

CHEMICAL WEED CONTROL IN THE FIELDS OF DIRECT
SEEDED RICE IN ALEXANDRIA REGION

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Abstract

Six herbicides were evaluated in direct-sown rice in Alexandria region, during 1987 and 1988 seasons. Herbicidal efficacy of the tested herbicides, as well as their effects on the growth and productivity were estimated. the dominant weed (s) in the experimental field were Echinochloa crus-galli and Cyperus difformis during 1987, and Echinochloa colonum during 1988. The most effective herbicides in the first season were Fenoxypoprop-ethyl at 1.2 L/ha, Bensulfuron-methyl at 71.4 gm/ha and Thiobencarb at 4.8 L/ha, while Oxadiazon Kz at 1.8 L/ha, Thiobencarb at 3.5 L/ha, and Pretilachlor at 1.7 L/ha exhibited good control of the weeds in the second season.

Most of the herbicidal treatments caused significant increase not only in the grain and straw yields but also in the harvest index, plant height, number of panicles, panicle length, number of filled grains, panicle weight, 1000-grains weight and grain protein content.

Introduction

Because of the high hand-labour costs, and the good performance of the several herbicides, the chemical weed control in most of rice field becomes a common practice. Thiobencarb, one of the most common herbicides in this respect, gave good control of the rice weeds, and improved the grain yield and plant height (Senthong, 1985). The herbicide, at its proper rate was selective and produced the highest straw and grain yield (Ali *et al.*, 1987; Mishra *et al.*, 1987 and 1988), and the protein and the amino acids contents of the grain rice were increased (Petibskaya, 1987). However, Subhakar and Nair (1986), found that, Thiobencarb at 1 Kg/ha increased the grain yield of rice than of weedy control, even though it did not affect the weedy control.

Bensulfuron-methyl showed considerable promise as a selective herbicide singly or in combinations in the restricting water movement management practices (Reeves *et al.*, 1986; and Hill *et al.*, 1987). Bernason and Datta, (1986); and Clampet, (1988) reported that Bensulfuron-methyl, when applied at 30-50 gm/ha, controlled Cyperus difformis, Echinochloa glabrescens, E. crus-galli, Sagittaria montevidensis and Monochoria vaginalis; and increased grain yield as well. Pacheco and Pope (1986) observed that, Bensulfuron-methyl at 35-140 gm/ha, when applied in sequential treatments with molinate gave excellent control of broad leaved weeds and sedges, 9, 10 and 22 days after rice sowing. No phytotoxicity to the rice crop or harmful effects on the yields were resulted from the mentioned herbicide application.

Fenoxaprop-ethyl was considered as an effective alternate to bensulfuron-methyl for grassy-weed control in rice, as it showed good control of *E. crus-galli* and produced good yield and high grain quality (Snipes and Street, 1987; and Khodayari *et al.*, 1989). It was also reported that, oxadiazon was an effective herbicide in the control of many weeds in rice (e.g. *Phyllanthus* spp., *Ageratum conyzoides*, *Digitaria adscendens*, *E. crus-galli*, *Portulaca oleracea* and *Commelina communis*) and it showed the greatest increase in the grain yield when compared with butachlor and pendimethalin (Bhole and Singh, 1987; Dayanand, 1987; Tiwari, *et al.*, 1987; Kehinde, 1988 and Zhao and Han 1988). However, Apud (1986) reported that, molinate and oxadiazon controlled properly *C. difformis* and *E. crus-galli*, but the highest grain yield was obtained from the molinate treatment.

The present study was conducted to demonstrate the effectiveness of the herbicidal treatments, for the weeds of direct-seeded rice field, at Alexandria region, as well as their effects on the grain yield.

Materials and Methods

Two field experiments were conducted in the Agricultural Experimental Station of Alexandria University located at Agous, during the 1987 and 1988 seasons. The main objectives of the experiments were studying the chemical weed control of six herbicides in the direct-seeded rice (*Oryza sativa*) and their effects on the grain yield.

