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Response of three cultivars of wheat (*Triticumaestivum*L.) and associated weeds to herbicides

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Abstract

This experiment was conducted to Study the response of three cultivars of bread wheat and the effect of herbicides on growth and yield of wheat cultivars during the growing season 2014-2015. The experiment comprised three wheat cultivars (Rabiaa, Khemsisi-1, Abugraib-3) and two herbicides treatments Pallas with rates (350, 500 and 650 ml ha^{-1}) and Topic Pallas with three rates (600, 750 and 900 ml ha^{-1}) by using factorial experiment arranged in Randomized Completely Block Design with three replicates. The results showed significant effect of cultivars, herbicides, and cultivars *herbicides concentration in number and dry weight of broad and narrow leaf weeds, 1000-grain weight, number of grain spike $^{-1}$. The Rabiaacultivar was superiority in grain yield which gave 1929.0 kg ha^{-1}andthe concentration 650 ml ha^{-1} for both herbicides was more effective in controlling of narrow leaf weeds. The Khemissi-1 cultivar treated with Pallas application at recommended dose (500 ml ha^{-1}) was recorded the lowest number and dry weight of broad leaf weeds 9.33 and 73 g. while the Abugraib-3 cultivar gave (50.28 g) for 1000-grain weight and yield (2016.6 kg ha^{-1}) with Pallas applied at 500 ml ha^{-1}.

Introduction

Wheat is a staple food and supplies of the calories and protein in the average diet [1] and [2] indicated that the yield reducing factors among others include insect, weed and disease.

The presence of weeds in a crop cans ableadverse effect of plant production in number of ways. Also, weed reduced quality and increases the harvesting cost. [3] reported that the increase wheat yields, it is important to manage weeds, which resulted higher yield in weeded crop.

[4] observed, the chemical and hard weeding have been used as a weed control in wheat and herbicides application and weeding decreased dry weight of weeds significantly as compared to dry weight in non-treated plots. Chemical weed control in wheat was the best in producing higher grain yield than hard weeding.

The application of grassy and broad leaf herbicides increased grain yield and yield components [5]. [6] observed weed infestation is one of the main causes of law grain yield of wheat over the world , as it reduces wheat grain yield by 37 to 50% [6] and [7]. In such situations, herbicides offer most ideal, practical, effective and economical means of reducing early weed competition and crop production losses [8]. At present, a number of pre and post –emergence herbicides are used in wheat fields for controlling weeds and to enhance wheat grain yield. There are evidences suggesting that herbicides besides controlling weeds reduced phytotoxic effect in crop. A decrease in chlorophyll [9] and [10], protein [11] and [12] and carbohydrate content [13] has been found in wheat treated with herbicides. The

study aimed to investigate the efficacy of herbicides and effective doses on weeds and grain yield of wheat cultivars.

Materials and Methods:

This experiment was carried out at Field Crops Research Farm of Agricultural College- University of Duhok during wintergrowing season 2014-2015 in a clay loam soil to evaluate the effect of three wheat cultivars and two herbicide treatments on yield and related weeds. The three wheat cultivars (Rabiaa, Abugraib-3, khemissi-1) and two herbicides treatments (Pallas and topic Pallas) with three application dose (0.1575, 0.225, 0.2925 Kg a.i. ha^{-1}which corresponded to 350, 500, 650 ml $ha^{-1}$for Pallas) and (0.048, 0.060, 0.072 Kg a.i. ha^{-1}which corresponded to 600,750,900 ml $ha^{-1}$for Topic Pallas) including one untreated check. The Factorial experiment in Randomized Complete Block Design with three replicates was used. The sowing date was 19th December 2014 using a seed rate of 120 kg ha^{-1} in four line 3m length and 0.25 m width between the rows. The normal cultural practices for growing wheat were applied as recommended. Nitrogen (N), were applied 120kg ha^{-1}as urea. Recommended rate of N was applied at 75 days after sowing and half of the N was applied after 100 days.Weeds were counted from one square meter randomly taken from each plot, then identified and classified to narrow and broad leaf,Table 1, revealed to occurrence of seventeen different accompanied weed species of wheat, comprised nine families, five narrow leaf and twelve broad leafand their dry weights were recorded by oven drying at 70 C for 48 hours.

