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EFFECT OF WEED CONTROL ON WEEDS, CEREAL APHIDS, NATURAL ENEMIES AND GRAIN YIELD OF WHEAT.

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ABSTRACT

Two field experiments were conducted in sandy soil at Ismailia Agricultural Research Station during two successive winter seasons 2000/01 and 2001/02 to study the effect of some weed control treatments on the fresh weight of weeds (g/m^2), grain yield of wheat (ardab/fed.) and seek out herbicides bi-effects on cereal aphids and their natural enemies. All weed control treatments significantly reduced the fresh weight of weeds and increased wheat grain yield. Bromoxynil at the rate of 1.0 L/fed gave the highest reduction percentage in fresh weight of weeds by 94% & 93.2% and increased wheat grain yield by 78 & 102.9% in the first and second season, respectively as compared with untreated check. From IPM point of view, hand weeding was suitable weed management, since they share in conserving natural enemies population. Clodinafop- propargyl at the rate of 140 g/fed. as grassy weeds herbicide and bromoxynil as broad leaved weeds herbicide treatments being effective seemed acceptable where they owed little harm effects regarding suppression of natural enemies, hence they might be safety incorporated in IPM programs.

INTRODUCTION

Weeds associated with wheat may adversely affect and reduce both quantity and quality of wheat grain yield and cause many harvesting problems. They are regularly controlled through hand weeding, tillage and specific herbicides. The conventional-herbicides, however, being hard chemicals, may have an impact on cereal aphids infesting wheat and their accompanied natural enemies. Besides, weeds themselves were investigated as alternative shelters for cereal aphids and their native natural enemies, especially predators and parasitoids. The organic farming does not expect entirely clean fields but sees the farm as an ecological system that has a diversity of plants, where the crop is the dominant species. The techniques used to control weeds focus on giving the crop a head start rather than eliminating all weed species. Patriquin (1989). Integrated weed management, however, makes use of a combination of different agronomic practices to manage weeds, so that the reliance on any one weed control technique is reduced. This means that these tools will be effective for the future use. The object of integrated weed management is to maintain weed densities at manageable levels while preventing shifts in weed populations to more difficult-to-control weeds. Herbicides can also affect both beneficial and pest insects. In some cases insect population increase, and in others they are not affected. The effects can be directly toxic, with herbicides applied during ovipositing or early larval development of the natural enemy. They can also

be indirect, as with the populations of the predators or parasitoids that feed on a previously treated pest populations. There is however, evidence that small insects like Aphids and Thrips are increased after herbicides applications, probably because of existence of fewer predators in the area, Messersmith and Adkins (1995). Wheat crop plants in Egypt, on the other hand, are liable to be accompanied with harmful weeds. Circumstances that favor wheat growth are suitable for many weeds, which are capable for giving large amounts of seeds that stay viable in the soil for long times. However, there are more than sixty weed species in wheat fields in Egypt, Hassanein, *et al.* (2000). The number may differ owing to soil type, irrigation scheme, temperature, crop rotation, etc. On the other hand, weeds are serving as alternative hosts for cereal aphids that attack wheat plantations. *Avena fatua, Cynodon dactylon; Echinochloa colonum & Polypogon monspeliensis* are merely examples of aphid harboring weeds. Weeds also as a dense plant cover between wheat plants may affect aphids landing response and behavior in the area. So it was important to reveal out the role played by herbicides and other weed eliminating techniques on cereal aphid's abundance and their native natural enemies. The present investigation aimed to study the effect of some weed control treatments on the fresh weight of weeds (g/m^2), grain yield of wheat (ardab/fed.) and seek out herbicides bi-effects on cereal aphids infested wheat plants and aphid predators.

MATERIALS AND METHODS

Herbicide bi-impacts on cereal aphids infested wheat plants *Triticum aseativum* L.) and their native predators and parasitoids, as well as their effects on the fresh weight (g/m^2) of associated weeds and wheat grain yield (ardab/fed.) were investigated at Ismailia Agricultural Research Station for two successive growing winter seasons 2000/01 and 2001/02. Wheat variety Sids 1 seeds (50 kg/fed.) were sown on 3rd week of November in both seasons in rows 20 cm. apart and 5 cm. between seeds. Plot area was 10.5 m^2 (3x3.5m.). The soil type was sandy texture. Surface irrigation system were done. All other practices were applied as recommended for wheat production in the region.

