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EFFECT OF HERBICIDES AND UREA AS ADDITIVE ON WHEAT, NUTRIENT UPTAKE, PHOTOSYNTHETIC PIGMENTS AND ASSOCIATED WEEDS

Soliman, I. E. ; G. M. Abd El-Hamed and A. M. Fadl - Allah
Weed Res. Cent. Lab., Agric. Res. Cent., Giza, Egypt.

ABSTRACT

Two field experiments were conducted during successive seasons of 2008/2009 and 2009/2010 at Sakha Agricultural Research Station to study the effect of herbicides and urea as an additive to herbicides on wheat, NPK uptake, photosynthetic pigments and associated weeds. The results indicated that using the recommended rate of herbicides, (isoproturon + diflufenican) at 300g a.i./fed. for control total annual weeds, tribenuron-methyl at 6.0g a.i/fed. for control broad-leaved weeds and clodinafop propargyl at 21g a.i./fed for control grassy weeds as applied alone post- emergence as well as hand weeding twice, gave excellent weed control (93.6, 68.0, 45.9 and 93.6 %), respectively. While, the same herbicides when applied at moderate rate (isoproturon + diflufenican) at 244.5g a.i./fed, tribenuron-methyl at 4.5g a.i /fed and clodinafop propargyl at 15.75g a.i/fed) mixing with 1% urea increased the herbicides efficiency in controlling the annual weeds by about (90.2, 65.9 and 44.5 %). Mixing 1% urea with the same herbicides at low rate (isoproturon + diflufenican at 165g a.i/fed, tribenuron-methyl at 3.0g a.i/fed and clodinafop propargyl at 10.5g a.i/fed) gave poor weed control and were significantly less efficient than the other treatments at the first survey in the first season.

Hand weeding treatment, (isoproturon + diflufenican), tribenuron-methyl and clodinafop propargyl at high rate, alone as post-emergence as well as the same herbicides at moderate rate plus 1% urea had higher efficiency in controlling annual weeds and increased the plant height, spike length, weight of grains/ spike, number of grains/spike, straw yield (ton/fed) and grains yield (Ardab/fed), compared with the other treatments used. All herbicidal treatments as well as hand weeding treatment increased protein, phosphors, potassium and carbohydrate percentages and their uptake kg/fed in wheat grains over control treatment. Data also, cleared that all herbicides treatments slightly decreased chlorophyll a, b and total chlorophyll and; increased carotene content. From results of correlation analysis the fresh weight of total weeds, grassy weeds and broad-leaved weeds biomass were negative correlated with wheat yield. Grassy weeds were more aggressive in their competitiveness effect than broad-leaved weeds on wheat yield and its components. These results indicated that under heavy infested with annual weeds, it is possible to apply herbicides i.e.(isoproturon + diflufenican) for annual weeds control, tribenuron-methyl for broad-leaved weeds control and clodinafop propargyl for grassy weeds control at high rate alone or same herbicides at moderate rates mixed with 1% urea. These findings revealed obviously that such weed control measure can minimize weed /wheat competition and consequently gave the highest reduction in weeds and increase wheat yield and its components.

INTRODUCTION

Wheat (*Triticum aestivum* L.) is considered as one of the most important cereal winter crops in Egypt, because the local production is not sufficient to supply the annual demands of the local requirements.

Wheat is often suffer strongly from competitive by numerous weed species, where the reduction of wheat yield due to weed infestation reached 30- 50%, Singh and Prasad, (1998), , Khaffagy, (2004), and Chhckar *et al*. (2007). Dhaliwal *et al*. (1997) found wheat yield losses exceeded 50% with phalaris at 500 plants/m2 and is mainly attributed to reduction in number of ears.

Chemical weed control in wheat fields by post-emergence herbicides such as bromoxynil, metosulam, tribenuron-methyl, clodinafop propargyl and isoproturon have been used to control weeds in wheat fields in Egypt to improve wheat productivity through elimination of weed competition. Recently, some evidence has been gathered that adding some additives, such as fertilizers to herbicide solution could increase its activity for weed control and consequently can reduce rates of these herbicides and minimizing environmental pollution.

Koscelny and Peeper, (1996) and Azad *et al.* (1997) they reported that spraying isoproturon mixed with urea 20- 30 days after planting proved to be the most effective control of the annual weeds in wheat. El-Desoki *et al.,* (1993) reported that mixing ammonium sulphate or urea with bromoxynil and hand weeding treatment gave the highest spike length and straw yield/fed compared with unweeded check. Azad *et al.,* (1997), Balyan *et al.* (1994) and; Pandey and Singh (1994) showed that tank mixing of urea with isoproturon increased wheat grain yields over herbicide alone. Nagla Al-Ashkar (1998), Metwally *et al.,* (1999) and Abd El-Hamid, (2002) reported that post-emergence application of isoproturon or metosulam as ell as hand weeding treatment increased the straw yield in wheat compared with the other treatment used.