A randomized complete block experimental design, with four replicates, was used in both experiments. The plot size was 21 m (3 X 7 m). Thirty-six hour water-soaked seeds were directly broadcasted by hand manually puddled, at a rate of 150 Kg/ha. Seeding dates were June 13, 1987 and June 29, 1988 for the two experiments.

Herbicides and Rates:

1. Thiobencarb (Benthiocarb) [S-(4-chlorobenzyl)-N,N-diethylthiocarbamate]; Saturn 50% EC; was applied 7 days after sowing at two rates, 3.5 and 4.6 l/ha.
2. Pretilachlor + Safner [2-chloro-2,6-diethyl-N-(2-propoxyethyl)-acetanilide] + [4,6-dichloro-2-phenyl-pyrimidine]; Sofit 30% EC, was applied 7 days after sowing at a rate of 1.2 L/ha.
3. Oxadiazon Kz [2-tert-butyl-4-(2,4-dichloro-5-isopropoxyphenyl)-1,3,4-oxadiazoline-5-one], Ronstar Kz 25% EC, was pre-sowing applied at a rate of 1.8 L/ha.
4. Bensulfuron-methyl [methyl -2-[[[[(4,6-dimethoxypyrimidine-2-yl) amino] carbonyl] amino] sulfonyl] methyl] benzoate]; Londax 60% W.P., was applied, 12 days after sowing at a rate 71.4 gm/ha.
5. Molinate [S-ethyl-N-N-hexamethylene thiocarbamate] or [s-Ethyl hexahydro-1H-azepine-1-carbothioate]; Sakkimol 70% EC, was applied 12 days after sowing at a rate of 6 L/ha.
6. Fenoxaprop-ethyl [ethyl-2-[4-O-(6-chloro-2-benzoxazolyl)oxyl] phenoxy propanoate]; Furore 12% EC, was applied, 12 days after sowing at a rate of 1.2 L/ha.

The herbicidal treatments were made in 360 L. of the water-/ha except Bensulfuron-methyl which was mixed with an amount of soil (at the rate of 150 Kg/ha.) and manually broadcasted on respective plots. Knapsack sprayer, model CP3 with red fan type nozzle, was used to apply the herbicides. In the hand-weeded treatments, the weeds were manually pulled, 30 days after sowing.

The assessment of the results was conducted by weighing the individual species of weeds, 45 days after sowing, and by measuring some of the agronomic characters, at harvest, such as grain and straw yields, harvest index, plant height, panicle length and weight, grain number (total and filled), number of grain per panicle and of panicles per unit area, and 1000-grain weight.

Chemical analysis of protein content was carried out according the method described in the Anonymous (1960).

Data were subjected to statistical analysis according to Snedecor (1955).

Results and Discussion

Two field trials were carried out in two succeeding seasons 1987 and 1988 in order to investigate the efficiencies of certain herbicides to control weeds in direct-seeded rice, as well as, their effects on the grain yield, yield components and grain quality characters.

1- Weed control:-

Results of the weed control are recorded in Table (1) and (2) for 1987 and 1988 seasons respectively.

In the first season (1987), Echinochloa crus-galli and Cyperus difformis were the dominant weeds, their percentages of infestation were 43.5 and 30.5%, respectively with a sum of 74% infestation, while the E. colonum and Eclipta alba percentages of infestation were 20 and 6%, respectively. Hence, it was suspected that the herbicides acting well on the first two weeds would perform good effect on the overall control of the weeds in the experiment. Bensulfuron-methyl at 71.4g, Fenoxaprop-ethyl at 1.2l and Thiobencarb at 4.8 L/ha exhibited the greatest effect on E. crus-galli; they reduced the fresh weight of the weed by 96.6, 95.4 and 89.1%, respectively. Similar results were previously reported by several investigators for examples. It was reported that, best control of E. crus-galli was obtained with Fenoxaprop-ethyl at a rate of 0.15 or 0.2 lb/acre applied at the 5 to 6-leaf stage of the weed before or after flooding (Snipes and Street, 1987). Fenoxaprop-ethyl, at 0.17 Kg/ha controlled E. crus-galli and Leptochloa fascicularis, and performed as well as or better than standard treatment of Propanil with Thiobencarb (Khodayari et al., 1989). Bensulfuron-methyl at 35-140 gm/ha gave excellent control of broad-leaved weeds and sedges (Pacheco and Pope, 1986), which included E. crus-galli, E. glabrescens, Monochoria vaginalis and Cyperus difformis. Oxadiazon, Molinate, Pretilachlor and Thiobencarb at 3.5 L/ha were found to be moderately effective on E. crus-galli, the corresponding % reduction in the weed fresh weight were 76.6, 69, 61.6, and 43.6%, whereas hand-

