Efficacy of Tribinuron–methyl, Fluroxypyr and their Combinations in Controlling Broad-Leaved Weeds in Wheat

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ABSTRACT

Field experiments were conducted at Itay EL-Baroud-Agricultural Research Station, Itay EL-Baroud, Beherah Governorate, Egypt, during the seasons 2020-2021 and 2021-2022. The objective was to evaluate the efficacy of tribinuron-methyl, fluroxypyr and their combinations in controlling broad-leaved weeds in wheat fields. Hand weeding was performed at 15 and 30 days after sowing (DAS), while the herbicides were applied at 15 days after sowing (DAS). At harvest, fresh and dried weed biomasses (g m^{-2}) were measured, as well as certain agronomic wheat crop parameters such as 1000 grain weight (grams), wheat grain and straw yields (kg fed^{-1}). The results showed that all of the tested formulations significantly reduced the biomass of weeds including both fresh and dried biomasses of annual broad-leaved weeds. *Melilotus indica* L., *Beta vulgaris* L., *Sinapis arvensis* L. and *Cichorium pumpilum* Jacq., which were the most predominant weeds in the wheat field during both seasons. Throughout the two seasons of investigation, the combinations of tribinuron-methyl+ fluroxypyr demonstrated the most significant reduction in both weed control efficiency (WCE) and the fresh weight of annuls of broad-leaved weeds. These compositions improved all wheat crop biological parameters, including grain and straw yields, throughout the investigated two seasons, and were followed by hand weeding.

Keywords: weeds, herbicides formulations, wheat, agronomic traits.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is among the most significant crops for cereals in Egypt and across the world, serving as both a necessary food grain for humans and a significant source of fodder straw for feeding animals (Safina and Absy, 2017). Wheat has always been Egypt's main crop. Wheat-containing foods provide for one-third of Egyptians' average calorie consumption and 45% of the protein they consume is provided mostly in the form of subsidized bread known as baladi (HLPE, 2016). Although weeds can be controlled using cultural, biological, and chemical means, the labor shortage is getting more acute by the day, and it will no longer be practicable or cost-effective to continue with traditional cultural weed management approaches (Oerke, 2005).

Chemical weed control with herbicides is important for improving wheat plant growth and productivity. Furthermore, the assessment of pesticides used in wheat cultivation is based not just on their effectiveness in eliminating weeds, also their impact on wheat plant development and yield (Salama, 2004). Furthermore, weeds interfere with crop development and productivity by acquiring essential resources like light, water, and nutrients, as well as acting as a secondary host for a variety of insect pests and illnesses (John and Michel, 2010). Tribenuron-methyl herbicide formulations controlled annual broad-leaved weeds in wheat effectively (Saad *et al.,* 2011 and EL-Kholy *et al.,* 2013). Fluroxypyr was shown to have been the most efficient treatment for broad-leaved weeds by Ahmed *et al.*, (2008). In this regard, the chemical control approach is faster, more effective, and saves time and effort compared to others (Ahmed *et al.,* 2008).

The objective of this study was to assess the effectiveness of tribinuron-methyl, fluroxypyr and their combinations in controlling broad-leaved weeds in wheat. The study also aimed to evaluate the impacts of these weed management strategies on some agronomic wheat crop traits such as grain and straw yield.

MATERIALS AND METHODS

Experimental treatments and design

The effectiveness of three post-emergence herbicides was assessed through field trials, tribinuron-methyl (Granstar 75% DF), fluroxypyr (Starane 20% EC), and tribinuron-methyl + fluroxypyr (Togon 20% WP), as well as, hand weeding twice, in controlling broad-leaved weeds in wheat fields during the two growing seasons 2020-2021 and 2021-2022. A random complete-block design that includes three replications was used to disperse all weed control method treatments. The plot size was 21 m^2 (7.0 x 3.0 m).