Varsheney and Singh (1990) reported that tank mixing of urea with isoproturon at 0.5 kg/ha as well as manual weeding twice reduce uptake of P and K by weeds by 54- 60% over herbicide alone. Metwally and Hassan (2001) indicated that mixing 1% urea or ammonium sulphate with isoproturon or fluoroglycofen-ethyl or metosulam at the low dose increased the herbicides efficiency in controlling the annual weeds by about 81.36- 84.99%. Mekky *et al*.(2010) found from series of experiments that Topik application at 70, 140, 210 g/fed. Either applied at 30 or 45 DAS of wheat. The main findings revealed that wheat was tolerant to the herbicide at recommended rate (140 g/fed.) when applied at 45 DAS and very effective against canary grass and increased wheat production. In pot experiments wheat was tolerant to herbicide at the mentioned rates while *Phalaris paradoxa, Lolium temulentym* and wild oat were very sensitive to all used rates. There slight inhibitory effects on chl a, b and carotenoids on wheat leaves at 60 DAS. Whichtman and Haynes(1985) and; Khalil and Gobarh (2001). reported that chlorophyll as well as carotenoids were reduced by herbicides alone while increased when treated by urea at 70 and 100 days after planting. Al – Marsafy *et al*., (1996) indicated that the losses in wheat yield due to grassy weed *Phalaris mixture* reached about 44%, meanwhile the losses in yield attributed to *Phalaris spp*. Ranged from 40 – 50%. Shaban *et al*. (2009) indicated that the reduction in wheat yield due to the broad-leaves weeds competition were

27.5 and 19.2%, for grassy weeds 43.7 and 33.2 % but for total annual weeds 46.8 and 46.4% in 2006/07 and 2007/08 seasons, respectively. Hassanein *et al*., (1999) reported that polynominal regression and economic analysis referred that there was a negative relationship between weed density and wheat yield and number of spikes/m2, where weed density of 50 – 60 *Phalaris* weeds/m2 decreased wheat yield by 1.22 t/ha as compared to zero level of weed density accompanied with decreasing in the profitability. Abd El-Hamid and El-Khanagry (2006) showed that simple correlation of dry weight of total weeds, grassy weeds and broad leaf weeds biomass were negatively correlated with wheat yield, where correlation coefficients were – 0.820, - 0.672 and – 0.504, respectively over the two seasons. The yield was positively correlated with number of spikes/m2 (0.9), 1000 – grain weight (0.504). Also, this study showed grassy weeds were more aggressive in their competitveness effect than broad leaf weeds on wheat yield and its components.

The recent trend for reducing herbicides used press to find some new practices to weed control. Thus, the present study aimed to evaluate the efficacy of adding urea to herbicides solution on weed control efficiency, growth, yield and some physiological and chemical characters of wheat plants.

MATERIALS AND METHODS

Two field experiments were performed at the Experimental Station, Sakha Agricultural Research during two successive winter seasons of 2008/2009 and 2009/2010 to study the effect of herbicides alone or with adding urea with reduced herbicidal rates. The soil was clay in both seasons as shown in Table 1.

Table 1 : Mechanical and chemical analysis of soil

season	Organic matter (%)	Soil PH	Sand %	Silt %	Clay %	Textural class	N (ppm)	p(ppm)	K(ppm)
2008/09	1.35	8.29	18.72	33.73	48.4	clay	22.00	20.00	280.92
2009/010	1.45	8.09	17.66	33.14	51.2	clay	19.53	18.45	277.10

Wheat grains (*Triticum aestivum* L.) cv. Sakha 93 were used. The plot size was 3.0 × 3.5 m. The grains were broadcasted on the soil at a rate of 60 kg/fed. in Nov. 15 and 20 for the first and second seasons, respectively. The experiments were laid out in a complete randomized block design with four replications, where eleven treatments were involved used as follow:

1- Topik (clodinafop propargyl 15% WP): Prop-2-ynyl-(P.)-2-[4-(5-chloro-3-fluoropyridin-2-yloxy) phenoxy] propionate at the rate of 21g a.i./fed. applied 35 days after sowing.
2- Topik (clodinafop propargyl 15% WP) at the rate of 15.75g a.i./fed.,+ urea at the rate of 4.7 kg/fed. applied at 35 days after sowing.

3- Topik (clodinafop propargyl 15% WP) : at the rate of 10.5 g a.i./fed.+ urea at the rate of 4.7 kg/fed., applied at 35 days after sowing
4- Granstar (tribenuron- methyl, 75% DF): 2-[[[(4-methoxy-6-methyl- 1, 3, 5-triazin-2-yl) methyl amino] carbonyl] amino] sylfonyl] benzoate. at the rate of 6.0 g a.i./fed. applied at 21 days after sowing.
5- Granstar (tribenuron- methyl, 75% DF) at the rate of 4.5 g a.i./fed.+ urea at the rate of 4.7 kg/fed. applied at 21 days after sowing.
6- Granstar (tribenuron- methyl, 75% DF) at the rate of 3.0 g a.i./fed.,+ urea at the rate of 4.7 kg/fed. applied at 21 days after sowing.
7- Panther (isoproturon, 50% + diflufenican 5% SC): 2, 4- difluoro-2- (ααα-trifluoro-m- tolyloxy) nicotinanilide. at the rate of 300g a.i./fed. applied at 28 days after sowing.
8- Panther (isoproturon, 50% + diflufenican 5% SC) at the rate of 244.5g a.i./fed.+ urea at the rate of 4.7 kg/fed. applied at 28 days after sowing.
9- Panther (isoproturon, 50% + diflufenican 5% SC) at the rate of 165.5g a.i./fed.+ urea at the rate of 4.7 kg/fed. applied at 28 days after sowing.
10- Hand weeding twice (carried out at 35 and 55 days after sowing) + urea at the rate of 4.7 kg/fed., applied at 21 days after sowing.
11- Control (untreated).

Herbicides + Urea in both field experiments were sprayed by Knapsack spryer CP_3 with water volume of 200 liters/fed. All agronomic practices in wheat such as land preparation, fertilization and irrigation were done as recommended during the two seasons of study.