weeding showed 65.3% control of it. For Cyperus difformis, Pretilachlor, Fenoxaprop-ethyl, Bensulfuron-methyl and Thiobencarb (4.8 L/ha) caused more than 85% reduction in its fresh weight. Such result agrees with what has been previously found. However, it was reported that, Thiobencarb at 3.75 Kg a.i./ha was particularly well controlled E. crus-galli (Zhao and Han, 1988); and for effective control of E. crus-galli and C. difformis, the application of Thiobencarb has to be eight days after sowing plus Propa-nil (at 1 Kg/ha) 16 days after sowing (Ali *et al.*, 1987). Oxadiazon at 0.75-1.0 Kg/ha, pre-emergence, gave better control of the weed in paddy rice than Thiobencarb, at 1.5-2.0 Kg/ha, applied 8 days after sowing (Tiwari *et al.*, 1987). Rapparini, (1989) who reported that, Bensulfuron-methyl applied at 0.1 kg/ha to rice at the 2- to 4-leaf stage in 3-10 cm water controlled C. difformis. The same results were also obtained by Clampet (1988) and Bernasor and Datta, 1988.

For E. colonum, the herbicidal treatments, in addition to hand-weeding, showed more than 80% reduction in the weed fresh weight. Oxadiazon, Thiobencarb (4.8 L/ha), Molinate and Pretilachlor, caused the highest reduction in this respect, which equal to 100, 97.5, 94.3 and 94%, respectively. The treatments were effective in controlling Eclipta alba with percentages of control ranged from 85 to 100%, whereas Molinate and 3.5 L/ha rate of Thiobencarb gave 76.7 and 65.4% control of the weed resp.

In general, Fenoxaprop-ethyl, Bensulfuron-methyl and 4.8 L/ha rate of Thiobencarb showed the strongest effect against the total weeds fresh weight, and the corresponding % were : 93.3, 92.1 and 91.0. The highly effective herbicides in this respect were those strongly effective on the predominant (E. crus-galli and C. difformis). Snipes and Street (1987); Bernasor and Datta, (1988) and Mishra *et al.*, (1988) supported the previous results.

In the second season (1988), the weed spectrum was different from that of the first one. The predominant weed for that season was E. colonum, that caused nearly 88% infestation, whereas, E. crus-galli (5.52%), C. rotundus (5.96) and C. difformis (0.66%) caused negligible percentages of infestation. Hence, E. colonum was considered the single factor that could affect of the total weeds population in the 1988 season. Therefore, the performance of the herbicidal treatments against the weeds could be different from the first to the second season. This could be best illustrated from the comparison between Table (1) and (2). Oxadiazon, Thiobencarb (4.8 L/ha), Molinate, Pretilachlor, and Bensulfuron-methyl proved to be highly effective, not only in controlling E. colonum but also in reducing the fresh weight of the total weeds as well (Table 2), since the percent reduction in the E. colonum fresh weight for these treatments were 100, 96.7, 92.0, 91.7 and 87.2% respectively, whereas the respective values for the total weeds fresh weight were 98.9, 94.3, 88.5, 91.6 and 88.7%. The contribution of E. crus-galli, C. difformis and C. rotundus weeds in this respect was minor, because of the low percentages of infestation with these weeds in the experimental field.

Table (1): Effect of Certain Herbicides on Fresh Weight (gm) of Weeds/Square Meter, 45 Days After Sowing of Direct-Seeded Rice in 1987 Season.