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Table 1. Some properties of the herbicides evaluated in wheat fields

Common name	Trade name	Recommended Rate fed^{-1} /200L Water	Time of application	Source of herbicide sample
Tribinuron – methyl	Granstar 75 % DF	8.00 g	Post-emergence (2 weeks after sowing)	Dupont Co.
Fluroxypyr	Starane 20% EC	200 ml	Post-emergence (2 weeks after sowing)	Samtrade Co.
Fluroxypyr17.3% + Tribinuron – methyl 2.7%	Togon 20% WP	120 g	Post-emergence (2 weeks after sowing)	Qingdao Hansen Biologic Science Co.
Hand weeding		twice	After 15 and 30 days in sowing)	

A knapsack sprayer (Gloria Hoppy No. 299 TS. (CP3)) at 200 L water fed^{-1} was used to apply the herbicide treatments. While the hand weeding technique was used twice (15 and 30 DAS, before the 1st and 2nd irrigations, respectively). The herbicidal treatments are shown in Table (1). The herbicides were applied once at 1st and 5th of December in the seasons of 2021 and 2022, respectively.

Sowing

(*Triticum aestivum* L. Gemizah 12 cv.) wheat seeds were dressed at a rate of 60 kg fed^{-1} on the 15th and 20th of November during the two seasons. Other agricultural strategies utilized in the area for wheat production were followed.

Evaluation of weed control treatments:

Thirty days following herbicide treatment, weeds in an area of 50 x 50 cm inside every plot was gathered four times at random. Weeds were sorted, recognized, counted, and weighed (Hassanein *et al.*, 2000). On the unweeded plot, weed density and biomass at the same time, were estimated in the following manner:

1-Weed density =average number of each weed m^{-2}.

$$\text{2- Percent of weed density} = \frac{\text{average number of one weed}}{\text{average number of total weeds}} \times 100$$

3- Weed biomass =average (fresh or dry) weight of each weed (g m^{-2}).

$$\text{4- Percent of weed biomass} = \frac{\text{average (fresh or dry) weight of one weed}}{\text{average (fresh or dry) weight of total weeds}} \text{X}100$$

While a biomass of weeds was being measured, fresh broad-leaved weeds (gm^{-2}) were dried in an oven at 70 °C for 72 hr, and their dry weight (gm^{-2}) was determined. Herbicidal activity that every formula exhibited was calculated as a reduction (% R) in the dried or fresh weights of weed plants. By this formula:

% weed control efficiency (% R) =(C-T/C) X100

Where:

C is the weed biomass in the unweeded control area.

T is the weed biomass of weeds in the treated area.

Yield evaluation:

Wheat plants are picked when they reach maturity and air-dried for three days. Straw and grain yields were calculated in kg fed^{-1}. The 1000 grain weights (gm), were determined by the following formula:

$$\text{\% Increase} = \frac{T - C}{T} \text{X}100$$

Where:

T is weight of grain yield (kg fed^{-1}) in treated area.

C is weight of grain yield (kg fed^{-1}) in the unweeded control.

The collected data was statistically analyzed accordance to Gomez and Gomez (1984). A least significant distinction (LSD) test was utilized to compare means at 5% and 1% levels of relevance.

RESULTS AND DISCUSSION

A- Weed species:

Table (2) indicated the predominant annual broad-leaved weeds present in untreated wheat fields, annual were present; ***Melilotus indica* L.**, ***Beta vulgaris* L.**, ***Sinapis arvensis* L.** and, ***Cichorium pumpilum* Jacq** over two growing seasons (2021 and 2022).

Table 2. The predominant annual broad-leaved weeds in wheat fields during two seasons (2020–2021, 2021–2022)

Vernacular name Arabic name	English name	Scientific name	Family name
Handaqooq	clover, India melitot	*Melilotus indica* L.	Leguminosae
Salq	Sea beet, wild beet	*Beta vulgaris* L.	Chenopodiaceae
Kabar, Khardal barri	Wild mustard	*Sinapis arvensis* L.	Brassicaceae
Chikoria, Sirees.	Chicory	*Cichorium pumpilum* Jacq	Compositae

B- Weed density (No.) and weed biomass (gm).