At harvest, a plant sample of one square meter from each plot was taken to determine number of grain $spike^{-1}$, 1000 - grain weight and grain yields (kg ha^{-1}). The data were subjected to analysis of variance with SAS computer software and the mean was compared by using Duncan multiple range test (DMRT) at the 5% probability level.

Table (1):Weed species in Wheat field duringgrowing season 2014-2015.

	Scientific name	Family name
a- Narrow leaf weeds		
1	*Phalaris minor* Retz.	Poaceae
2	*Hordeumglaucum*Steud.	Poaceae
3	*Cyperusrotundus* L.	Cyperaceae
4	*Cynodondactylon*(L.)Pers.	Poaceae
5	*Avenafatua*L.	Poaceae
b- Broad leaf weeds		
6	*Sinapisarvensis* L.	Brassicaceae
7	*Convolvulus arvensis* L.	Convolvulaceae
8	*TrifoliumcampestreScherb.*	Fabaceae
9	*Vaccariapyramidata*Medik.	Caryophyllaceae
10	*Euphorbia helioscopia* L.	Euphorbiaceae
11	*Carthamusoxycantha*Bieb.	Asteraceae
12	*Sonchusoleraceas*	Asteraceae
13	*Xanthium strumarium* L.	Asteraceae
14	Lactucavirosa	Asteraceae
15	*Cichoriumintybus* L.	Asteraceae
16	*Centaureaibérica*Trevir. Spreng.	Asteraceae
17	*Hypericumperforatum* L.	Hypericaceae

Results and Discussion:

Table (2) showed highly significant and significant effect of cultivars on number and dry weight of broad leaf weeds, number of grains $spike^{-1}$, 1000-grain weight and non- significant on other traits, while the herbicide concentrations showed a highly significant effect in all traits except number of grain $spike^{-}$

[1].Regarding to the interaction between cultivars and herbicide concentrations, the results in the same table showed a highly and significant effect on number of grain spike $^{-1}$, number of narrow leaf, number and dry weight of broad leaf weeds, 1000-grain weight and non-significant on grain yield(kg ha^{-1}) and dry weight of narrow leaf weeds. This results in accordance with the work [14] and [15].

Table (2): Mean squares for studied traits of Wheat cultivars and herbicide concentrations during growing season 2014-2015.

Source of Variance	df	No. of Narrow leaf weeds m^{-2}	Dry Weight of Narrow leaf weeds m^{-2} (g)	No. of Broad leaf weeds m^{-2}	Dry Weight of Broad leaf weeds m^{-2} (g)	No. of grains spike^{-1}	1000 grain weight (g)	Yield kg ha $^{-1}$
Block	2	28.19 N.S.	2022 N.S.	47.7 **	12788 **	3.321 **	35.33 **	34866 N.S.
Cultivars (A)	2	149.33 **	129350 **	8899.1 **	76478 **	30.096	4.70 **	35784 **
Herbicide concentrations (B)	6	797.29 **	785147 N.S.	3025.3 **	162257 **	74.434 **	184.25 **	866828 N.S.
A *B	12	250.37	92355	1439.5	45845	24.877	128.30	45211
Error	40	46.59	19030	130.3	2433	5.440	15.70	67266
Total	62							

*,** represent significant effect at 0.05 and 0.01levels respectively.

Results in Table (3) revealed the effect of wheat cultivars on studied traits, the cultivars Rabiaa and Abugraib-3 were recorded the lowest number of narrow leaf weeds (12.4), while the Khemissi-1 was recorded the maximum number of narrow leaf weeds (15.0) , this indicate that the cultivars Rabiaa and Abugraib-3 were more competitive with weeds. The cultivar Abugraib-3recorded the high dry weight of narrow leaf weeds (401.6 g) followed by cultivar Rabiaa with value (266.3 g) and the Khemissi-1 was obtained the lowest value (265.1 g).Concerning the effect of wheat cultivars on number of broad leaf weeds, the results showed the cultivar Rabiaa was recorded the lowest number of broad leaf weeds (36.9) while the cultivars Khemissi-1 and Abugraib -3 were obtained 50.1 and 77.0 respectively, this mean the cultivar Rabiaa gave more tillers and a good growth in the primary of growth so that effect significantly on number of broad leaf weeds. The results in the same table showed the cultivar Abugraib-3 was recorded the minimum dry weight of broad leaf weeds (178.9 g) and followed by cultivar Rabiaa (247.09 g), this mean the cultivars were different in competitive with weeds. Also the data in the same table indicated that the wheat cultivars have a significant effect on number of grain spike^{-1}, the cultivar Abugraib-3 obtained the maximum number of grains spike^{-1} (38.5), while the differences between other cultivars was non-significant and recorded 37.6 and 36.2 for Rabiaa and Khemissi-1 cultivars respectively. Regarding to 1000-grain weight and yield kg ha^{-1} non-significant effects were appeared and also yield components (number of grains spike^{-1} and 1000-grain weight) were not effected in grain yield ha^{-1}, so that the differences between wheat cultivars were not different significantly between them. These results agree with the finding of researchers [3] and [11].