Treatments	Rate / ha.	Echinochloa colonum		Echinochloa crus-galli		Cyperus difformis		Eclipta alba		Total of over Weeds	
		Wt.	% R	Wt.	% R	Wt.	% R	Wt.	% R	Wt.	% R
Thiobencarb 50%	4.8 L	30.0	97.5	283.3	89.1	250.0	86.3	6.7	96.2	540.0	91.0
Thiobencarb 50%	3.5 L	215.5	82.0	1466.7	43.6	290.0	84.1	16.7	65.4	1988.9	66.8
Pretilachlor+Safner 30%	1.7 L	72.0	94.0	1000.0	61.6	0.0	100.0	0.0	100.0	1072.0	82.1
Quadiazon KZ 25%	1.8 L	0.0	100.0	610.0	76.6	890.0	51.1	50.0	86.0	1550.0	74.1
Sensulfuron-methyl 60%	71.4 g	170.0	85.8	83.3	96.8	233.3	87.8	0.0	100.0	476.6	92.1
Molinate 70%	6.0 L	68.7	94.3	806.7	69.0	300.0	83.6	83.3	76.7	1256.7	79.0
Fenoxaprop-ethyl 12%	1.2 L	213.3	82.2	119.7	95.4	75.0	96.2	0.0	100.0	403.0	93.3
Hand Weeded	--	200.0	83.3	903.3	65.3	1506.7	17.3	0.0	100.0	2610.0	56.4
Un-Weeded	--	1200.0	0.0	2690.0	0.0	1620.0	0.0	356.7	0.0	5976.7	0.0
% of Weed Infestation		20.0		43.5		30.5		6.0		100.0	

% R = Percentage of reduction (or % control) in Fresh Weight of each weed.

Table (2): Effect of Certain Herbicides on Fresh Weight (gm) of Weeds/Square Meter, 45 Days After Sowing of Direct-Seeded Rice in 1986 Season.

Treatments	Rate / ha.	Echinochloa colonum		Echinochloa crus-galli		Cyperus difformis		Cyperus rotundus		Total of over Weeds	
		Wt.	% R	Wt.	% R	Wt.	% R	Wt.	% R	Wt.	% R
Thiobencarb 50%	4.8 L	65.0	96.7	0.0	100.0	0.0	100.0	65.0	51.9	130.0	94.3
Thiobencarb 50%	3.5 L	442.5	77.8	200.0	0.0	0.0	100.0	5.0	96.3	647.5	71.5
Pretilachlor+Safner 30%	1.7 L	165.0	91.7	0.0	100.0	0.0	100.0	25.0	81.5	190.0	91.6
Quadiazon KZ 25%	1.8 L	0.0	100.0	0.0	100.0	0.0	100.0	25.0	81.5	25.0	98.9
Sensulfuron-methyl 60%	71.4 g	255.0	87.2	0.0	100.0	0.0	100.0	0.0	100.0	255.0	88.7
Molinate 70%	6.0 L	160.0	92.0	0.0	100.0	100.0	0.0	0.0	100.0	260.0	88.5
Fenoxaprop-ethyl 12%	1.2 L	517.5	74.6	0.0	100.0	0.0	100.0	75.0	44.4	592.5	73.8
Hand Weeded	--	652.5	67.2	140.0	0.0	0.0	100.0	5.0	96.3	797.5	64.8
Un-Weeded	--	1990.0	0.0	125.0	0.0	15.0	0.0	135.0	0.0	2265.0	0.0
% of Weed Infestation		87.85		5.52		0.66		5.96		100.0	

% R = Percentage of reduction (or % control) in Fresh Weight of each weed.

Table (3): Effect of Certain Herbicides on Growth and Productivity of Direct-Seeded Rice in 1987 Season.

