The Influence of Herbicides on Major Field Crops in the Newly Reclaimed Areas of Egypt

III. Effect of Recommended Application Methods of Herbicides on Weed Seedlings Associated with Wheat, Cotton, Maize, and Rice.

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ABSTRACT

A pot experiment was conducted at the Faculty of Agriculture Experimental Farm, Alexandria, in 1971, to test the visual effect of the herbicides: Atrazine, Linuron, Fluometuron, and Trifluralin on the weeds; jungle rice (*Echinochloa colonum*, (L.) Link), barnyardgrass (*Echinochloa crus-galli*, (L.) Beauv.), pigweed (*Amaranthus caudatus*, L.), common purslane (*Portulaca oleracea*, L.), and yellow foxtail (*Setaria glauca*, (L.) Beauv.). Moreover, the influence of Propanil and Molinate was investigated on jungle rice, barnyardgrass, and pigweed and 2,4-D on curly dock (*Rumex dentatus*, L.), annual sowthistle (*Sonchus oleraceus*, L.), black mustard (*Brassica nigra*, L.), and lambsquarters (*Chenopodium* album, Koch.). Five concentrations of each herbicide were applied. A numerical grade scale (from zero to ten) was used for facilitating the estimation of different herbicidal effects on weeds.

Results showed that the weeds treated with 1.0 liter/f (f = faddan = 4,200 m^2) of Trifluralin, as a preplanting treatment, were satisfactorily controlled. All weeds (except pigweed and common purslane) sprayed with Fluometuron at the rates of 0.5 and 1.0 kg/f were satisfactorily controlled. However, these two weeds (pigweed and common purslane) were completely killed only by the highest rate (4.0 kg/f) of Trifluralin.

When Molinate was applied at the rate of 2.5 liters/f, as a postemergence treatment, it resulted in satisfactory weed control. The low concentration (1.25 liters/f) of this herbicide was not effective in weed killing.

The postemergence application of Propanil at the rate of 6.0 liters/f also resulted in satisfactory weed control.

The preemergence application of Atrazine at the rate of 1.0 kg/f was satisfactory in controlling weeds. The lowest concentration (0.5 kg/f) of this herbicide, however, was not effective.

The preemergence application of Linuron at the concentration of 1.0 kg/f was sufficient for killing all weeds under study.

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Weed control was satisfactory when 2,4-D was sprayed at a rate of 1.0 liter/f as a postemergence treatment. On the other hand, the lowest rate of 0.5 liter/f did not kill the weeds completely but the higher concentration (4.0 liters/f) showed complete weed control.

INTRODUCTION

In the newly reclaimed land of Egypt, weeds became widely spread in the cultivated field crops. Few weed species were indiginous to the area studied before reclamation, while the other species were introduced after cultivation.

In general, weed species respond differently to various herbicide treatments as a result of the chemical nature and selectivity of the herbicide and the method of herbicidal application. In fact, a recommended method of herbicidal application is usually determined by the manufacturer under certain circumstances. It is necessary, however, to test these recommendations and compare them with other possible methods under specific local conditions.

Several investigators tested the effect of application methods of herbicides on weed seedlings in wheat, maize, cotton, and rice fields. Walls (8) reported that barnyardgrass (*Echinochloa crus-galli*) was controlled by Atrazine as a preemergence treatment in maize fields. Most broadleaf weeds and summer grasses were also killed. Kale *et al.* (2) showed that the high concentrations of Propanil gave a ninety percent control of monocotyledonous weeds when applied to rice seedlings at the 4–5 leaf stage. While Triplett (6) found that Linuron alone gave unsatisfactory weed control in maize, Veselovskii and Manko (7) reported that the preemergence application of Linuron, at a concentration of 3.0 kg/ha, effectively controlled the annual weeds in maize. Zahran *et al.* (10) indicated that the pre- and postemergence applications of Fluometuron, at the rate of 3.0 lb/f, were satisfactory for weed control in Egyptian cotton. Moreover, Trifluralin, incorporated at the rate of one pound per faddan, with or without Fluometuron, was most effective against the summer annual weeds. Swain and Campion (5) reported that Trifluralin, applied at the rates of 1.0 and 1.5 kg/ha, showed the best control of grass weeds in cotton but had no effect upon the broadleaf weeds. Church (1) found that the preemergence application of Fluometuron, at the rate of 1.5–3.0 kg/ha, resulted in excellent weed killing but damaged the cotton crop.