The collected data were recorded as follows:

On weeds:

Weeds were hand pulled at random from one square meter from each plot after 60 and 90 days from sowing and classified into three categories (broad- leaved, grassy and total weeds). The fresh weight of each species was estimated as (g/m^2). Weed control was evaluated in the form of percent reduction (%R) in the fresh weight of each individual species of weeds as well as the total weeds. Percent of reduction (%R) was calculated according to Topps and Wain(1957)formula as following:% R = (A- B)/A× 100

Where: A= the fresh weight of weeds in untreated plot.
B= the fresh weight of weeds in entreated plot.

Chlorophyll and carotenoid contents:

Determination of photosynthetic pigments (chlorophyll a, b and carotenoids) were carried out on the fresh material of the leaves of wheat in the two successive samples 21 and 35 days after application. The leaves were extracted with dimethylformamide to determine both to total chlorophylls and carotenoids spectrophotometerically (Nornai, 1982).

Chemical composition of wheat grains:

Determination of total nitrogen, phosphorus and potassium were carried out on the ground dry material. The samples were digested in a mixture of sulfuric acid, salicylic acid and hydrogen peroxide according to Linder (1944). Total nitrogen content was estimated by Kjeldahl method (Rangnna, 1979). Phosphorus and Potassium percentages in grains were determined according to Cottenie *et al.* (1982). Total carbohydrates were

hydrolyzed using 1N sulphuric acid and determined spectrophotometerically according to Dubois *et al.* (1956).

Wheat growth characters and yield components:

At harvest, samples of 10 wheat plants were randomly collected from each plot to study the following characters: Plant height (cm), spike length (cm), weight of grains/spike and number of grains/spike. The straw yield (ton/fed) and grain yield (ard/fed) were determined at harvest from yield of the whole plot.

Statistical analysis:

The obtained data were subjected to proper statistical analysis of variance according to Snedecor and Cochran (1980) and the least significant differences (LSD) at 5% level of significance were calculated. Correlation coefficients between of studied characters were computed according to the procedure outlined by Gomez and Gomez (1984) using Statistical Analysis System (SAS) version, 9. 1, 2002.

RESULTS AND DISCUSSION

Effect of mixed urea with weed control treatments :

On weeds :-

The most dominant weeds accompanied with wheat plants were; common bishops weed (*Ammi majus*), burclover (*Medicago hispida Gaerth.*), chicory (*Cichorium endivia* L.), annual sowthistle (*Sonchus oleraceus* L.) and annual yellow sweetclover (*Melilotus indica* L.) as broad-leaved weeds and ryegrass (*Lolium temulentum* L.), littleseed canarygrass (*Phalaris minor Retz.*) and wild oat (*Avena spp.)* as grassy weeds in both growing seasons.

Table 2 shows means of fresh weight of broad-leaved, grassy and total annual weeds of the two weed surveys as affected by different herbicides alone or mixed with urea compared with the control treatment in both seasons. At the first survey, all tested treatments either alone or mixed with urea significantly reduced the fresh weight of annual weeds compared with control treatment. Clodinafop propargyl herbicide decreased the fresh weight of grassy weeds. Similar results agreement with Mekky *et al*., (2010), tribenuron-methyl decreased the fresh weight of broad-leaved weeds while, (isoproturon + diflufenican) decreased the fresh weight of total annual weeds. Hand weeding treatment as well as foliar application of (isoproturon + diflufenican), tribenuron-methyl and clodinafop propargyl each alone at high rate gave higher efficiency in controlling annual weeds (93.6, 93.6, 68.0 and 45.9%). Moreover, isoproturon, tribenuron-methyl and clodinafop propargyl at moderate rate mixed with 1% urea showed good control of annual weeds (90.2, 65.9 and 44.5 %).

On the contrary, the same herbicides at low rate mixed with 1% urea gave the less effective control of total annual weeds (59.4, 43.5 and 41.0%) compared with the other treatments.

Table 2: Effect of weed control treatments alone or mixed with urea on fresh weight of annual weeds (g/m2) after 60 and 90 days from wheat sowing in 2008/2009 and 2009/2010 seasons.