Table (3): Effect of Wheat cultivars on studied traits during growing season 2014-2015.

Cultivars	No. of Narrow leaf weeds m^{-2}	Dry Weight of Narrow leaf weeds m^{-2}(g)	No. of Broad leaf weeds m^{-2}	Dry Weight of Broad leaf weeds m^{-2}(g)	No. of grains spike^{-1}	1000 - grain weight (g)	Yield kg ha $^{-1}$
Rabiaa	12.4 b	266.3 b	36.9 c	247.0 b	37.6ab	41.30 a	1929.0 a
Abugraib-3	12.4 b	401.6 a	77.2 a	178.0 c	38.5 a	42.03 a	1910.3 a
Khemissi-1	15.0 ab	265.1 b	50.1 b	298.3 a	36.2 b	42.19 a	1850.0 a

Values within each set of means followed by the same letter are not significantly different at p=0.05.

Table (4) clarified the effect of herbicide concentrations on studied traits. Regarding to number and dry weight of narrow leaf weeds the results showed the Topic Pallas herbicide application at 650 ml ha^{-1}

concentration gave the minimum number of weeds per m^2 (2.22) and so that this treatment gave lower dry weight (46.0 g) followed by Pallas herbicide application at 650 ml ha^{-1} that gave 8.89 and 172.0 g for number and dry weight of narrow leaf weeds respectively, while the check treatment recorded maximum number (32.89) and weight (930.3 g) and can say that the concentration 650 ml ha^{-1} for both herbicides was more effective in controlling of narrow leaf weeds. These finding are also inconformity with of [8] and [16] who stated that weed populations lower in herbicide treated plots than control plot.

Regarding the herbicide concentrations, the table (4) ratified the lower number and dry weight of broad leaf weeds 26.22 and 99.2 g were noticed by recommended dose of Pallas, for the Topic Pallas, the lowest number was recorded by dose (650 ml ha^{-1}) 45.78, but the check and application of Topic Pallas at higher dose appeared the highest number and weight of broad leaf weeds (73.33, 519.0 g 81.56 and 249.5 g) respectively. The results were in line with [3] and [8].

Concerning the effect of herbicide concentrations on number of grains $spike^{-1}$, the application of Pallas at 500 and 350 ml ha^{-1} dose showed the maximum number of grains $spike^{-1}$ (40.81 and 39.67) respectively, while the dose 750 ml ha^{-1} of Topic Pallas exhibited the maximum value 39.88 compare with other doses but, the lowest number of grains $spike^{-1}$ was recorded in the weedy check (33.34), these results in accordance with the work of [17] who found that this may related to broad spectrum number of grains $spike^{-1}$.

The maximum 1000-grain weight was noticed by Topic Pallas application at 650 ml ha^{-1} dose (48.07 g) followed by treatment of Pallas application at 350 ml ha^{-1} (44.22 g), while the minimum weight of 1000-grain was recorded in the weedy check (33.67 g). This finding is directly supported with study of [18] and [19] who reported that due to strong competition of weeds with crop on necessary elements the weight of grains majority reduced. Regarding to yield kg ha^{-1} , the herbicide concentration appeared significant difference with the check treatment and the yield range between 1925.6 to 2051.5 kg ha^{-1} but the check gave 1199.3 kg ha^{-1} and also noticed that the difference between the concentration levels were not significant in this trait.

Table (4): Effect of herbicide concentrations on studied traits during growing season 2014-2015.

Values within each set of means followed by the same letter are not significantly different at p=0.05.