First season (2000/01 season)

Twelve weed control treatments were conducted as follows:

1- Bromoxynil (Brominal 24% EC.) at the rate of 1.0 L/fed. at 2-3 leaf stage of wheat plants.
2- Tribenuron-methyl (Granstar 75% DF.) at the rate of 8 g/fed. after completely germination stage.
3- Bromoxynil (Pardner 22.5% EC.) at the rate of 1.0 L/fed. at 3-5 leaf stage.
4- Sulfamoy urea (Jupiter 10% WP.) at the rate of 100 g/fed. at 2-4 leaf stage.
5- Diclofop-methyl (Illoxan 36% EC.) at the rate of 1.0 L/fed. at 2-4 leaf stage.
6- Clodinafop- propargyl (Topik 15% WP.) at the rate of 140 g/fed. at 45 days after sowing.
7- Isoproturon (Arelon 50% FL.) at the rate of 1.25 L/fed at 2-4 leaf stage.
8- Isoproturon (Arina 39% FL.) at the rate of 1.35 L/fed. at 2-4 leaf stage.

9- Isoproturon (Swatt 50% SC.) at the rate of 1.25 L/fed. at 2-4 leaf stage.
10-Isoproturon (Proturon 50% SC.) at the rate of 1.25 L/fed. at 2-4 leaf stage.
11-Hand weeding twice at 30 and 45 days after sowing.
12-Untreated check. (weedy check).

Second season (2001/02 season)

Five weed control treatments were conducted as follows:
1-Tritosulfuron (Tarouk 71.4% WG.) at the rate of 20 g/fed. at 2-4 leaf stage.
2-Bromoxynil (Framinal 24% EC.). at the rate of 1.0 L/fed. at 3-5 leaf stage.
3-Bromoxynil (Brominal 24% EC.) at the rate of 1.0 L/fed. at 3-5 leaf stage.
4-Pyraflufen-ethyl (Ekopart 2% SC.) at the rate of 250 cc./fed. at 2-4 leaf stage.
5-Hand weeding twice at 30 and 45 days after sowing.
6-Untreated check (weedy check).

In both seasons two check treatments (hand weeding twice at 30 and 45 days after sowing and untreated check), were included for comparisons. Treatments were arranged in randomized block design with four replicates. All herbicidal treatments were sprayed with a knapsack sprayer at water volume of 200 L/fed. Weeds were hand pulled from one square meter chosen randomly from each plot at 60 days after sowing. Weeds were identified according to Tackholm (1974). The fresh weight (g/m^2) of weeds were extracted. At harvest time, all wheat plants of each plot area were harvested. The grain yield of each plot were weighted and compared as ardab/fed. Aphid populations and their relevant predators and parasitoids were evaluated on wheat plants through successive observations. Weekly regular counts were started on the 4^{th} week of December till end of each season. Sample unit was aphid numbers found on 20 tillers from 20 wheat plants/plot; predators numbers found on 20 plants/plot and parasitism percentage as number of mummies/100 aphid individuals. All the acquired data were statistically analyzed according to Snedecor and Cochran (1967). For comparison between means Duncan's multiple range test was applied (Duncan, 1955). Means followed by the same alphabetical letter(s) are not statistically different at the 0.05 level of significant.

RESULTS AND DISCUSSION

First season (2000/01 season)

I. Effect on aphids and natural enemies

The present data revealed that check plots (hand weeding twice and untreated) whereas there were no herbicide applications, received the lowest cereal aphid populations on wheat plants, and this in turn may reflect a reliable natural enemies establishments, Table 1. At the same time, predators populations were the highest at hand weeding twice treatment, untreated check and Topik (140 g/fed.) as grassy weed herbicide meaning that it is safer than other herbicides in conserving natural enemies populations. On the other hand, Brominal (1.0 L/fed.), Granstar (8 g/fed.) and Pardner (1.0 L/fed.) treatments gave higher aphid populations than the check (hand weeding twice and untreated) plots, exhibiting the negative effects upon natural

enemies. Hand weeding twice at 30 and 45 days after sowing, Brominal (1.0 L/fed.) and Illoxan (1.0 L/fed.) treatments were in the second rank after check plots in conserving natural enemies. Predators mean numbers being 17.67; 17.83 & 17.67, respectively. Table 1. The other tested herbicides, however, gave different natural enemies impact patterns.

