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The Influence of Some Herbicides and Additional Hoeing In Maize Growth and Yield and Yield Components

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ABSTRACT

Field experiments were conducted in the agricultural experimental station of National Research Centre at Shalakan, Kalubia Governorate, Egypt. The investigation was undertaken to study the influence of some herbicides and additional hoeing in maize growth, yield and yield components. In general, all tested herbicides alone or in combination as well as hoeing twice and thrice resulted in satisfactory control of weeds in both seasons. Hand hoeing three times was more effective in controlling weeds and thus increasing maize growth and yield. Among herbicides treatments, simazine at 2 kg/fed + Ametryn at 2 kg/fed treatment showed superiority to the other treatments in controlling grasses, broad-leaved and the weeds. The studied treatments increased maize growth and yield through their effect in controlling the weeds , more so with hand hoeing.

Key Words: Herbicides; Hoeing; Weeds; Yield; Maize

INTRODUCTION

Now-a-days, maize (*Zea mays L.*) grains are valued by the different Communities, in particular Egypt, to be used for human nutrition to meet the rapid increase in the population. Thus, great attention should be given to increase the productivity of maize crop per feddan of the agricultural land. There are several approaches to increase crop productivity: improved farming practices, employing merging technology, using modified cultivators and a suitable environmental program of chemical inputs (e.g. fertilizers and pesticides).

Weeds are one of the obstacles that affect the productivity and quality of maize yield. In Egypt, the farmers use little technology and possess soil with a heavy load of seeds, and therefore, weeds represent a major management problem. Researches indicate that maize plants are very susceptible to weed competition and yield losses are estimated at 35% to complete crop failure (Sharma *et al.,* 1998; Zaciragic & Grabo, 2003). Herbicides used in maize production are increasing dramatically and traditional weed management strategies for maize are no longer applied in many areas (Isaacs *et al.,* 2003). Among herbicides used, Rout and Satapathy (1996) found that Atrazine, Metalachlor and Alachlor are more efficient in reducing dry weight of weeds, thus increasing the maize yield and yield attributes. In this connection, a mixture of herbicides is recommended in controlling maize weeds, rather than applying herbicides separately (El-Bially, 1995). The present investigation aims, therefore, to study the influence of chemical and mechanical weed control treatments on weed growth, yield and yield components of maize plants.

MATERIALS AND METHODS

Plant materials. The grains of maize (*Zea mays L.,* Cv. Single cross 122) were obtained from Ministry of Agriculture, Giza, Egypt.

Growth conditions. This study was conducted during 2002 and 2003 seasons at the experimental station of the National Research Center, Shalakan, Kalubia governorate. The grains were sown during the last week of May in both seasons. Many seeds were planted per hill and the germinated seeds were thinned to one seedling/hill after two weeks of sowing. The plants were watered and fertilized as recommended (irrigation every 15 days, 120 unit of N). The experiments were set up in a randomized complete block design with four replicates for each treatment. The size of each plot was 12 m² divided into five rows, each row was 3.50 × 0.7m. The soil texture was a clay loam soil (pH=7.8, organic matter = 1.9%) with medium fertility. During the growth seasons, the climatic conditions were average photoperiod 11.3 h, day/night temperatures 35.26/22.16°C and relative humidity 66%.

Treatments. 1- simazine (2-Chloro- 4: 6 bis ethylamino -s-triazine) at 1 kg or 2 kg per fed, 2- ametryn (2-Methylthio-4-iso-propylamino-6-ethylamino-s-triazne) at 1kg or 2 kg per feddan, 3- simazine at 1 kg/fed + ametryn at 1 kg/fed, 4- simazine at 2 kg/fed + ametryn at 2 kg /fed

The herbicides were applied by using a knapsack sprayer equipped with one nozzle loam and water volume of 200 L per feddan after two weeks from sowing.

5- hand hoeing: plots were hoed either twice or thrice. The first, second and third hand hoeing were carried out after 15, 30 and 45 days of sowing, respectively.

6- unweeded (control): weeds were left without control for comparison with different weed control treatments.

Growth of the weeds. Weeds were hand pulled from one row of each plot at two ages, namely 6 and 12 weeks of sowing. Weeds were classified to three classes**:** grassy weeds, broad–leaved weeds and total weeds. Fresh weight

per one m² of each class of weeds was determined.

Growth and yield of maize. Maize samples of five plants were taken randomly from each plot to determine plant height (cm) and weights (g) after 60, 90, 120 days of sowing.

Yield and its components. After 120 days of sowing, random samples of ten guarded plants were taken from each plot to determine ear length (cm), ear weight (g), weight of grains/ear (g), weight of 100 grains (g) and the yield (ton/feddan).

Statistical analysis. Data were subjected to the analysis of variance according to Snedecor and Cochran (1980). Mean values were compared using least significant difference (L.S.D.) at 5%

RESULTS AND DISCUSSION

Effect of weed control treatments on weed growth. The dominant weed species encountered in the experimental plots during the two seasons as arranged in descending order were: a– annual broad–leaved purslane weed (*Portulaca oleraceae L.*) and small infestation of pigweed (*Amaranthus sp.*) and spiny cocklebur (*Xanthium spinosum L.*), b– annual grasses: Junglerice (*Echinochloa colonum (L.) link*), c– perennials: nutsedge (*Cyperus rotundus L.*) and bindweed (*Convolvulus arvensis L.*).