The data of each type of weeds was recorded at the 9 weeks in the unweeded was check during both seasons (Table 3), the data revealed that ***Melilotus indica*** L. had the highest density of weeds (**25** and **31**weeds m^{-2}) while, ***Sinapis arvensis*** **L.** had the highest biomass (**991.51** and **798.81**g m^{-2}) at both seasons, consecutively. The appropriate biomass rates and weed density were calculated to be (**35.21**and **37.80**%) and (**43** and **53.7**%) respectively for each, in both seasons. The data also revealed that *Sinapis arvensis* L. had the second with weed density rates of (**23.94**and **26.82**%) and ***Beta vulgaris*** **L.** weed biomass rates of (**16.3** and **17.1**%) in both seasons, respectively. ***Cichorium pumpilum*** **Jacq.** had the lowest density rates of (**19.71**and **12.19**%) in both seasons.

The data indicated that number of each weed species and total weeds fluctuated both annually and among different weed type. These findings are in harmony with those obtained by Skora-Neto (2001) found that the density of weeds in fields of maize fluctuated over subsequent years based on meteorological and cultural conditions. Our results indicated that the broad-leaved weeds' biomass and density varied between years according to their species. These results are consistent with those of many authors (Abdelmonem and El-kholy, 2007; El-Kholy *et al.*, 2013; Hamada *et al.*, 2013; Marzouk, 2013; Hamada, 2014; Hussain *et al.*, 2015 and Choudhary *et al.*, 2016). They concluded that the above-mentioned broad-leaved weeds were common in fields of wheat, and the weeds varied in density and biomass according to their kind, from one season to another.

Effect of chemical treatments on fresh weed biomass:

Based on the data presented in Tables (4 and 5), all of the studied herbicide formulas and manual weeding, significantly (p=0.05) reduced the weed biomass (fresh weight) of the annual broad-leaved weeds compared to the unweeded control at 60 DAS in both seasons (2020-2021 and 2021-2022). The highest reduction of weed biomass of broad- leaved was obtained from Togon 20% WP (tribinuron-methyl + fluroxypyr) by (94.05, 100, 99.95 and 100%) in the 1st season and (100, 98.3, 100 and 100%) in the 2nd season for ***Melilotus indica*** **L., *Beta vulgaris* L., *Sinapis arvensis* L., and *Cichorium pumpilum* Jacq**., respectively. These results significantly higher compared to all tested herbicide formulations and unweeded check. Our results indicated that fluroxypyr (Starane 20 %EC), tribinuron-methyl (Granstar 75% DF) and hand-weeding in both seasons significantly decreased the fresh weight of both broad-leaved and overall weeds in relation to the unwedded control.

Table 3. Weed biomass and density of annual broad-leaved weeds in wheat field, during two seasons after 60 days after sowing (DAS)

Scientific name	60 Days after sowing (DAS)							
	Average number m^{-2}		% of Total weeds		Average fresh weight (gm^{-2})		% of Total weeds	
	A*	B**	A*	B**	A*	B**	A*	B**
Melilotus indica L.	25	31	35.21	37.80	215.54	201.21	9.34	13.5
Beta vulgaris L.	15	19	21.12	23.17	376.82	254.21	16.3	17.1
Sinapis arvensis L.	17	22	23.94	26.82	991.51	798.81	43	53.7
Cichorium pumpilum Jacq	14	10	19.71	12.19	722.65	233.51	31.3	15.7
Total weeds	**71**	**82**	**-**	**-**	**2306.52**	**1487.74**	**100**	**100**

A* = 2020-2021 season, B** = 2021-2022 season.