The present investigation was conducted to test the effect of the recommended application methods (9) of some herbicides on weed seedlings commonly found in wheat, cotton, maize and rice fields under the soil conditions of the North Tahreer Province in Egypt.

MATERIALS AND METHODS

The experiment was carried out in pots at the Faculty of Agriculture Experimental Farm, Alexandria, in 1971. The following seven herbicides were used:

1. Atrazine (2,chloro-4-ethylamino-6-isopropylamine-5-triazine).
2. Linuron [3-(3,4-dichlorophenol)-1-methoxy-1-methylurea].
3. Fluometuron [1,1-dimethyl-3-(a,a,a,-trifluoro-m-tolyl) urea].
4. Trifluralin (alpha,alpha,alpha,trifluoro-2,6-dinitro-N,N-dipropyl-p-toluidine).
5. Molinate (5-ethyl hexahydro-1 H-azepine-1-carbothioate).
6. Propanil (3,4-dichloropropionanilide).
7. 2,4-D (2,4-dichlorophenoxyacetic acid).

Table 1 Herbicides, methods of application and concentrations used in the study.

Herbicides	Methods of application	Concentrations
Atrazine	Preemergence	0.0, 0.5, 1.0, 2.0, and 4.0 kg/f[a].
Linuron	Preemergence	0.0, 0.5, 1.0, 2.0, and 4.0 kg/f.
Fluometuron	Preemergence	0.0, 0.5, 1.0, 2.0, and 4.0 kg/f.
Trifluralin	Preemergence	0.0, 0.5, 1.0, 2.0, and 4.0 liters/f.
Molinate	Preemergence	0.00, 1.25, 2.50, 5.00, and 7.50 liters/f.
2,4-D	Postemergence	0.0, 0.5, 1.0, 2.0, and 4.0 liters/f.
Propanil	Postemergence	0.0, 3.0, 6.0, 9.0, and 12.0 liters/f.

[a]kg/f = Kilograms per faddan (one faddan = 4200 m^2).

Five concentrations of each herbicide were tested. The herbicides were applied as recommended by Zahran (9). The concentration of herbicides and methods of application are presented in Table 1. As for the preemergence herbicides, the corresponding amounts to the different concentrations were based upon the soil surface area of each pot. The postemergence herbicides were prepared by dissolving the proper amount per faddan of each herbicide in 400 liters of water. The most common weeds associated with wheat, cotton, maize, and rice in the North Tahreer area were the only ones tested in this study. The weeds were grouped and certain herbicides were tested on each group, as indicated in Table 2.

Table 2 Common weed species and herbicides tested for each group.

Common weed species		
Scientific names	Common names	Herbicides
Echinochloa colonum, (L.) Link.	Jungle rice	Atrazine, Linuron, Fluometuron, and Trifluralin.
E. crus-galli, (L.) Beauv.	Barnyardgrass	
Amaranthus caudatus, L.	Pigweed	
Portulaca oleracea, L.	Common purslane	
Setaria glauca, (L.) Beauv.	Yellow foxtail	
E. colonum, (L.) Link.	Jungle rice	Propanil and Molinate.
E. crus-galli, (L.) Beauv.	Barnyardgrass	
Amaranthus caudatus, L.	Pigweed	
Rumex dentatus, L.	Curly dock	2,4-D.
Sonchus oleraceus, L.	Annual sowthistle	
Brassica nigra, L.	Black mustard	
Chenopodium album, Koch.	Lambsquarters	

Fifty seeds of each weed species were sown in plastic pots (8 cm in diameter) filled with 250 g of the North Tahreer Province soil (fine sandy loam). Seeds of pigweed and curly dock were treated with sulfuric acid solution (75%) for about one minute, rinsed with tap water, and then placed in pots to enhance germination.