Treatments	Rate (a.i. g/fed.)	60 days after sowing			90 days after sowing		
		Broad-leaved weeds g/m2	Grassy weeds g/m2	Total weeds g/m2	Broad-leaved weeds g/m2	Grassy weeds g/m2	Total weeds g/m2
		2008/2009					
Clodinafop propargyl	21.0	1052.3	3.4	1057.7	2104.4	6.9	2111.3
Clodinafop + urea	15.75+1%	1073.5	10.7	1084.2	2146.7	20.4	2167.1
Clodinafop + urea	10.5+1%	1092.6	49.8	1152.4	2184.8	98.6	2283.4
Tribenuron-methyl	6.0	9.7	614.6	624.3	18.5	938.5	957.0
Tribenuron + urea	4.5+1%	35.4	630.2	665.6	60.7	985.2	1045.9
Tribenuron + urea	3.0+1%	71.6	731.5	1103.1	112.2	1362.8	1485.0
Isoproturon	330	59.2	65.6	124.8	92.6	142.6	235.2
Isoproturon + urea	244.5+1%	92.6	99.7	192.3	134.9	190.7	325.6
Isoproturon + urea	165.5+1%	355.8	432.5	798.3	497.8	604.4	1102.2
Hand weeding + urea	Twice+1%	79.3	46.3	125.6	158.4	86.6	245.0
Control	-	1086.4	867.4	1953.8	2172.4	2926.7	5099.1
LSD at 5%		36.6	41.7	49.1	46.2	52.1	62.4
		2009/2010					
Clodinafop propargyl	21.0	1150.9	7.8	1158.7	2168.9	23.7	2192.6
Clodinafop + urea	15.75+1%	1188.6	41.9	1230.5	2193.8	76.6	2270.4
Clodinafop + urea	10.5+1%	1409.7	107.2	1516.9	2231.2	153.4	2384.6
Tribenuron-methyl	6.0	22.4	742.7	765.1	53.7	1462.8	1016.5
Tribenuron + urea	4.5+1%	73.5	778.4	851.9	92.9	1503.5	1596.4
Tribenuron + urea	3.0+1%	148.1	921.6	1069.7	192.4	1833.2	2025.6
Isoproturon	330	156.8	257.5	414.3	112.6	343.7	476.3
Isoproturon + urea	244.5+1%	195.3	292.6	487.9	174.8	392.2	367.0
Isoproturon + urea	165.5+1%	389.6	484.2	873.8	452.7	512.6	965.3
Hand weeding + urea	Twice+1%	103.5	156.8	260.3	192.4	137.8	366.2
Control	-	1836.3	1212.3	3048.6	2642.5	2213.3	4855.8
LSD at 5%		46.3	45.1	51.0	44.3	56.4	59.6

At the second survey, the same trend for controlling total annual weeds was observed. Hand weeding treatment, (isoproturon + diflufenican), tribenuron-methyl and clodinafop propargyl each applied alone at high rate as post-emergence reduced the fresh weight of total annual weeds 95.2, 95.4, 81.2 and 58.6 % in the first season and 92.5, 90.2, 79.1 and 54.8 % in the second season compared with the other tested treatments. The same herbicides at moderate rate mixed with 1% urea proved to be effective against total annual weeds in wheat fields. The superiority of these treatments in controlling weeds may be due to that urea had capacity to give synergistic herbicidal effects with herbicides used as reflected by the higher reduction in weed growth. These results were in agreement with the results of (Metwally and Hassan 2001) and metosulam (Nagla Al-Ashkar, 1998) and clodinalop propargyl (Mekky *et al*., 2010)

On chlorophyll and carotenoid contents:-

Data in Table 3 show that isoproturon, tribenuron-methyl and clodinafop propargyl applied alone at high rate caused a great reduction in chlorophyll a, b and total chlorophyll contents.

Table 3: Effect of some herbicides alone or mixed with urea on chlorophyll and carotenoids contents (mg/g*) fresh weight of wheat leaves after 21 and 35 days from application in 2008/2009 and 2009/2010 seasons.

Treatments	Rate (a.i. /fed)	21 days				35 days			
		Ch.a	Ch.b	T. ch	Caro.	Ch.a	Ch.b	T. ch	Caro.
		2008/2009							
Clodinafop propargyl	21.0	1.35	0.461	1.81	0.111	1.59	0.503	2.09	0.117
Clodinafop + urea	15.75+1%	1.47	0.476	1.95	0.098	1.69	0.515	2.21	0.098
Clodinafop + urea	10.5+1%	1.61	0.492	2.10	0.071	1.86	0.538	2.40	0.089
Tribenuron-methyl	6.0	1.11	0.399	1.51	0.134	1.45	0.478	1.93	0.157
Tribenuron+ urea	4.5+1%	1.32	0.411	1.73	0.113	1.56	0.499	2.09	0.126
Tribenuron+ urea	3.0+1%	1.57	0.447	2.02	0.079	1.81	0.533	2.34	0.088
Isoproturon	330	1.08	0.379	1.46	0.136	1.41	0.431	1.84	0.169
Isoproturon+ urea	244.5+1%	1.20	0.401	1.60	0.121	1.53	0.443	1.97	0.149
Isoproturon+ urea	165.5+1%	1.45	0.493	1.98	0.091	1.66	0.512	2.17	0.108
Control		2.03	0.651	2.68	0.054	2.10	0.705	2.81	0.073
LSD at 5%		0.127	0.016	0.164	0.010	0.134	0.023	0.213	0.030
		2009/2010							
Clodinafop propargyl	21.0	1.31	0.463	1.77	0.118	1.53	0.492	2.02	0.113
Clodinafop + urea	15.75+1%	1.42	0.472	1.89	0.105	1.65	0.512	2.16	0.086
Clodinafop + urea	10.5+1%	1.65	0.499	2.15	0.093	1.76	0.548	2.31	0.075
Tribenuron-methyl	6.0	1.19	0.353	1.54	0.131	1.41	0.408	1.82	0.145
Tribenuron+ urea	4.5+1%	1.36	0.383	1.74	0.116	1.54	0.425	1.97	0.121
Tribenuron+ urea	3.0+1%	1.57	0.420	1.99	0.104	1.79	0.478	2.27	0.077
Isoproturon	330	1.09	0.314	1.40	0.157	1.36	0.426	1.79	0.152
Isoproturon+ urea	244.5+1%	1.29	0.364	1.65	0.120	1.49	0.437	1.93	0.131
Isoproturon+ urea	165.5+1%	1.62	0.486	2.11	0.096	1.58	0.496	2.08	0.095
Control		2.19	0.614	2.80	0.036	2.02	0.708	2.73	0.063
LSD at 5%		0.182	0.011	0.196	0.017	0.115	0.010	0.178	0.036

Mg/g = Weight of chlorophyll determined by mg per gm of leaves of wheat plants.
Ch = Chlorophyll Caro = Carotenoids

At 21 days after chlorophyll a was decreased by (46.8, 45.3 and 33.5%) for wheat plants treated by (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl at high rate alone. the same herbicides at moderate rate mixed 1% urea (40.9, 35.1 and 27.6 %), while, the same herbicides at low rate mixed with 1% urea recorded (26.6, 22.7 and 20.7%), respectively in the first season.