Table 4. Effect of herbicide compositions and hand-weeding on the mean fresh weight (gm^{-2}) of broad-leaved weeds in a wheat field (c.v. Gemizah 12) 60 days after planting over the 2020-2021 seasons

Treatments and formulations	Rate ($g\ fed^{-1}$)	*Melilotus indica* L.		*Beta vulgaris* L.		*Sinapis arvensis* L.		*Cichorium pumpilum* Jacq		Total broad leaved weeds	
		Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight ($g\ m^{-2}$)	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency
Granstar 75 % DF	8.00g	24.76	88.51	27.21	92.78	33.43	96.63	12.98	98.2	98.38	95.7347
Starane 20%EC	200ml	18.32	91.5	12.5	96.68	4.61	99.54	22.54	96.88	57.97	97.48669
Togon 20% WP.	120g	12.82	94.05	0	100	0.51	99.95	0	100	13.33	99.42207
Hand weeding	twice	38.21	82.27	30.41	91.93	45.31	95.43	49.54	93.14	163.47	92.9127
Untreated (Control)		215.54	0	376.82	0	991.51	0	722.65	0	2306.52	0
L.S. D. at 5%		**43.65**		**76.43**		**62.76**		**64.32**		**154.87**	

Table 5. Effect of herbicide compositions and hand-weeding on the mean fresh weight (gm^{-2}) of broad-leaved weeds in a wheat field (c.v. Gemizah 12) 60 days after planting over the 2021-2022 seasons

Treatments and formulations	Rate ($g\ fed^{-1}$)	*Melilotus indica* L.		*Beta vulgaris* L.		*Sinapis arvensis* L.		*Cichorium pumpilum* Jacq		Total broad leaved weeds	
		Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight ($g\ m^{-2}$)	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency	Fresh weight (gm^{-2})	% Weed control efficiency
Granstar 75 % DF	8.00g	33.1	83.55	11.87	95.33	18.87	97.64	29.02	87.57	92.86	93.75832
Starane 20%EC	200ml	25.91	87.12	15.98	93.71	12.41	98.45	23.71	89.85	78.01	94.75648
Togon 20% WP.	120g	0	100	4.31	98.3	0	100	0	100	4.31	99.7103
Hand weeding	twice	54.98	72.68	34.98	86.24	44.1	94.48	56.87	75.65	190.93	87.16644
Untreated (Control)		201.21	0	254.21	0	798.81	0	233.51	0	1487.74	0
L.S. D. at 5%		**48.65**		**54.65**		**76.32**		**65.54**		**106.87**	

Table 6. Effect of herbicide compositions and hand-weeding on the mean dry weight (gm^{-2}) of broad-leaved weeds in a wheat field (c.v. Gemizah 12) 60 days after planting throughout the 2020–2021 seasons

Treatments and formulations	Rate (g fed^{-1})	*Melilotus indica* L.		*Beta vulgaris* L.		*Sinapis arvensis* L.		*Cichorium pumpilum* Jacq		Total broad leaved weeds	
		Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (g m^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency
Granstar 75 % DF	8.00g	5.31	94.38	7.82	91	8.21	95.36	2.71	98.37	24.05	95.41
Starane 20%EC	200ml	4.12	95.64	2.90	96.66	.98	99.45	4.76	97.13	12.76	97.57
Togon 20% WP	120g	2.01	97.87	0	100	0.16	99.91	0	100	2.17	99.59
Hand weeding	twice	9.65	89.78	10.43	88	13.87	92.16	16.76	89.9	50.71	90.32
Untreated (Control)		94.43	0	86.92	0	176.83	0	165.86	0	524.04	0
L.S. D. at 5%		**15.64**		**18.76**		**32.65**		**28.65**		**32.65**	

Table 7. Effect of herbicide compositions and hand-weeding on the mean dry weight (gm^{-2}) of broad-leaved weeds in a wheat field (c.v.Gemizah 12) at 60 days after planting over the 2021-2022 seasons