Table 1: Mean numbers of cereal aphids and their native predators on wheat plants as affected by weed control treatments in 2000/01seasons.

Weed control treatments	Rate /fed.	Cereal Aphids	Predators*
Bromoxynil (Brominal 24% EC)	1 L	48.13 e	17.83 c
Tribenuron-methyl (Granstar 75% DF)	8 g	47.47 e	17.00 bc
Bromoxynil (Pardner 22.5% EC.)	1 L	47.47 e	13.67 a
Sulfamoy urea (Jupiter 10% WP)	100 g	43.80 d	14.67 ab
Diclofop-methyl (Illoxan 36% EC)	1 L	33.97 b	17.67 c
Clodinafop- propargyl (Topik 15% WP)	140 g	37.23 c	20.67 d
Isoproturon (Arelon 50% FL.)	1.25 L	34.21 cb	15.67 ab
Isoproturon (Arina 39% FL.)	1.35 L	34.93 cb	13.67 a
Isoproturon (Swatt 50% SC)	1.25 L	44.83 d	15.33 ab
Isoproturon (Proturon 50% SC)	1.25 L	45.73 ed	14.67 ab
Hand weeding (twice)		36.19 c	17.67 c
Untreated check		29.23 a	21.34 d

* **Predatory species were different morphs of *Coccinella undecimpunctata* L., *C. septempunctata* L. *Scymnus* spp.; *Syrphus* spp. and *Chrysoperla carnae* (Steph.).**

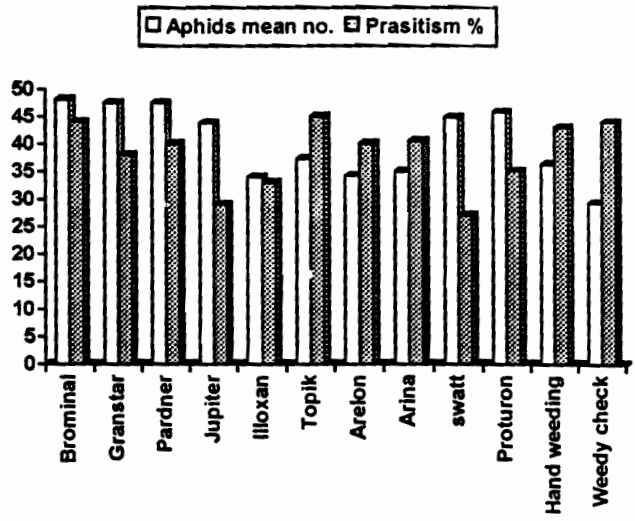

Fig. 1: Cereal aphids mean numbers and parasitism percentages on wheat plants as affected by weed control treatments in 2000/01 season.

Regarding parasitism percentage, Fig.1 shows that the highest negative impacts of herbicides was recorded among Swatt (1.25 L/fed) and Jupiter (100 g/fed) while, Topik (140 g/fed.) and Brominal (1.0 L/fed.) exhibited promising good results as hand weeding twice and untreated check plots. Parasitism percentages being 7.56; 9.5; 13.07; 12.03; 12.1 and 12.3, respectively.

II. Effect on weeds

As concern to weed control treatments, weed survey at 60 days after sowing showed that predominated weed species in both seasons were *Ammi majus, Anagallis arvensis, Brassica kaber, Emex spinosus Medicago polymorpha and Melilotus indica* as broad leaved weeds and *Avena fatua and Lolium multiflorum* as narrow leaved weeds. Data presented in Table 2 showed that all weed control treatments significantly reduced the fresh weight (g/m^2) of weeds compared with untreated check. Brominal (1.0 L/fed.), Granstar (8 g/fed.), Arelon (1.25 L/fed.) and Topik (140 g/fed.) gave the lowest fresh weight of weeds, respectively. The values of reduction percentage in fresh weight (g/m^2) due to the previous treatments were 94.0, 91.0, 86.3 and 84.6%, respectively, compared to untreated check. The superiority of Brominal, Granstar, Arelon and Topik in weed control may be attributed to the highly efficiency of these treatments against weeds. Saad and Omar (1991), reported that bromoxynil gave effective control in broad leaved weeds. Abd El-Samie (2001), found that Granstar at 8g/fed. and Arelon at 1.25 L/fed. were the most effective weed control treatments against weeds.