As for chlorophyll b content, data observed that chl b was decreased by (41.8, 38.7 and 29.2 %) for wheat plants treated by (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl at high rate alone. The same herbicides at moderate rate mixed 1% urea recorded (38.4, 36.9 and 26.9 %). While, the same herbicides at low rate mixed 1% urea recorded

(24.3, 31.3 and 24.4%) in 2008/2009 season, respectively. Generally, the same trend was showed for total chlorophyll in the second time (35 days after application) and second season. Also, the results tabulated revealed that chl a was more sensitive to the herbicides than chl b in the leaves of wheat plants.

Regarding carotene content, data indicated that (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl alone at high dose caused increase in carotene content as compared to healthy plants (control treatment). At 21 days after application, wheat plants treated with (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl at high rate mixed 1% urea increased carotene by (60.3, 59.7 and 51.4 %). The same herbicides at moderate rate mixed 1% urea increased carotene by (55.4, 52.2 and 44.9%). While, the same herbicides at low rate mixed 1% urea increased carotene by (40.7, 31.7 and 24.1 %) in the first season, respectively. The same trend was presented at 35 days after application and the second season with slight differences. Similar results had bean reported by Whichtman and Haynes(1985) and; Khalil and Gobarh (2001) and Mekky *et al*., (2010).

On wheat yield components :-

Data presented in Table 4 all tested treatments alone or mixed with urea increased significantly wheat plants hight than untreated check treatment. Hand weeding, (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl alone at high rate as well as the same herbicides at moderate rate mixed with 1% urea gave the high values and significant increased the plant height of wheat at harvest in both seasons, respectively. All herbicidal treatments at low rate were significantly lower than the other treatments. The reduction in plant height under the control treatment could be attributed to the negative effects of weeds on crop growth which may be occurred as a result of the competition between wheat and weed plants.

Concerning spike length data in Table 4 show that spike length is significantly affected by all treatments at harvest during the two growing seasons. In general, all tested treatments significantly surpassed control treatment. Spike length ranged from 7.3 to 13.1 cm. The highest spike length was obtained by (isoproturon + diflufencan), tribenuron-methyl, clodinafop propargyl alone at high rate and hand weeding. While, spraying the same herbicides at moderate rate mixed with 1% urea were statistically equal to the hand weeding treatment. The rest herbicidal treatments gave significantly shorter spike length than the hand weeding treatments. These results are similar to those obtained by El-Desoki *et al.* (1993) and; Metwally and Hassan (2001).

Data recorded in Table 4 revealed significant differences between treatments in number and weight of grains/spike at harvest in both growing seasons. Generally, all treatments alone or mixed with urea significantly increased number and weight of grains/spike compared to control treatment. The highest value of number and weight of grain/spike was obtained from (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl alone at high rate as well as hand weeding treatment. This, could be attributed to

the higher weed control efficiency (Table 1). On the other side, the lowest number and weight of grains/spike was obtained from control treatment. This might be due to weed competition which caused decrease number and weight of grain/spike. While, the herbicides at low rate mixed with 1% urea were significantly less than the rest other treatments. Similar results were reported by Nagla Al-Ashkar (1998), Metwally *et al.* (1999) and; Metwally and Hassan (2001).

Table 4: Effect of weed control treatments alone or mixed with urea on wheat yield components at harvest in 2008/2009 and 2009/2010 seasons.

Treatments	Rate (a.i/fed)	Plant height (cm)	Spike length (cm)	Wt. of grains spike (g)	No. grains/ spike
		2008/2009			
Clodinafop propargyl	21.0	109.3	12.9	2.1	49.4
Clodinafop + urea	15.75+1%	103.6	9.8	2.5	44.9
Clodinafop + urea	10.5+1%	95.4	8.8	1.2	39.0
Tribenuron-methyl	6.0	111.8	13.1	3.0	58.8
Tribenuron + urea	4.5+1%	104.6	9.9	2.6	43.9
Tribenuron + urea	3.0+1%	96.2	7.9	1.2	35.1
Isoproturon	330	114.5	13.02	3.1	50.2
Isoproturon + urea	244.5+1%	110.4	11.60	2.9	46.0
Isoproturon + urea	165.5+1%	102.3	9.5	1.6	37.9
Hand weeding + urea	Twice+1%	112.6	12.2	2.8	48.0
Control	-	81.4	7.3	0.7	24.18
LSD at 5%		4.68	2.37	1.25	5.74
		2009/2010			
Clodinafop propargyl	21.0	105.7	12.4	2.9	48.8
Clodinafop + urea	15.75+1%	99.3	10.3	2.4	40.4
Clodinafop + urea	10.5+1%	88.6	8.2	1.3	38.3
Tribenuron-methyl	6.0	106.5	12.6	2.9	52.4
Tribenuron + urea	4.5+1%	100.4	10.4	2.3	41.5
Tribenuron + urea	3.0+1%	91.6	7.7	1.4	30.5
Isoproturon	330	109.2	12.8	2.8	51.6
Isoproturon + urea	244.5+1%	101.4	12.1	2.1	45.1
Isoproturon + urea	165.5+1%	89.3	9.6	1.5	37.4
Hand weeding + urea	Twice+1%	107.7	11.7	2.3	42.4
Control	-	82.8	7.1	0.7	21.7
LSD at 5%		4.59	2.01	1.36	5.27