RESULTS AND DISCUSSION

The effect of the seven herbicides was based on visual observations. A numerical grade scale was used to determine the effect of the different treatments on weed seedlings. This scale ranged from zero for poor control (resistant reaction) up to ten for

Table 3 Numerical grade scale of the weed seedling reaction to the different herbicidal treatments.

Scale	Response of Weeds
0 to 2	Resistant (poor control)
3 to 5	Moderately resistant (intermediate control)
6 to 8	Moderately susceptible (satisfactory control)
9 to 10	Susceptible (complete control)

complete control (susceptible reaction). Varying degrees between these two extremes were determined (Table 3). The figures in Tables 4 and 5 represent the average values for weed seedling reaction to the different concentrations of the seven herbicides.

It is obvious in Table 4 that Atrazine completely controlled the five weed species when applied as recommended (preemergence) at the concentrations of 2.0 and 4.0 kg/f. The weeds were moderately resistant and resistant at the 1.0 and 0.5 kg/f concentrations, respectively.

Jungle rice, barnyardgrass, pigweed, common purslane, and yellow foxtail were susceptible to the two rates: 2.0 and 4.0 kg/f of Linuron, since they rated from nine to ten on the scale (Table 4). The lowest concentration (0.5 kg/f) of this herbicide was moderate-

Table 4 Average values for weed seedling reaction to different concentrations of herbicides.

			Weeds				
Herbicides	Concentrations per faddan	Methods of application	Jungle rice	Barn-yard-grass	Pigweed	Common purs-lane	Yellow foxtail
Atrazine	0.5 kg	preemergence	4.5	4.0	5.5	4.5	4.0
	1.0 kg	preemergence	8.0	8.0	7.5	8.5	8.5
	2.0 kg	preemergence	10.0	9.0	9.0	9.5	9.0
	4.0 kg	preemergence	10.0	10.0	10.0	10.0	10.0
Linuron	0.5 kg	preemergence	6.0	5.0	5.5	7.0	6.0
	1.0 kg	preemergence	7.0	7.5	8.5	9.0	9.0
	2.0 kg	preemergence	9.5	9.0	9.5	10.0	10.0
	4.0 kg	preemergence	10.0	10.0	10.0	10.0	10.0
Fluometuron	0.5 kg	preemergence	7.0	7.0	1.5	1.5	6.5
	1.0 kg	preemergence	9.0	8.0	2.0	3.0	7.5
	2.0 kg	preemergence	10.0	9.5	5.0	5.0	9.5
	4.0 kg	preemergence	10.0	10.0	7.0	7.0	10.0
Trifluralin	0.5 liters	preemergence	7.0	6.0	3.5	4.0	5.0
	1.0 liters	preemergence	8.0	7.5	6.5	7.5	7.0
	2.0 liters	preemergence	9.5	8.5	7.5	9.0	8.5
	4.0 liters	preemergence	10.0	10.0	9.0	10.0	10.0
Molinate	1.25 liters	preemergence	4.5	5.0	4.0	—	—
	2.50 liters	preemergence	8.5	8.5	6.5	—	—
	5.00 liters	preemergence	9.0	9.5	8.5	—	—
	7.50 liters	preemergence	9.5	10.0	10.0	—	—
Propanil	3.0 liters	postemergence	4.5	5.0	3.0	—	—
	6.0 liters	postemergence	8.0	8.0	5.0	—	—
	9.0 liters	postemergence	9.0	9.5	8.5	—	—
	12.0 liters	postemergence	9.5	10.0	9.0	—	—

Table 5 Average values for weed seedling reaction to different concentrations of 2,4-D. (postemergence application).