Table 2: Effect of weed control treatments on fresh weight of total weeds (g/m^2) and wheat grain yield (ardab/fed.) in 2000/01 season.

Weed control treatments	Rate /fed	Fresh weight of weeds (g/m^2)	Grain yield (ardab / fed.)
Bromoxynil (Brominal 24% EC.)	1 L	33.3 a	7.85 c
Tribenuron-methyl (Granstar 75% DF.)	8 g	49.88 ab	7.94 c
Bromoxynil (Pardner 22.5% EC.)	1 L	133.02 de	6.48 b
Sulfamoy urea (Jupiter 10% WP.)	100 g	110.85 cd	5.87 b
Diclofop-methyl (Illoxan 36% EC.)	1 L	111.41 cd	8.11 c
Clodinafop- propargyl (Topik 15% WP.)	140 g	85.36 bc	9.0c d
Isoproturon (Arelon 50% FL.)	1.25 L	75.93 bc	9.96 d
Isoproturon (Arina 39% FL.)	1.35 L	164.06 e	5.78 b
Isoproturon (Swatt 50% SC.)	1.25 L	148.54 de	7.76 c
Isoproturon (Proturon 50% SC.)	1.25 L	110.30 cd	8.69 c
Hand weeding (twice)		205.08 f	6.35 b
Untreated check		554.26 g	4.41 a

On the other hand, all weed control treatments significantly increased the grain yield of wheat (ardab/fed.) as compared with untreated check. Arelon, Topik, Proturon and Illoxan gave the highest grain yield of wheat. The

previous treatments gave 9.96, 9.0, 8.69 and 8.11 ardab/fed., respectively compared with untreated check being to 4.41 ardab/fed. The superiority of Arelon and Topik in wheat grain yield may be due to successful weed control of these treatments which decreased the competition of weeds to wheat plants on essential growth factors as water, nutrients and light and resulted the highest grain yield. Abd El-Hamid (1998), found that Arelon (1.25 L/fed.) gave significant increase in wheat grain yield as compared with weedy check. Moshtohry and Daie (2002), reported that Topik (140g/fed.) improved wheat grain yield by 77.8% as compared with unweeded check. From IPM point of view and dealing with wheat fields and accompanied weeds, cereal aphids and natural enemies as a small ecosystem, we should prefer hand weeding twice treatment as a safe conserving procedure for beneficial, then under higher narrow leaved weeds infestation, Topik is advised. Brominal and Granstar may be used under heavy infestations with broad-leaved weeds, Table 2.

Second season (2001/02 season)

I. Effect on aphids and natural enemies

Cereal aphids were at their lowest attitude among untreated check and hand weeding plots. In hand weeding plots, however, natural enemies have their chance for dropping off the picked-up weeds and hence to live and bringing aphid populations at lower figures. Aphid mean numbers and the corresponding predators at untreated check and hand weeding plots (in brackets) were 46.6 (32.67) & 48.1 (29.33), respectively, Table 3. The other four treatments shared in lessening predator numbers but they were insignificantly different. However, if the weed populations got higher, treatments of Brominal & Ekopart may be recommended since they are the nearest to hand weeding practice, Table 3.

Table 3: Mean numbers of cereal aphids and their native predators on wheat plants as affected by weed control treatments in 2001/02 season.