Treatments and formulation s	Rate (g fed^{-1})	*Melilotus indica* L.		*Beta vulgaris* L.		*Sinapis arvensis* L.		*Cichorium pumpilum* Jacq		Total broad leaved weeds	
		Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (g m^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency	Dry weight (gm^{-2})	% Weed control efficiency
Granstar 75 % DF	8.00g	8.43	89.34	2.41	97.49	4.62	98.32	8.32	90.53	23.78	95.58
Starane 20%EC	200ml	6.42	91.88	3.87	95.96	2.01	99.27	4.87	94.46	17.17	96.81
Togon 20% WP.	120g	0	100	0.32	99.67	0	100	0	100	0.32	99.94
Hand weeding	twice	2.54	96.79	9.54	90.05	13.98	94.92	10.75	87.77	36.81	93.16
Untreated (Control)		79.09	0	95.87	0	274.98	0	87.90	0	537.84	0
L.S. D. at 5%		**14.76**		**20.76**		**18.98**		**27.86**		**29.03**	

The data shown in Tables (4 and 5) indicate that no noticeable variations in the herbicidal efficacy of any formulations against the biomass of broad-leaved weeds, in both seasons. However, Togon 20% WP demonstrated higher efficiency compared to other herbicide treatments.

The results indicated that the effectiveness of studied herbicide formulations' in reducing weed biomass varied (measured as the fresh weight of broad-leaved and total weeds grown in the experimental wheat field); this variability in efficiency could be attributed to the varying sensitivity levels of the dominant weeds, as well as the different mechanisms by which these herbicides work to inhibit weed growth and development. Similar findings were observed by Ahmed *et al.*,(2008). Results were supported by Zand *et al.*,(2006); Singh *et al.*,(2008); Marzouk (2009); Pannacci *et al.*,(2010); El-Kholy *et al.*,(2013); Hamada *et al.*,(2013) and Hamada (2014). They concluded that chemical herbicides were more efficient in controlling the broad leaves in wheat fields. They also found that the reduction of weed biomass resulted in effective control of broad-leaved weeds compared with hand weeding. Also, weed species, herbicide effectiveness, and prevalent agro-climatic conditions all contributed to the greatest reduction in weed biomass. Additionally, they concluded that hand weeding is an inefficient and costly practice; hence, herbicides have become a significant part in broad-leaved weed eradication in wheat fields.

In this regard, El-Kholy & Abdelmonem (2007); Abouziena *et al.*,(2008) and Singh *et al.*,(2008) found that the most common broad-leaved weeds in wheat are *Beta vulgaris*, *Chenopodium album*, *Chicorium pumpilum*, *Medicago intertexta*, *Melilotus indica*, and *Rumex dentatus*. The density (average number of weeds, m^{-2}) and biomass (average fresh weight of weed, (gm^{-2}) of these weeds changes in both seasons. Trezzi *et al.*,(2005) and Kir and Dogan (2009) observed similar findings, who stated that foramsulfuron herbicide effectively controlled weeds in corn field. They added that fluroxypyr reduced the biomass of common purslane by 91.5%, but hand weeding twice reduced it by 83.3 %.

Effect of chemical treatments on dry weed biomass:

Tables (6,7) demonstrate the result of hand weeding treatments and tested herbicide formulations on dry weight of broad-leaved and total dry biomass of weeds in the wheat crop. The results were similar to what was seen for the fresh weight of annual broad-leaved during both seasons. Compared to the unweeded control, dry weights in these annual broad-leaved weeds were significantly reduced. Chemical treatments, on the other hand, were equally effective against these weeds over both seasons.