Weed control treatments had significant influence on fresh weight of grass weeds in both seasons (table I). That is, all treatments decreased the weed fresh weight significantly relative unweeded treatment. This result is consistent with previous published data (El-Bially, 1995; Forcella, 2000; Salarzai, 2001; Perry *et al.*, 2004). Hand hoeing was more effective in controlling the all weed species in both seasons as compared with other treatments (Table I). The least weight fresh weight was obtained with hand hoeing thrice. Our results are in agreement with those of Forcella (2000) and Perry *et al.* (2004) who reported that hoeing is superior to herbicidal application in maize. The effectiveness of hand hoeing treatments might be attributed to the notion that hoeing was most likely more efficient in eradication and growth stunting of the weeds that the other herbicidal treatments.

Simazine at 2 kg/fed + ametryn at 2 kg/fed treatment decreased the fresh weight the most after 6 and 12 weeks of application in the two seasons comparing with the other herbicidal application (Table I). Other studies indicate that atrazine is one of the herbicides that effectively control maize weeds (Patel *et al.*, 2000; Bogdan, 2002; Perry *et al.*, 2004).

Effect of weed control treatments on maize growth and yield. Continuous weed infestation in the unweeded plots decreased all growth characters of maize (plant height and weight) compared with those of chemical and mechanical weed control treatments in the two seasons (Table II).

Table I. Effect of weed control treatments on fresh weight of weeds (kg/m²) during the two successive seasons (2002 and 2003).

Treatments	Season 2002					
	6 weeks after application			12 weeks after application		
	Grassy weeds	Broad leaved	Total weeds	Grassy weeds	Broad leaved	Total weeds
Simazine at 1 k /fed.	0.254	0.469	0.722	0.376	0.712	1.088
Ametryn at 1 kg/fed.	0.030	0.509	0.812	0.378	0.732	1.110
Simazine at 1kg/fed+Ametryn at 1kg/fed	0.025	0.269	0.294	0.189	0.297	0.486
Simazine at 2kg / fed.	0.217	0.249	0.467	0.264	0.312	0.576
Ametryn at 2 kg /fed.	0.203	0.243	0.449	0.297	0.412	0.709
Simazine at 2kg/fed+Ametryn at 2kg/fed	0.017	0.136	0.153	0.102	0.095	0.197
Hand hoeing (twice).	0.111	0.199	0.309	0.205	0.366	0.571
Hand hoeing (three times)	0.013	0.068	0.08	0.017	0.050	0.067
Unweeded	0.511	0.842	1.369	0.689	2.024	2.712
L. S. D at 5%.	0.035	0.068	0.102	0.085	0.075	0.118
			Season 2003			
Simazine at 1 kg /fed.	0.333	0.650	0.983	0.537	0.628	1.165
Ametryn at 1 kg /fed.	0.408	0.657	1.065	0.592	0.712	1.303
Simazine at 1kg/fed+Ametryn at 1kg/fed	0.054	0.469	0.523	0.188	0.497	0.686
Simazine at 2kg / fed	0.331	0.621	0.651	0.473	0.402	0.875
Ametryn at 2 kg /fed.	0.260	0.368	0.629	0.405	0.454	0.860
Simazine at 2kg/fed+Ametryn at 2kg/fed	0.047	0.120	0.167	0.020	0.097	0.116
Hand hoeing (twice).	0.192	0.301	0.494	0.271	0.331	0.602
Hand hoeing (three times).	0.016	0.030	0.045	0.014	0.041	0.054
Unweeded.	0.572	1.039	1.611	0.918	1.597	2.515
L. S. D at 5%.	0.102	0.136	0.142	0.060	0.118	0.116

Table II. Effect of weed control treatments on growth of maize plants during the two successive seasons (2002-2003)