Weed control treatments	Rate /fed.	Cereal Aphids	Predators
Tritosulfuron (Tarouk 71.4% WG.)	20 g	30.3 b	19.33 b
Bromoxynil (Framinal 24% EC.).	1 L	51.8 b	20.67 b
Bromoxynil (Brominal 24% EC.)	1 L	57.6 a	23.33 b
Pyraflufen-ethyl (Ekopart 12% SC.)	250 cc.	55.0 a	22.33 b
Hand weeding (twice)		48.1 b	29.33 a
Untreated check		46.6 bc	32.67 a

On the other hand, Fig 2 exhibit that % of parasitism among Topik (12.03) was superior (among herbicide treatments) in conserving parasites at reliable levels. On the other hand, untreated check and hand weeding treatments were the best regarding higher parasitism percentages, being 14.52% & 13.52%, respectively. Fig.2.

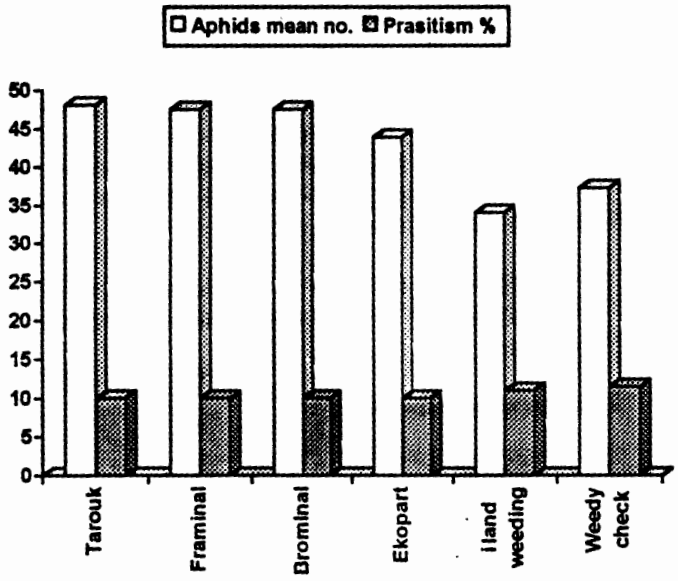

Fig. 2 : Cereal aphids mean numbers and parasitism percentages on wheat plants as affected by weed control treatments in 2001/02 season.

II. Effect on weeds

Data presented in Table 4 revealed that all weed control treatments significantly reduced the fresh weight of weeds as compared with untreated check. Brominal (1.0 L/fed.) and Tarouk (20 g/fed.) gave the lowest fresh weight of weeds (g/m^2). These treatments reduced the fresh weight of weeds by 93.2 and 89.6%, respectively as compared with untreated check. Several investigators reported that Brominal (1.0 L/fed.) reducing significantly the fresh weight g/m^2 of total weeds associated with wheat plants as compared with untreated check. Kholosy *et al.* (1991) showed that the application of bromoxynil at 1.0 L/fed. decreased the fresh weight of weeds (g/m^2) by 92.1 and 99.7%, respectively, in the first and second seasons. Al-Marsafy *et al.* (1992) reported that Brominal at 1.0 L/fed. decreased significantly the fresh weight of susceptible weeds. Meanwhile, the previous treatments improved wheat grain yield and gave the highest wheat grain yield being 14.47 and 13.83 ardab/fed., respectively as compared with untreated check value being 7.13 ardab/fed. The superiority in wheat grain yield due to these treatments may be due to the reducing in fresh weight of total weeds (g/m^2) which minimize the competition on growth factors between weeds and wheat plants then maximizing wheat grain yield Saad and Omar (1991), Kholosy *et al.* (1991) and Al-Marsafy *et al.* (1992) they found that Brominal (bromoxynil 24% EC.) at the rate of 1.0 L/fed. increased wheat grain yield as compared with weedy check. Thus, the IPM or ICM practitioner will judge and decide between several aspects before choosing the appropriate and profitable

means for good crop management (1) weed elimination by heavy herbicide chemicals in itself is not a badly needed target (2). Hand weeding or tillage seems to be in proportional with conserving natural enemies, and lessening environmental pollution hazards as well. (3) However, if weed populations were high enough to threaten the wheat crop, We must use the proper herbicide, which lessen weeds and at the same time conserve the naturally occurring biological control agents, which ultimately will aid in keeping cereal aphid populations under check.

Table 4: Effect of weed control treatments on fresh weight of total weeds (g./m^2) and wheat grain yield (ardab/fed.) in 2001/2002 season.