These findings corroborate those of other studies:

According to a study by Hussein and El-Desoki (2001) the use of tribenuron-methyl (Granstar) significantly reduced the weight and number of weeds growing in wheat fields compared to an unweeded treatment. According to a study by Saad El-Din and Ahmed (2003), hand-weeding and tribenuron-methyl (Granstar) treatments had the greatest effectiveness in decreasing the fresh and dry weight of all weeds when compared to unweeded treatments. Zand *et al.*,(2006) reported that all dosages (10, 15, 20, and 25 gha^{-1}) of tribenuron-methyl formulations reduced dry weight and quantity of weeds when assessed against the untreated control, with no statistically significant changes found in tribenuron-methyl formulations at the highest dosage (25gha^{-1}). According to El-Metwally *et al.*,(2010); El-Kholy *et al.*,(2013) and Marzouk (2013), all weed managing methods considerably decreased total weeds (number and dry weight of broad-leaved weed species and grasses) after 60 and 90 DAS compared to unweeded control. The herbicides metosulam, sulfonylurea, isoproturon + diflufinican, and isoproturon had the most severe decrease in both the quantity and dry weight of broad-leaved weeds.

Effects of herbicide formulations on agronomic traits of wheat crop.

Tables (8, 9, and 10) indicate the influence of herbicide treatments and manual weeding treatments on agronomic characteristics, 1000 grain weight (TGW) (g), grain yield (kg fed^{-1}), straw yield (kg fed^{-1}) and yield of biological (kg fed^{-1}) of crop wheat in two seasons 2020-2021 and 2021-2022. In both seasons, compared to hand weeding and UWT, tested herbicides raised these values with no statistically significant differences (p=0.05) in their effects.

Results presented in Table (8 ,9, and 10) indicated that the highest level of biological yield with Togon, 20% WP were obtained in both seasons (tribinuron-methyl + fluroxypyr) (10376 and 10390 kg fed^{-1}), this was followed by fluroxypyr (Starane 20 %EC) (10014and 9712), tribinuron-methyl (Granstar 75% DF) (9340 and 9770 kg fed^{-1}) and hand weeding (8424and 8890 kg fed^{-1}), throughout both seasons, respectively.

Table 8. Effect of herbicide compositions and hand-weeding on some agronomic traits of wheat crop (c.v. Gemizah 12) during 2020-2021 season

Treatments and formulations	Length of spike (cm)		Number of spikelet per spike		Number of grain per spike		Weight of spike(g)		Weight of grain spike (g)	
	Mean	% increase	Mean	% increase	Mean	% increase	Mean	% increase	Mean	% increase
Granstar 75 % DF	9.98	25.75	19.43	13.38	55.72	28.54	4.13	44.07	3.21	59.19
Starane 20%EC	10.12	26.78	19.98	15.77	56.82	29.92	3.98	41.96	3.01	56.48
Togon 20% WP.	10.65	30.42	19.96	15.68	58.91	32.41	4.65	50.32	3.41	61.58
Hand weeding	9.51	22.08	18.34	8.233	53.78	25.96	3.12	25.96	2.13	38.5
Untreated (Control)	7.41	0	16.83	0	39.82	0	2.31	0	1.31	0
L.S.D at 5%	**N.S**		**N.S**		**N.S**		**N.S**		**N.S**	

N.S= Non significant

Table 9. Effect of herbicide compositions and hand-weeding on some agronomic traits of wheat crop (c.v. Gemizah 12) during 2021-2022 season

Treatments and formulations	Length of spike (cm)		Number of spikelet per spike		Number of grain per spike		Weight of spike(g)		Weight of grain spike (g)	
	Mean	% increase	Mean	% increase	Mean	% increase	Mean	% increase	Mean	% increase
Granstar 75 % DF	9.87	21.38	19.65	14.4	56.98	17.85	3.87	37.21	2.95	55.25
Starane 20%EC	10.54	26.38	19.53	13.88	57.21	18.18	3.65	33.42	3.01	56.15
Togon 20% WP.	9.87	21.38	19.42	13.39	57.72	18.9	3.75	35.2	2.87	54.01
Hand weeding	9.56	18.83	18.00	6.556	55.12	15.08	3.12	22.12	2.03	34.98
Untreated (Control)	7.76	0	16.82	0	46.81	0	2.43	0	1.32	0
L.S.D at 5%	**N.S**		**N.S**		**N.S**		**N.S**		**N.S**	