Treatment	Season 2002					
	Plant height (cm)			Weight / Plant (G)		
	60 days	90 days	120 days	60 days	90 days	120 days
Simazine at 1 kg /fed	120.63	175.0	209.2	403.5	596.9	885.3
Ametryn at 1 kg /fed.	126.6	189.7	213.4	356.6	617.0	829.8
Simazine at 1kg/fed+Ametryn at 1kg/fed	135.83	190.2	233.0	473.0	639.6	955.8
Simazine at 2kg / fed.	131.63	204.9	216.0	356.6	718.1	1032.1
Ametryn at 2 kg /fed.	136.03	199.7	216.7	443.1	741.7	1048.2
Simazine at 2kg/fed+Ametryn at 2kg/fed	140.28	224.0	227.5	531.6	800.0	1193.8
Hand hoeing (twice).	139.73	201.1	217.9	452.2	746.5	1015.3
Hand hoeing (three times).	145.4	239.2	243.2	565.1	854.7	1421.0
Un weeded.	103.85	153.9	174.7	302.8	412.9	578.8
L. S. D at 5%.	8.45	12.13	14.10	60.96	52.75	98.62
				Season 2003		
Simazine at 1 kg /fed.	129.95	189.3	209.6	464.8	743.2	1033
Ametryn at 1 kg /fed.	135.48	196.7	215.3	440.6	685.3	1003.0
Simazine at 1kg/fed+Ametryn at 1kg/fed	142.55	203.8	228.7	566.5	731.2	049.2
Simazine at 2kg / fed.	133.75	212.4	219.0	478.4	760.3	974.2
Ametryn at 2 kg /fed.	134.73	211.8	230.2	479.0	689.8	1050.2
Simazine at 2kg/fed+Ametryn at 2kg/fed	146.88	237.4	236.2	634.1	841.5	1212.5
Hand hoeing (twice).	136.53	219.3	229.0	548.9	749.8	1001.5
Hand hoeing (three times).	150.4	245.9	256.7	617.0	1169.7	1484.8
Unweeded.	104.08	150.1	188.9	306.2	389.1	539.2
L. S. D at 5%.	8.90	11.83	10.10	68.29	184.48	111.56

Table III. Effect of weed control treatments on the yield and yield components of maize plant during the two successive seasons (2002-2003)

Treatments	Season 2002				
	Ear length(cm)	Ear weight (g)	Ear grainweight (g)	Weight 100 grain (g)	Yield Ton/fed
Simazine at 1 kg /fed	17.6	162.2	130.7	25.3	2.615
Ametryn at 1 kg /fed.	17.6	191.8	159.8	29.4	3.195
Simazine at 1kg/fed.+Ametryn at 1kg/fed.	19.5	163.2	133.2	31.6	2.667
Simazine at 2kg / fed.	18.3	174.9	141.9	34.1	2.539
Ametryn at 2 kg /fed.	17.4	206.8	168.0	34.9	3.360
Simazine at 2kg/fed.+Ametryn at 2kg/fed.	19.7	203.5	168.6	41.0	3.372
Hand hoeing (twice).	18.7	222.4	181.4	41.8	3.688
Hand hoeing (three times).	20.9	238.1	193.8	46.9	3.875
Unweeded.	15.0	123.6	98.8	17.9	1.976
L. S. D at 5%.	0.98	14.07	13.06	3.35	0.261
			Season 2003		
Simazine at 1 kg /fed.	19.9	175.1	139.0	29.4	2.781
Ametryn at 1 kg /fed.	22.7	189.9	160.9	36.3	3.217
Simazine at 1kg/fed.+Ametryn at 1kg/fed.	20.6	194.0	157.1	41.5	3.142
Simazine at 2kg / fed.	22.9	193.1	157.6	43.7	3.152
Ametryn at 2 kg /fed.	26.7	210.5	172.6	44.1	3.453
Simazine at 2kg/fed.+Ametryn at 2kg/fed.	22.7	220.2	180.6	44.2	3.611
Hand hoeing (twice).	25.8	226.4	193.7	48.7	3.874
Hand hoeing (three times).	31.1	241.8	205.9	54.2	4.118
Unweeded.	16.0	125.3	105.2	23.6	2.104
L. S. D at 5%.	4.18	15.51	12.98	5.85	0.259

In both seasons, the greatest increase in the plant height and plant weight was obtained by hand hoeing three times (Table II). This increase was 39, 146 and 36, 175%, respectively, compared with unweeded treatment. Similarly, herbicidal treatments increased the growth parameters measeared of maize, but with lesser degree relative to hand hoeing (Table II). This might be attributed to a better weed control efficiency for handhoeing treatment, compared with the other treatments. Similar results were obtained by Metwaly *et al.* (1994). Similar results were obtained by El-Bially (1995) and Ahmed (1999) how confirmed that hand hoeing twice was the best weed control treatment used in maize as compared with several herbicides. Also, Mekky (2001) indicates the superiority of hand hoeing twice to several herbicides in increasing increased maize yield.

Maize yield and yield components (ear length, ear

weight, ear grain weight and weight 100 grain) were increased with hand hoeing thrice more than applying herbicides alone combined, as compared with unweeded control (Table III). Salarzai (2001) reported the efficiency of atrazine in controlling the weeds and thus increasing maize yield. Maglhaes *et al.* (2000) obtained greatest maize yield by controlling weeds with paraquat + extavon and ametryn. In their study, post-emergence herbicide application was effective in controlling weeds with no phytotoxic effect.

For herbicids, simazine at 2 L/fed + ametryn at 2 L/fed were the most effective amongst the other herbicidal treatments in controlling weeds and increasing maize yield (ton/feddan) in both seasons (Table III). Although the elimination of weeds with chemical and mechanical treatment reduced weed infestation in the succeeding maize crop, mechanical treatment was more effective. This in turn favored the growth of maize, increased metabolic efficiency and consequently increased yield and yield components. Furthermore, weed eradication made more water and nutrients available for maize growth, which was reflected in the enhanced growth and thus yield.

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