On wheat yield :

Data in Table (5) show that all treatments significantly produced higher straw yield (ton//fed) than control treatment. The highest straw yield/fed was obtained from (isoproturon + diflufencan), tribenuron-methyl and clodinafop propargyl single at high rate as well as hand weeding treatment and mixing of 1% urea with the same herbicides at moderate rate, respectively, compared to the herbicidal treatments at low rate and control treatment. Such superiority might be due to the increase in plant height at harvest as a result of better weed control in two seasons. In contrast, the lowest straw yield/fed was obtained from control treatment. Similar results

were obtained by Metwally *et al.* (1999) and; Metwally and Hassan (2001) who reported that post-emergence application of isoproturon or metosulam as well as hand weeding treatment increased the straw yield in wheat compared with the other treatments used.

Table 5: Effect of weed control treatments alone or mixed with urea on wheat yield at harvest in 2008/2009 and 2009/2010 seasons.

Treatments	Rate (a.i / fed)	Straw yield (ton/fed)	Grain yield (Ard./fed)	Straw yield (ton/fed)	Grain yield (Ard./fed)
		2008 / 2009		2009 / 2010	
Clodinafop propargyl	21.0	4.82	16.72	4.72	16.96
Clodinafop + urea	15.75+1%	4.41	15.92	4.10	15.0
Clodinafop + urea	10.5+1%	3.16	12.56	3.18	12.24
Tribenuron-methyl	6.0	4.99	17.88	4.86	17.52
Tribenuron + urea	4.5+1%	4.13	15.56	4.11	15.28
Tribenuron + urea	3.0+1%	3.11	12.88	3.17	12.0
Isoproturon	330	4.94	18.80	4.87	18.44
Isoproturon + urea	244.5+1%	4.19	17.16	4.13	17.02
Isoproturon + urea	165.5+1%	3.49	13.08	3.16	13.16
Hand weeding + urea	Twice+1%	4.76	17.46	4.59	16.48
Control	-	1.92	8.33	1.88	8.74
LSD at 5%		0.97	2.69	0.81	2.04

Data presented in Table 5 showed that grain yield (arrd./fed) was affected by different weed control treatments during two growing seasons. All treatments alone or in combination with urea significantly exceeded the control treatment in grain yield/fed. It is evident that, the best treatments were (isoproturon + diflufencan) at 33g a.i/fed, tribenuron-methyl at 6.0g a.i/fed, clodinafop propargyl at 21g a.i/fed alone as well as hand weeding treatment, respectively. Also, (isoproturon + diflufencan) at 244.5g a.i/fed, tribenuron-methyl at 4.5g a.i/fed, clodinafop propargyl at 15.75g a.i/fed mixed with 1% urea. These treatments significantly increased grain yield/fed about 55.69, 53.41, 50.18, 52.29, 54.02, 46.46 and 47.68 % in the first season over the control treatment, respectively, the same trend was presented in second season. These increases might be mainly due to only the higher weed control efficiency for the previous treatment (Table 1), but also to their significant effects in raising grain yield per unit area and its related components such as spike length, number of grain/spike and weight of grain/spike leading to the higher grain yield/fed. On the other hand, the same herbicides at low rate mixed 1% urea gave significantly lower increase in grain yield/fed than the other treatments used. While the lowest grain yield/fed was obtained from control treatment. This drop in grain yield/fed was obtained from control treatment might be attributed to the reduction in the values of growth characters, which occurred as a result of the competition between wheat and weed plants for the essential environmental resources i.e., light, water and nutrients. These results are in harmony with those obtained by Pandey and Singh (1994) showed that tank mixing of urea with isoproturon increased wheat grain yields over herbicide alone. Nagla Al-

Ashkar (1998), Metwally *et al.* (1999), Metwally and Hassan (2001) and Khaffagy(2004) who reported that hand weeding treatment as well as foliar application of isoproturon or metosulam gave the highest grain yield of wheat compared to the other herbicidal treatments used.

On nutrient uptake:

Data in table 6 show that the uptake of N,P,K (kg/fed) in wheat grain yield was higher and significant with all weed control treatment as compared with unweeded check. These results were true as an average of the two seasons. The highst percentages were obtained from hand weeding treatment, isoproturon, tribenuron-methyl and clodinafop propargyl either the recomend and moderate rates. These superiorities are attributed to the increases in N P K % in wheat grain yield in one side and minimizing weed competition which in turn increased the availability of these elements to wheat plants uptake as compared with wheat plants which accompanied with weeds which share these plants in nutrient uptake. These results are confirmed with the correlation study which show negative effects of weeds on wheat yield. Similar results were obtained by Varsheney and Singh (1990) they found that isoproturon and hand weeding twice reduced uptake of P and K by weeds by 54 – 60 %

Table 6: Effect of weed control treatments alone or mixed with urea on NPK and carbohydrate percentage and uptake (kg/fed) in wheat grains. (Average of 2008/2009 and 2009/2010 seasons).