N.S= Non significant

Table 10. Effect of herbicide compositions and hand-weeding on some biological parameter as well as grain and straw yields of wheat crop during 2020-2021 and 2021-2022 seasons

Treatments and formulations	Season 2020-2021								Season 2021-2022							
	Biological yields (Kg/fed)		Weight of 1000 Grains (g)		Grain yield (Kg/fed)		Straw yield (Kg/fed)		Biological yields (Kg/fed)		Weight of 1000 Grains (g)		Grain yield (Kg/fed)		Straw yield (Kg/fed)	
	Mean	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**	**Mean**	**% increase**
Granstar 75 % DF	9340	30.28	51.31	25.49	3588	43.53	5752	22.01	9770	9.765	54.31	36.83	3708	38.35	6062	28.57
Starane 20%EC	10014	34.97	53.12	28.03	3662	44.68	6352	29.38	9712	9.226	56.34	39.1	3370	32.17	6342	31.73
Togon 20% WP.	10376	37.24	53.76	28.89	3930	48.45	6446	30.41	10390	15.15	57.65	40.49	3944	42.04	6446	32.83
Hand weeding	8424	22.7	45.21	15.44	3142	35.52	5282	15.07	8890	0.832	51.35	33.18	3124	26.82	5766	24.9
Untreated(Control)	6512	0	38.23	0	2026	0	4486	0	8816	0	34.31	0	2286	0	4330	0
L.S.D at 5%	**476.87**		**9.71**		**841.41**		**843.65**		**423.54**		**11.54**		**798.09**		**894.90**	

N.S= Non significant

The results from Table (8) indicated that the herbicidal treatments significantly ($p=0.05$) increased their values compared to the control treatments similar to straw yields. Wheat grain yields ranged from 3930 to 3944 kg fed^{-1} for Togon 20% WP. and 3662 to 3370 kg fed-1 for Starane 20% EC respectively, throughout both seasons. Also, hand weeding had the least effect (3142 and 3124 kg fed^{-1}) in comparison to herbicidal treatments. The same pattern was found in the instance of TGW, straw yield and other agronomic characteristics in both seasons. These results corroborate those of other researchers. Ashiq *et al.*,(2007) found Shield 75 % WDG (tribenuron-methyl) gave 26% more grain yield 3144 kg ha^{-1} and 1000 grain wt. 30.4 gm than the control grain yield of 2865 kg ha^{-1}, 1000 grain wt. 28.5 g in comparison to the weedy check. Abouziena *et al.*,(2008) reported that tribenuron-methyl herbicide increased the number of grains $spike^{-1}$, 1000 grain wt. 35.9 g, grain yield 2.13 t fed^{-1} and biological yield 4.3 t fed^{-1} compared to the control check which had number of grains $spike^{-1}$ (21.6), 1000 grain wt. 35.0 g, grain yield 1.11 t fed^{-1} and biological yield 1.8 t fed^{-1}. The data indicated that the use of chemical herbicides increased straw and grain yields in comparison to hand-weeding and control. Fayed (1992) and Fayed *et al.*,(1993) reported that application of Brominal and Granstar increases the plant height, spike length, number of spikelets $spike^{-1}$, number of grains $spike^{-1}$, TGW, grain weight $spike^{-1}$, number of $spike^{-1}$, grain and straw yield fed^{-1}, compared to UWT. The conclusion was supported by the studies conducted by Khan *et al.*,(2003); Ashiq *et al.*,(2007); Abouziena *et al.*,(2008); El-Metwally *et al.*,(2010); El-Kholy *et al.*,(2013) and Hamada (2014). It was established that the use of chemical control to manage weeds, lowered biomass and weed population while increasing tilling per unit of space, this led to higher wheat grain production compared to hand weeding and check unweeded. The increase of the number of viable tillers m^{-2} led to better food availability and other growth characteristics, spike length, number of grains $spike^{-1}$, and weight of 1000 grains. Moreover, several authors (Zand *et al.*, 2007; Shehzad *et al.*, 2012a, b and EL-Kholy *et al.*, 2013) agreed that wheat plants compete with broad-leaved weeds, which was to blame for the least TGW and grain yield in the unweeded check. They concluded that the decrease in wheat crop grain production could be attributed to weed crops competing for natural resources, which affects wheat output. Moreover, as a result of competition from broad-leaved weeds and wheat plants, the UWT may have the lowest TGW and grain yield. Many authors validated these findings (Gupta, 2004; Zand *et al.*, 2007; El-Kholy & Abdelmonem, 2007; Marzouk, 2009; Marzouk *et al.*, 2009; Shehzad *et al.*, 2012 a, b; and El-Kholy *et al.*, 2013). The decrease in wheat grain yield may be caused by broad-leaved weeds competing for natural resources with the wheat crop, resulting in a decrease in both wheat grain and straw yield.