Herbicide concentrations	No. of Narrow leaf weeds m^{-2}	Dry Weight of Narrow leaf weeds m^{-2} (g)	No. of Broad leaf weeds m^{-2}	Dry Weight of Broad leaf weeds m^{-2}(g)	No. of grains $spike^{-1}$	1000 - grain weight (g)	Yield kg ha^{-1}
Pallas (650 ml ha^{-1})	8.89bc	172.0cd	54.89b	162.6cd	35.77bc	38.93bc	2051.5a
Pallas (500 ml ha^{-1})	15.56b	273.9bc	26. 22c	99.2d	40.81a	42.49ab	1994.2a
Pallas (350 ml ha^{-1})	14.67b	123.7cd	47.11b	261.7b	39.67a	44.22ab	2029.4a
Topic Pallas (900 ml ha^{-1})	17.78b	232.6bcd	81.56a	249.5b	38.02ab	42.07b	1925.6a
Topic Pallas (750 ml ha^{-1})	13.33b	398.7b	54.22b	200.0bc	39.88a	43.44ab	2034.9a
Topic Pallas (650 ml ha^{-1})	2.22c	46.0d	45.78b	194.9bc	34.71bc	48.07a	2040.0a
Check	32.89a	930.3a	73.33a	519.6a	33.34c	33.67c	1199.3b

The data in Table (5) showed the interaction between wheat cultivars and herbicide concentrations, the Abugraib-3 and Khemissi-1 cultivars treated with Topic Pallas applied at 650 ml ha^{-1} were recorded the minimum number and dry weight of narrow leaf weeds 1.33, 1.33, 47.4 g and 22.0 g respectively followed by Rabiaa and Abugraib-3 cultivars with application of Pallas at dose 350 ml ha^{-1} which recorded 5.33, 4.0, 97.9 g and 56.3 g respectively , therefore the lower dose application of herbicides for controlling of weeds ultimately was important for reducing the soil pollution and was economic. The Khemissi-1 cultivar treated with Pallas application at recommended dose (500 ml ha^{-1}) was recorded the lowest number and dry weight of broad leaf weeds 9.33 and 73 g, while the highest dry weight was appeared for check treatment 855.7 g with Khemissi-1 cultivar. The results were in line with [3] and [8].

Table 5: Effect of interaction between Wheat cultivars and herbicides concentrations on weed traits duding growing season 2014-2015.

Characters	No. of Narrow leaf weeds m^{-2}			Dry Weight of Narrow leaf weeds m^{-2} (g)			No. of Broad leaf weeds m^{-2}			Dry Weight of Broad leaf weeds m^{-2} (g)		
Cultivars	**Rabiaa Cultivar**	**Abugraib -3 Cultivar**	**Khemissi -1 Cultivar**	**Rabiaa Cultivar**	**Abugraib -3 Cultivar**	**Khemissi-1 Cultivar**	**Rabiaa Cultivar**	**Abugraib -3 Cultivar**	**Khemissi -1 Cultivar**	**Rabiaa Cultivar**	**Abugraib-3 Cultivar**	**Khemissi-1 Cultivar**
Herbicide concentrations												
Pallas (650 ml ha^{-1})	8.00 d-g	10.67 c-g	8.00 d-g	203.9 de	202.8 de	109.3 de	68.00 cd	74.00 bcd	22.67 fg	273.3 bcd	70.9 g	143.7 d-g
Pallas (500 ml ha^{-1})	8.00 d-g	25.33 a-e	13.33 c-g	122.5 de	532.7 bcd	166.4 de	22.67 fg	46.67 def	9.33 g	108.0 efg	116.6 efg	73.0 fg
Pallas (350 ml ha^{-1})	5.33 efg	4.00 fg	34.67 ab	97.9 e	56.3 e	216.8 de	16.00 fg	49.33 c-f	76.00 bcd	306.0 bc	254.2 b-e	224.9 b-f
Topic Pallas (900 ml ha^{-1})	21.33 a-g	17.33 b-g	14.67 b-g	287.1 cde	212.7 de	198.0 de	51.33 c-f	120.00 a	73.33 bcd	303.6 bc	221.0 b-g	223.8 b-g
Topic Pallas (750 ml ha^{-1})	12.00 c-g	24.00 a-f	4.00 fg	406.1 b-e	742.4 ab	64.8 e	29.33 efg	62.67 cde	70.67 bcd	197.5 c-g	82.0 fg	320.6 bc
Topic Pallas (650 ml ha^{-1})	4.00 fg	1.33 g	1.33 g	51.3 e	47.4 e	22.0 e	29.33 efg	84.00 bc	24.00 fg	202.9 c-g	135.5 d-g	246.1 b-e
Check	28.00 a-d	41.33 a	29.33 abc	695.5 abc	999.8 a	1095.7 a	41.33 d-g	104.00 ab	74.67 bcd	337.3 bc	365.8 b	855.7 a

Values within each set of means followed by the same letter are not significantly different at p=0.05.