Treatments	Rate (a.i. g /fed)	N %	P %	K %	Absolute amount kg/fed			Total carboh-ydrate %
					N	P	K	
Clodinafop propargyl	140.0	2.01	0.322	0.613	50.41	8.08	15.37	72.86
Clodinafop + urea	90+1%	1.97	0.286	0.575	41.75	6.83	13.73	71.78
Clodinafop + urea	70+1%	1.80	0.248	0.529	34.16	4.71	10.04	63.22
Tribenuron-methyl	8.0	2.05	0.319	0.611	54.98	8.56	16.39	73.20
Tribenuron + urea	6+1%	1.94	0.279	0.569	45.28	7.45	13.28	70.16
Tribenuron + urea	4+1%	1.83	0.236	0.515	35.36	4.56	9.95	59.54
Isoproturon	0.6	2.06	0.299	0.585	58.09	8.43	16.50	72.44
Isoproturon + urea	0.4+1%	1.95	0.294	0.578	50.19	7.57	14.88	69.31
Isoproturon + urea	0.3+1%	1.77	0.353	0.518	34.73	4.96	10.16	53.01
Hand weeding + urea	Twice+1%	2.12	0.358	0.622	55.52	9.38	16.29	73.83
Control	-	1.33	0.142	0.233	17.39	1.86	3.05	48.28

Regarding percentage of total carbohydrate in wheat grains, Data showed that all treatments increased total carbohydrates when compared with the control treatment. the higher values (73.83, 73.2, 72.86 and 72.44 %) were obtained by hand weeding treatment, tribenuron-methyl, clodinafop propargyl and (isoproturon + diflufencan) alone at high rate, respectively. This may be due to effective control of weeds (Table 1). In contrast, the lowest value (53.28%) was observed with control treatment. Similar results were obtained by Metwally and Hassan (2001) and; Khaffagy (2004).

Correlation between all studied characters and wheat grain yield:

Data presented in Tables 7 indicated clearly that correlation between fresh weight of grasses and broad- leaved weed species and wheat grain yield was statistically significant and negative at 5% level very strong with grassy weeds (- 0.643 and – 0.772) than with broad-leaved weeds (- 0.597 and – 0.602) in 2008/2009 and 2009/2010 seasons, respectively. This mean that grassy weeds were more aggressive in their competition to wheat than broad-leaved weeds. Correlation between fresh weight of total annual weeds and weight grain yield recorded the highest value, where vit negatively affected wheat grain yield by (- 0.869 and – 0.879) at 5% level in the two sowing seasons, respectively. Similar results were reported by Hassanein *et al*., (1999).

Table 7: Correlation coefficient between all studied characters and wheat grain yield in 2008/2009 and 2009/2010 seasons.

studied characters	Fresh weight of grassy weeds g/m2	Fresh weight of total weeds g/m2	Plant height cm	Spike length cm	No. grains/spike	Weight of grains/spike g	Straw yield T./fed	Grain yield/ Ard./fed
Fresh weight of broad-leaved weeds g/m2	0.156	0.614*	- 0.130	- 0.104*	- 0.396*	- 0.531*	- 0.445*	- 0.597*
Fresh weight of grassy weeds g/m2		0.812*	- 0.156	- 0.213*	- 0.515*	- 0.611*	- 0.572*	- 0.643*
Fresh weight of total weeds g/m2			- 0.167*	- 0.592*	- 0.666*	- 0.841*	- 0.729*	- 0.869*
Plant height cm				- 0062	- 0136*	- 0278*	- 0217*	- 0.201*
Spike length cm					0.801*	0.641*	0.571*	0.589*
No. grains/spike						0.843*	0.752*	0.711*
Weight of grains/spike g							0.764*	0.836*
Straw yield ton/fed								0.867*
2009/2010 season								
Fresh weight of broad-leaved weeds g/m2	0.192	0.701*	- 0.233*	- 0.146*	- 0.417*	- 0.620*	- 0.556*	- 0.602*
Fresh weight of grassy weeds g/m2		0.841*	- 0.364	- 0.357*	- 0.601*	- 0.645*	- 0.594*	- 0.772*
Fresh weight of total weeds g/m2			- 421*	- 0.618*	- 0.614*	- 0.792*	- 0.821*	- 0.879*
Plant height cm				- 0134	- 0.242*	- 0351*	- 0.278*	- 0.209*
Spike length cm					0.831*	0.672*	0.601*	0.576*
No. grains/spike						0.816*	0.773*	0.721*
Weight of grains/spike g							0.749*	0.801*
Straw yield ton/fed								0.846*

*** Significant at 5% level of probability**

Also, correlation analysis revealed that the yield increases due to type of weed competition were positively contributed to the increases in spike length, number of grain/spike and weight of grain/spike. Theseresults are in harmony with those obtained by Abd El-Hamid and El-Khanagry (2006). The

correlations between total weeds and wheat grain yield, spike length, number of grain/spike and weight of grain/spike were highly statistically significant. Hassanein *et al*., (1999) reported that polynominal regression was negative between weed density and yield and number of spikes/m2. Hence, weed control play a major role in increasing wheat productivity per unit urea, if applied at the suitable time, rate and stage of weed growth.

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تـأثير مبيـدات الحشـائش واليوريـا كمـادة منشـطة علـى القمـح وامتصـاص العناصـر الكبرى وصبغات التمثيل الضوئى والحشائش المصاحبة له.