Treatments	Rate / ha.	Grain yield t/ha	Straw yield t/ha	Harvest index (%)	Plant height (cm)	50%* Heading time	No. of panicles /m ²	Panicle length (cm)	No. of filled grain/ panicle	No. of unfilled grain/ panicle	Panicle weight (gm)	1000- grain weight (gm)	Grain protein content (%)
Thiobencarb 50%	4.6 L.	5.38	10.90	33.60	103.80	116.20	284.30	16.63	113.90	5.94	2.87	22.93	9.68
Thiobencarb 50%	3.5 L.	4.31	9.50	31.20	99.30	119.50	256.60	16.73	110.90	8.82	2.43	20.44	9.69
Pretilachlor+Safner 30%	1.7 L.	4.90	10.14	32.60	102.50	118.40	268.40	17.66	112.60	7.25	2.69	21.64	9.92
Oxadiazon KZ 25%	1.8 L.	5.55	11.17	33.20	104.40	115.80	287.10	18.94	115.60	5.62	2.92	23.24	9.58
Bensulfuron-methyl 60%	71.4 g	5.19	10.43	33.20	103.20	117.90	275.60	18.25	113.50	6.36	2.64	22.54	9.77
Molinate 70%	6.0 L.	5.90	11.60	33.70	105.60	114.30	292.20	19.32	116.10	5.24	2.98	23.72	9.49
Exprop-ethyl 12%	1.2 L.	5.14	10.29	33.30	102.90	118.10	272.60	17.85	113.20	6.93	2.76	22.23	9.95
Hand Weeded	—	4.62	9.64	32.40	101.20	118.70	261.70	17.38	112.30	8.64	2.61	21.23	9.56
Un-Weeded	—	3.71	8.76	29.80	96.70	120.60	247.40	16.23	109.20	10.75	2.33	19.84	9.12
L.S.D 0.05		0.179	0.176	0.800	0.670	0.350	8.300	0.280	3.100	0.640	0.090	0.418	0.085

* = Time in days of the 50% heading, starting from the sowing date.

Table (4): Effect of Certain Herbicides on Growth and Productivity of Direct-Seeded Rice in 1988 Season.

Treatments	Rate / ha.	Grain yield t/ha	Straw yield t/ha	Harvest index (%)	Plant height (cm)	50%* Heading time	No. of panicles /m ²	Panicle length (cm)	No. of filled grain/ panicle	No. of unfilled grain/ panicle	Panicle weight (gm)	1000- grain weight (gm)	Grain protein content (%)
Thiobencarb 50%	4.6 L.	5.69	11.19	33.70	109.60	117.50	297.30	19.76	122.60	5.15	3.11	23.74	9.62
Thiobencarb 50%	3.5 L.	4.64	9.69	32.40	105.80	120.70	268.50	17.52	118.20	8.34	2.55	20.55	9.58
Pretilachlor+Safner 30%	1.7 L.	5.14	10.29	33.30	107.20	119.10	287.50	18.65	120.80	6.46	2.87	22.32	9.93
Oxadiazon KZ 25%	1.8 L.	6.02	11.62	34.10	110.30	116.90	302.40	19.95	123.10	4.54	3.18	24.45	9.47
Bensulfuron-methyl 60%	71.4 g	5.38	10.76	33.30	108.80	118.30	295.50	19.34	122.30	5.63	2.99	23.22	9.69
Molinate 70%	6.0 L.	6.29	12.19	34.00	110.70	116.20	306.60	20.24	123.80	4.25	3.20	24.84	9.42
Exprop-ethyl 12%	1.2 L.	5.29	10.57	33.30	107.90	118.80	290.40	19.15	121.70	8.84	2.93	22.65	9.71
Hand Weeded	—	4.90	9.98	33.00	107.50	119.60	279.60	18.21	121.10	7.22	2.74	21.92	9.48
Un-Weeded	—	3.98	9.10	30.40	103.40	121.40	253.30	16.84	115.70	10.44	2.46	20.17	9.05
L.S.D 0.05		0.167	0.164	0.900	0.620	0.350	6.400	0.370	3.500	0.330	0.080	0.356	0.079

* = Time in days of the 50% heading, starting from the sowing date.

Generally, it could be shown that, the dominant weed(s) in the field of the experiment, plays an important rule in the overall control of the weeds by the selective herbicides.