CONCLUSION

The use of herbicides has a desirable effect on weed biomass, crop yield and yield components; thus, all tested herbicide formulations significantly decreased weed density as well as fresh and dry weed biomasses of the obtained annual broad-leaved weeds, which were predominant in wheat fields during both seasons. Whereas, combinations (tribinuron–methyl + fluroxypyr) resulted in the maximum reduction of fresh weight of annuls broad-leaved weeds and gave the highest weed control efficiency (WCE). The tested herbicide formulations also increased all biological parameters of the wheat crop including the yields of both grain and straw. Additionally, the use of hand hoeing during the two studied seasons, also contributed to this increase.

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الملخص العربي

كفاءة مبيدى الحشائش ترايبنيورون-ميثيل والفلوكسبير ومخاليطهما في مكافحة الحشائش العريضة الأوراق في محصول القمح

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أجريت التجارب الحقلية بمحطة البحوث الزراعية بإيتاى البارود محافظة البحيرة، مصر، فى موسمى ٢٠٢٠–٢٠٢١ و٢٠٢١–٢٠٢٢م بهدف تقييم كفاءة مبيدى الحشائش ترايبنيورون–ميثيل والفلوكسبير ومخاليطهما في مكافحة الحشائش عريضة الأوراق في محصول القمح مقارنة بالغير معامل. النقاوة اليدويه تم الانتهاء منها بعد ١٥ يوم و٣٠ يوم من الزراعة، بينما المبيدات المختبره تم تطبيقها بعد ١٥ يوم من الزراعة. تم تسجيل الوزن الرطب والجاف بالجرام/م٢ للحشائش بعد ٦٠ يوم من الزراعة وكذلك بعض مكونات محصول القمح عند الحصاد مثل وزن ١٠٠٠ حبه بالجرام ومحصول الحبوب والقش كيلوجرام للفدان. وأوضحت النتائج أن كل تجهيزات مبيدات الحشائش المختبره قد خفضت معنوياً وزن الحشائش العريضه السائده الرطبة والجافة مثل الحندقوق والسلق والكبر والسريس فى محصول القمح خلال موسمى الدراسة. وكان أعلى خفض للوزن الرطب للحشائش العريضه وأعلى نسبة مكافحة لخليط مبيد **ترايبنيورون–ميثيل مع مبيد الفلوكسبير خلال** موسمى الدراسة. وأيضا كما أظهرت جميع معاملات مكافحة الحشائش المختبرة زيادة فى مكونات المحصول البيولوجى للقمح وكذلك محصول الحبوب والقش مقارنة بالنقاوة اليدويه خلال موسمى الدراسة.