Results from Table (6) represented that the Abugraib-3 cultivar treated with Pallas application at recommended and lower doses recorded highest number of grains $spike^{-1}$ 43.3 and 43.83 respectively, whereas the Rabiaa cultivar was surpassed in number of grains $spike^{-1}$ when treated with Topic Pallas at 900 ml ha^{-1} which recorded 42.60, while the minimum value related to weedy check 31.80 with Khemissi-1 cultivar. These results agree with the finding of [17].

From the same table there were highly significant effects in 1000-grain weight and yield kg ha^{-1} traits. Rabiaa cultivar exceeded others in 1000-grain weight and recorded 55.23 g with Topic Pallas at dose 650 ml ha^{-1} which gave highest yield 2096.4 kg ha^{-1} and followed by the same herbicide at dose 900 ml ha^{-1} (2113.3 kg ha^{-1}). From the above results the herbicide Topic Pallas appeared more effective in controlling of most weeds at doses 650 and 900 ml ha^{-1} compare to Pallas herbicide, while the Abugraib-3 cultivar gave (50.28 g) for 1000-grain weight and yield (2016.6 kg ha^{-1}) with Pallas applied at 500 ml ha^{-1}, whereas the minimum weight of 1000-grain was recorded in the weedy check (32.03 g) with Khemissi-1 cultivar while the same treatment with Rabiaa cultivar recorded lowest yield (1157.0 kg ha^{-1}), the results clearly indicated the Khemissi-1 and Rabiaa cultivars were weak competitors with narrow and broad leaf weeds . these results in accordance with the work of [18]and [19].

Table 6: Interaction between Wheat Cultivars and Herbicides and Concentrations on Studied Traits Duding Growing Season 2014-2015.

Characters	No. of grains $spike^{-1}$			1000- grain weight (g)			Yield kg ha^{-1}		
Cultivars	**Rabiaa Cultivar**	**Abugraib-3 Cultivar**	**Khemissi-1 Cultivar**	**Rabiaa Cultivar**	**Abugraib-3 Cultivar**	**Khemissi-1 Cultivar**	**Rabiaa Cultivar**	**Abugraib-3 Cultivar**	**Khemissi-1 Cultivar**
Herbicide concentrations									
Pallas (650 ml ha^{-1})	34.43 def	35.30 c-f	37.57 a-f	35.88 c-f	33.04 ef	47.86 abc	2004.7 abc	2239.4 a	1910.5 abcd
Pallas (500 ml ha^{-1})	38.87 a-f	43.30 a	40.27 a-e	34.5 def	50.28 ab	42.70 b-f	2016.6 ab	2020.1 ab	1945.8 abcd
Pallas (350 ml ha^{-1})	41.07 a-d	43.83 a	34.10 abc	46.67 a-d	37.90 c-f	48.08 abc	2088.2 a	2149.4 a	1850.5 abcd
Topic Pallas (900 ml ha^{-1})	42.60 ab	36.90 a-f	34.57 def	39.64 b-f	50.49 ab	36.07 c-f	2113.3 a	1703.4 abcd	1960.0 abcd
Topic Pallas (750 ml ha^{-1})	37.53 a-f	40.17 a-e	41.93 abc	41.25 b-f	44.10 a-f	44.96 a-e	2026.6 ab	2038.4 ab	2039.7 ab

Topic Pallas	35.83	35.30	33.00	55.23	45.39	43.60	2096.4	2017.4	2006.3
(650 ml ha^{-1})	b-f	c-f	ef	a	a-e	a-f	a	ab	abc
Check	33.20	35.03	31.80	35.93	33.04	32.03	1157.0	1203.9	1237.0
	ef	c-f	f	c-f	ef	f	d	cd	bcd

Values within each set of means followed by the same letter are not significantly different at p=0.05.

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