00	58.80	64.76	4.85	5.05	19.40	20.40
	UnWeeded	-	110.6	108.3	165.8	179.0	32.10	31.90	31.77	29.51	2.35	2.36	11.02	11.50
6 leaf stage	Pallas	160	95.0	95.3	298.2	315.0	59.30	62.00	57.94	61.31	4.50	4.80	18.67	19.50
	Pallas + Mineral Oil	160 + 1L	89.8	92.9	323.0	339.2	64.30	64.40	61.49	62.01	4.90	5.13	19.77	20.80
	Atlantis	400	95.9	100.5	287.8	308.7	55.20	56.60	56.36	57.48	4.32	4.67	18.17	19.10
	Atlantis + Mineral Oil	400 + 1L	99.4	102.9	267.2	297.7	51.40	52.60	44.42	49.51	3.95	4.24	16.92	17.90
	Acopik super	100	108.6	109.8	191.5	227.0	36.40	38.50	40.84	38.81	2.95	3.23	12.50	13.90
	Acopik super + Mineral Oil	100 + 1L	105.9	107.3	203.0	234.7	38.50	39.70	41.19	38.34	3.10	3.26	13.40	14.40
	Axial	500	104.9	106.8	226.7	248.0	43.90	44.50	41.91	42.22	3.42	3.64	14.12	15.10
	Axial+ Mineral Oil	500 + 1L	103.1	106.4	2231.	253.0	44.70	45.40	38.32	42.64	3.55	3.82	15.60	16.10
	Traxos	500	101.3	103.1	256.0	275.7	48.20	47.10	42.48	44.50	3.81	4.02	16.57	17.10
	Traxos+ Mineral Oil	500 + 1L	98.4	102.0	271.5	301.5	53.10	54.40	45.57	47.51	4.12	4.47	17.92	18.30
	Hand Weeding	Twice	92.2	95.0	308.8	335.0	60.40	61.20	60.96	63.33	4.783	5.05	19.35	20.30
	UnWeeded	-	108.9	112.3	152.2	169.2	31.20	30.90	31.61	28.48	2.42	2.60	9.87	10.90
F-test			**	NS	**	**	**	**	**	*	**	*	*	*
LSD at 0.05			**3.55**	**--**	**17.95**	**16.55**	**3.61**	**3.60**	**4.99**	**4.15**	**0.2**	**0.38**	**1.22**	**0.98**

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

7- Correlation analysis:

Correlation coefficients were estimated during 2018/ 2019 and 2019/ 2020 seasons and presented in table (7). The results revealed highly significant positive correlations between Italian ryegrass dry weight and plant height in both seasons, however highly significantly negative correlations found between both of Italian ryegrass dry weight and plant height, no. spike/$m^{2,}$ no. grains/spike, 1000-grain weight, straw and grain yields in both seasons. Grain yield ardab/ fed. Highly significant correlated with its components namely no. spike/m^2, no. grains/spike, 1000-grain weight, straw yield in both seasons. These cleared that grassy weed population in the experimental field exhibited severe effects of competition to wheat crop which reflected in decreased yield and its components. The present findings are in harmony with those obtained by **Sheikhhasan *et al.*, (2012); Mandal *et al.*, (2014); Mehmood *et al.*, (2014); Mehmeti *et al.*, (2018).**

Table (7): correlation analysis between studied traits:

Traits	Plant height (cm)	No. spike/m^2	No. grains/spike	1000-grain weight (g)	Straw yield (t/fed.)	Grain yield (ardab/fed.)
			2018-2019			
Italian ryegrass dry	0.763 **	-0.873 **	-0.852 **	-0.735 **	-0.891 **	-0.884 **
Plant height	-	-0.884 **	-0.892 **	-0.785 **	-0.885 **	-0.868 **
No. spike/m^2		-	0.951 **	0.794 **	0.945 **	0.933 **
No. grains/spike			-	0.831 **	0.950 **	0.935 **
1000-grain weight				-	0.840 **	0.791 **
Straw yield					-	0.932 **
Grain yield						-
			2019-2020			
Italian ryegrass dry	0.738 **	-0.904 **	-0.879 **	-0.815 **	-0.893 **	-0.911 **
Plant height	-	-0.834 **	-0.831 **	-0.779 **	-0.828 **	-0.828 **
No. spike/m^2		-	0.943 **	0.845 **	0.939 **	0.944 **
No. grains/spike			-	0.862 **	0.927 **	0.948 **
1000-grain weight				-	0.862 **	0.847 **
Straw yield					-	0.923 **
Grain yield						-

***, ** and N.S. indicate statistically significant at 0.05 and 0.01 levels and insignificancy of differences, respectively.**

CONCLUSION:

It could be concluded that, all weed control treatments decreased the dry weight of Italian ryegrass as compared with un-weeded(control) treatment, application of Pallas + Mineral Oil at 2 leaf stage decreased the dry weight of main predominant grassy weed (*Lolium perenne* L.) and increased wheat yield and its components under El Minia governorate condition

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الملخص العربي

مكافحة حشيشة الصامة في القمح الديورم ومدي تأثرها بمواعيد تطبيق مبيدات الحشائش وإضافة الزيت المعدني

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المعمل المركزي لبحوث الحشائش– مركز البحوث الزراعية

أقيمت تجربتان حقليتان بالاراضي حديثة الاستصلاح بمحافظة المنيا– مصر خلال الموسم الشتوي 2018–2019 و 2019–2020 لدراسة تأثير 12 معاملة مكافحة الحشائش (بالاس، بالاس+ 1 لتر زيت معدني، أطلنتس، أطلنتس+ 1 لتر زيت معدني، أكوبيك سوبر، أكوبيك سوبر+ 1 لتر زيت معدني، أكسيال، أكسيال+ 1 لتر زيت معدني، تراكسوس، تراكسوس+ 1 لتر زيت معدني، نقاوة يدوية مرتين و بدون معاملة) تحت ثلاثة مواعيد إضافة (في طور 2، 4، 6 أوراق لمحصول القمح) علي مكافحة حشيشة الصامة، المحصول ومكوناته للقمح الديورم صنف بني سويف5.

أشارت النتائج المتحصل عليها أن إستخدام معاملات الحشائش مبكراً في طور ورقتين لمحصول القمح تفوقت علي التطبيق في عمر 4، 6 أوراق لمحصول القمح في كلا الموسمين في خفض الوزن الجاف لحشيشة الصامه وزيادة عدد السنابل/م^2، عدد الحبوب/السنبلة، وزن الالف حبة، ومحصول الحبوب والقش في كلا الموسمين. كما أدي استخدام مبيد البلاس بمعدل 160 سم^3/ فدان خلطاً مع الزيت المعدني بمعدل 1 لتر/ فدان الي الحصول علي أعلي نسبة مكافحة لحشيشة الصامة، عند استخدامه في طور ورقتين لمحصول القمح حيث خفضت هذه المعاملة الوزن الجاف لحشيشة الصامة كما أدت إلي زيادة محصول حبوب القمح ومكوناته.

كما اشارت النتائج إلي أن الوزن الجاف لحشيشة الصامة أظهر إرتباطاً سلبيا عالي المعنويه مع عدد السنابل/م^2، عدد الحبوب/السنبلة، وزن الالف حبة، ومحصول الحبوب والقش في كلا الموسمين. كما أظهر محصول الحبوب إرتباطاً موجباً عالي المعنويه مع مكونات المحصول (عدد السنابل/م^2، عدد الحبوب/السنبلة، وزن الالف حبة، ومحصول القش في كلا الموسمين)