2- Rice Growth and Reproductivity:

The results of the rice growth and reproductivity measures, for the two seasons, are presented in Table (3) and (4).

Grain yield of the seven herbicidal treatments as well as those of the hand-weeded ones, were significantly higher than those of the un-weeded treatments in the two seasons. Molinate followed by Oxadiazon, Thiobencarb (with the higher rate), Bensulfuron-methyl, Fenoxaprop-ethyl, and Pretilachlor, produced higher grain yields than those of the hand-weeded treatment, in the two seasons. However, Thiobencarb, at the low rate, produced amounts of grain yield less than those of the hand-weeded treatment for the two seasons (Table 3 and 4). Such results are quite logic, by referring to the data of Table (1) and (2), it seems that, the least percentages reduction in the fresh weight of the individual (or even the total) weed species, were those of the Thiobencarb (at low rate) followed by the hand-weeded treatment hence, these treatments produced the least yield of grains. Molinate exhibited the greatest improvement in the grain reproductivity followed by Oxadiazon and Thiobencarb in descending sequence. A similar trend to that of the grain yield, was also observed in the straw yield property. The treatment produced higher grain yield, produced higher straw yield as well, with shorter 50% heading time, and vice versa.

However, Molinate followed by Oxadiazon, Thiobencarb (4.8 L/ha) and Bensulfuron-methyl showed the highest values of the plant height, number of panicles, panicle length and weight, number of filled grain/panicle and 1000-grain weight, as well as of that of grain a straw yields, for the two seasons. The treatments showed also the shortest 50% heading time as well (Table 3 and 4). The mentioned four herbicides were highly effective in controlling the predominant weed of the second season E. colonum (Table 2), and they were moderately effective in controlling the predominant two weeds of the first season (E. crus-galli and C. diffinis) (Table 1). Such results were in agreement with that have been reported by Abud (1986) and Senthong (1986), they found that no signs of phytotoxicity or differences between numbers of grains or sterile spikelets per panicle were observed with Molinate produced the highest grain yield. Thiobencarb at 1.0 Kg/ha was also found by Kumar and Gautam (1986) to give higher grain yield and increased the number of panicles per square meter and filled grains per panicle compared with the control. On the other hand, Fenoxaprop-ethyl, Bensulfuron-methyl and Pretilachlor were improved the protein content of grains in both seasons.

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الملخص العربي

مكافحة الكيموية للحشائش في حقول الارز البدار بالاسكندرية

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تم تطبيق ستة مبيدات حشائش من ناحية كفاءة قتلها في مكافحة الحشائش وايضا من ناحية تأثيرها على نمو وانتاجية محصول الارز البدار في منطقة الاسكندرية خلال موسمي ١٩٨٧ ، ١٩٨٨ .

واظهرت النتائج ان حشيشة الدنوب والعجيرة كانتا السائدتين في موسم ١٩٨٧ بينما حشيشة ابو رغبة هي السائدة في موسم ١٩٨٨ ومن اكثر المبيدات فعالية في موسم ١٩٨٧ هي مكافحة الحشائش في فينوكسابروب-ايشايل بمعدل ٩٠ لتر/هكتار وبيسلترون-ميشايل بمعدل ٨٠ لتر/هكتار والثيوبنتكارب بمعدل ٨٠ لتر / هكتار بينما الاوكساديازون بمعدل ٨٠ لتر/هكتار والثيوبنتكارب بمعدل ٨٠ لتر/هكتار والبيرميت-لاكتور بمعدل ٧٠ لتر/هكتار هم من اكثر المركبات كفاءة في موسمي ١٩٨٨ .

اذت معظم مبيدات الحشائش المستخدمة التي زيادة معتوية ليس فقط في محصول الحبوب ولكن في الارز البدار ولكن فسي دليل الحصاد وارتفاع الانتاجات و...
اسباب طول السنبلة وعدد الحبوب المملوءة بالسنبلة ووزن السنبلة و...
١٠٠٠ غيه وايضا محتوى الحبوب من البروتين.