Concentrations (liters/faddan)	Weeds			
	Curly dock	Annual sowthistle	Black mustard	Lambs-quarters
0.5	4.0	5.0	5.0	3.0
1.0	8.0	8.0	8.0	8.5
2.0	9.0	9.0	9.5	9.0
4.0	9.5	10.0	10.0	9.5

ly effective on the weeds. Common purslane and yellow foxtail were completely controlled by using the 1.0 kg/f concentration.

The five weed species varied in their response to Fluometuron. At the 4.0 kg/f rate, jungle rice was susceptible, whereas pigweed and common purslane showed moderate susceptibility. The 2.0 kg/f concentration showed a slightly lower degree of weed control than the 4.0 kg/f rate. The lowest rate of Fluometuron (0.5 kg/f) was insufficient for controlling pigweed and common purslane.

Trifluralin completely controlled the five weed species at the 2.0 and 4.0 liters/f concentrations, as they rated nine and ten on the scale. Generally, the weed species were moderately resistant and susceptible at the 1.0 and 0.5 liters/f rates, respectively (Table 4).

Data in Table 4 further indicate that Molinate completely controlled barnyardgrass, jungle rice, and pigweed at the 7.5 liters/f concentration. A complete control was also obtained for jungle rice and barnyardgrass when treated with 5.0 liters/f Molinate. The lowest concentration (1.25 liters/f) was not satisfactory in its effect on the three weeds. In fact, jungle rice and barnyardgrass, that are commonly associated with rice, were similarly controlled by Molinate.

Jungle rice and barnyardgrass showed susceptible reactions to Propanil concentrations of 9.0 and 12.0 liters/f. When the recommended rate (6.0 liters/f) was applied, jungle rice and barnyardgrass were also satisfactorily controlled. The lowest concentration (3.0 liters/f) was only moderate in its effect on the weed species (Table 4).

Data in Table 5 showed that 2,4-D completely controlled curly dock, annual sowthistle, black mustard, and lambsquarters when applied at the concentrations of 2.0 and 4.0 liters/f. The weeds were moderately resistant at the lowest rate (0.5 liter/f).

According to these results, the following conclusions may be drawn under the conditions of the present investigation:

1. For Atrazine and Linuron

The recommended application method (preemergence) and concentration (1.0 kg/f) proved to be sufficient for weed control in rice and maize. Concentrations above 1.0 kg/f may not be used because they were injurious to crop seedlings, especially maize as reported by Shaalan and El Khishen (3).

2. For Fluometuron

The recommended method of application (preemergence) and concentration (1.0 kg/f) were not effective for weed control in cotton and could be increased up to 2.0 kg/f. Although the 4.0 kg/f dose showed complete control of most weeds, it might not be used

in cotton because its seedlings were severely injured by this high rate (3). The recommended rate (1.0 kg/f), applied as a preemergence treatment, injured rice, maize, and wheat seedlings and may not be recommended for weed control.

3. For Trifluralin

The recommended application method (preplanting) and rate (1.0 liter/f) proved to be sufficient for controlling the weed species under study only in rice and cotton. Maize and wheat seedlings were injured by this treatment (3).

2. For Molinate

The recommended preemergence treatment of Molinate completely controlled the weed species tested at the 5.0 and 7.5 liters/f concentrations. This treatment, however, may be recommended only for weed control in rice because cotton, maize, and wheat seedlings were severely injured (3).

5. For Propanil

The recommended postemergence application and concentration (6.0 liters/f) proved to be sufficient for controlling jungle rice and barnyardgrass in rice. This treatment may not be recommended for weed control in cotton, maize and wheat because their seedlings were severely injured, as found by Shaalan *et al.* (4). Although the concentrations above 6.0 liters/f showed complete killing of weeds, they should not be used in rice because rice seedlings were injured by these rates (4).

6. For 2,4-D

The recommended application method (postemergence) and rate (1.0 liter/f) proved to be sufficient for controlling the weeds in maize and rice. Rates up to 2.0 liters/f may be used as a postemergence application in wheat. These treatments are not recommended for cotton because its seedlings were severely injured (4).

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