إبراهيم السيد سليمان ، جلال محمد عبد الحميد و أشرف محمد فضل الله
المعمل المركزى لبحوث الحشائش- مركز البحوث الزراعية- الجيزة- مصر

أجريـت تجربتـان حقليتـان بمحطـة البحـوث الزراعيـة بسـخا- كفرالشـيخ خـلال موسـمى الزراعـة٢٠٠٨/٢٠٠٩ و٢٠٠٩/٢٠١٠م لدراسـة تـأثير مبيـدات الحشـائش (ايزوبروتـورون + دايفلوفيكـان، ترايبنورون-ميثايل، كلودينافوب بروبارجل) واليوريا كمادة منشطة على القمح وامتصاص العناصر الكبرى وصبغات التمثيل الضوئى والحشائش المصاحبه له بالإضافة إلى معاملة النقاوة اليدوية مرتين

وقد أظهرت النتائج ما يلى :

- استخدام مبيدات الحشائش (ايزوبروتورون + دايفلوفيكان،٣٠٠جرام مادة فعالة /ف، ترابينورون ٦ جرام مادة فعالة/ف، كلودينافوب بروبارجل٢١ جرام مادة فعالة/ف) بالمعدلات الموصى بها بصورة منفردة بعد الإنبات وكذلك معاملة النقاوة اليدوية أعطت مكافحة ممتازة للحشائش الحولية المصاحبة لنباتات القمح فى كلا موسمى الزراعة. إضافة اليوريا بتركيز ١% إلى المعدلات المتوسطة (م٣/ فدان المعدل الموصى به) لنفس المبيدات سالفة الذكر أدى إلى زيادة فعالية المبيدات فى مكافحة الحشائش حيث أعطت تلك المعاملات نتائج جيدة بدون أى فروق معنوية واضحة بينها وبين المعدلات الموصى بها حيث أعطت نسبة إبادة للحشائش حوالى ٩٣,٦، ٦٨,٠، ٤٥,٩ ، ٩٣,٦، ٩٠,٢ ، ٦٥,٩، ٤٤,٥ % على التوالى. كذلك أظهرت معاملة إضافة اليوريا بتركيز ١% إلى المعدلات المنخفضة (م٢/١ فدان المعدل الموصى به) لنفس المبيدات السابقة مكافحة متوسطة للحشائش حيث أعطت تلك المعاملات نسبة مكافحة قدرها ٥٩,١ ، ٤٣,٥ و٤١,٠ % فقط على التوالى.
- أظهـرت معاملـة النقـاوة اليدويـة وكـذلك مبيـدات الحشـائش (ايزوبروتـورون، ترايبنـورون-ميثايـل وكلودينافوب بروبارجل) سواء بصورة منفردة أو مع اليوريا بعد الانبثاق تفوقاً كبيراً فى تحسين نمو القمح وزيادة جودة محصول الحبوب ومكوناته مقارنة بالمعاملات الأخرى.
- أعطت معاملة النقاوة اليدوية ومبيدات الحشائش سواء استخدمت بالمعدلات الموصى بها أو المعدلات المتوسطة مختلطة باليوريا زيادة ملحوظة فى نسبة البروتين والفوسفور والبوتاسيوم والكربوهيدرات فى حبوب القمح مقارنة بالمعاملات الأخرى والكنترول.
- تناقص محتوى كلوروفيل أ، ب والكلوروفيل الكلى فى أوراق نباتات القمح قليلا بعد المعاملة بمبيدات الحشـائش بالمعـدلات الموصـى بهـا بصـورة منفـردة. بينمـا زاد هـذا المحتـوى بالمعـاملات المتوسـطة والمنخفضة للمبيدات بعد إضافة اليوريا بتركيز ١%. من ناحية أخرى ظهرت هذه التركيزات عكسية على محتوى النباتات من الكاروتينات.
- أظهـر تحليـل الارتبـاط أن الـوزن الرطـب للحشـائش الكليـة وضـيقة الأوراق وعريضـة الأوراق يـرتبط ارتباطا سلبيا مع محصول الحبوب. كما ارتبط محصول الحبوب ارتباطا ايجابيا مع كل من طول السنبلة ، ووزن السنيبلات فى السنبلة وعدد السنيبلات فى السنبلة. كذلك اوضح تحليل الارتباط أن الحشائش الضيقة الأوراق كانت أكثر تأثيرا فى قدرتها التنافسية من حيث خفض محصول الحبوب ومكوناته مقارنة بالقدرة التنافسية للحشائش عريضة الأوراق. لذا فان مكافحة الحشائش تلعب دورا كبيرا فى رفع انتاجية الفدان من محصول القمح .
- لهذا توصى هذه الدراسة بإمكانية مكافحة الحشائش فى حقول القمح بمبيدات الحشائش (ايزوبروتورون + دايفلوفيكان، لمكافحة الحشائش الحولية، ترايبنورون-ميثايل لمكافحة الحشائش العريضة، كلودينافوب بروبارجل لمكافحة الحشائش النجيلية) بـ م٣/ فدان المعدل الموصى به مع إضافة اليوريا بتركيز ١% الى محلول الرش حيث أعطت مكافحة جيدة للحشائش وزيادة في تحسين خواص وانتاجية محصول القمح. حيث كان الفرق بين هذه المعدلات و المعدلات الموصى بها بصورة منفردة غير معنوياً سواء فى مكافحة الحشائش أو انتاجية محصول القمح.

قام بتحكيم البحث

أ.د / سعد احمد المرسى	**كلية الزراعة – جامعة المنصورة**
أ.د / زكريا الرفاعى يحى	**مركز البحوث الزراعية**

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