Weed control treatments	Rate /fed.	Fresh weight of weeds (g/m^2)	Grain yield (ardab / fed.)
Tritosulfuron (Tarouk 71.4% WG.)	20 g	79.16 b	13.83 d
Bromoxynil (Framinal 24% EC.).	1 L	150.71d	10.12 b
Bromoxynil (Brominal 24% EC.)	1 L	51.76 a	14.47 d
Pyraflufen-ethyl (Ekopart 12% SC.)	250 cc.	111.89 c	11.69 c
Hand weeding (twice)		199.05 e	9.33 b
Untreated check		761.15 f	7.13 a

In the present work, however, Brominal and Topik as broad and grassy weed herbicides, respectively, were shown to be the promising tactic after hand weeding in conserving natural enemy populations. On the other hand, field plant diversity seems in favor for beneficial insects establishments. Bowden and Dean (1977) assessed the distribution of adult syrphids and found that they were more concentrated at the diverse portions of the fields. Altieri and Letoumeau (1982) stated that cover crops like weeds can harbor both pest and beneficial insects. Bugg and Dutcher (1989) found that flowering buckwheat (*Fagopyrum esculentum*), commonly used as a cover crop, is attractive to hoverflies adults and that cover crops can afford alternate prey and harbor lady beetles. Parasitic wasps (Braconidae, Chalcidoidea & Ichneumonidae) are important in biological control of insect pests, and may rely on honeydew or pollen and nectar in the adult stages. Several parasitic wasp species were observed taking extra-floral nectar from buckwheat or faba bean flowers, Bugg *et al.* (1989).

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تأثير مكافحة الحشائش على الحشائش ومن الحبوب والأعداء الطبيعية والمحصول فى القمح

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*** قسم بحوث الحشرات الثاقبة الماصة- الزقازيق - معهد بحوث وقاية النبات – مركز البحوث الزراعية.**

**** المعمل المركزى لبحوث الحشائش – مركز البحوث الزراعية**

أجريت تجربتان حقليتان بمحطة البحوث الزراعية بالاسماعيلية خلال الموسمين المتعاقبين ٢٠٠٠/٢٠٠١ و ٢٠٠١/٢٠٠٢ لدراسة تاثير بعض معاملات مكافحة الحشائش على الوزن الغض للحشائش المصاحبة لمحصول القمح (جم/م٢) ومحصول الحبوب (أردب/فدان) ومدى أنتشار من النجيليات والأعداء الحيوية المصاحبة له.

أظهرت النتائج ان كل معاملات مقاومة الحشائش أدت إلى نقص معنوى فى الوزن الغض للحشائش (جم/م٢) وزيادة معنوية فى محصول الحبوب (اردب/فدان) مقارنة بمعاملة الكنترول .

أعطت معاملة البروميناال (بروموكسانيل ٢٤%) بمعدل ١ لتر /فدان اعلى نسبة نقص فى الوزن الغض للحشائش فى كلا الموسمين قدرت بحوالى ٩٤% و ٩٣,٢% فى الموسمين على التوالى مقارنة بمعاملة الكنترول . ومن جهة أخرى فإن نفس معاملة البروميناال (بروموكسانيل EC.%٢٤) بمعدل ١ لتر / ف اعطت أعلى قيمة لمحصول الحبوب (اردب / فدان) فى كلا الموسمين .

ومن منظور المكافحة المتكاملة فإن النقاوة اليدوية تعتبر وسيلة مكافحة جيدة للحشائش حيث حافظت على الأعداء الحيوية مما أدى إلى زيادة المجموع الحشرى لكل من مفترسات وطفيليات المن وبالتالى خفض العدوى بالمن . وكانت معاملة التوبيك (كلودينافوب- بروبايل WP.%١٥) بمعدل ١٤٠ جم/فدان كمبيد للحشائش ضيقة الأوراق ومعاملة البروميناال (بروموكسانيل EC. %٢٤) بمعدل ١ لتر/ فدان، كمبيد للحشائش عريضة الأوراق أقل معاملات المبيدات المستخدمة ضرراً على الأعداء الحيوية ، وبذلك يمكن أن تنضم إلى برامج المكافحة المتكاملة للحشائش فى القمح .