



Research Article

Effect of weed control on weeds, grain yield and its components of maize (*Zea mays* L)

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ABSTRACT

The present study entitled “effect of weed control on weeds, grain yield and its components of maize (*Zea mays* L.) cv. Single cross-10 was carried out at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt. The experiment was conducted in the summer 2017 and was repeated in 2018 on the same piece of land to conform previous findings. The experiment design was Randomized Complete Block design (RCBD) having three replications. Six treatments include atrazine (1.0 kg/ha), glyphosate (0.8 kg/ha), atrazine + glyphosate, one hand hoeing after three weeks, hand hoeing twice after three and five weeks from sowing and weedy chick as control were used. Results indicated that glyphosate was found superior to atrazine for all studied characters. Moreover, lower weed dry matter accumulation and higher weed control % as well as higher values of ear characters (ear length, ear diameter, grain weight/ear and shilling %) and grain yield per unit area were recorded in tank mix application of atrazine + glyphosate followed by hand hoeing twice.

Keywords: Maize, yield, yield components and weed control.

INTRODUCTION

Maize (*Zea mays* L.) occupies the key place in the cropping system of Egypt for it is a short duration crop and provides a more economic return to the farmers. It is the third most important staple food crop both in terms of area and production after wheat and rice in Egypt. The total area under cultivation of maize in Egypt is about 1.03 million hectares which is about 25.2% of the total cultivated agricultural land, which the average yield is 8.3 t/ha (FAOSTAT, 2016). Therefore, increasing maize production is an important goal to reduce the gap between production and consumption through expanding the maize cultivated area and increasing productivity per unit area. Consequently, increasing maize production under Egyptian conditions is major concern of agronomists. Despite average yield of maize is very low. The reassures for low yield are many, but one of the most serious and less noticeable, is the competition of weeds. Weeds have such significant effects on crop yield because they interfere with normal growth of crop, through competition for nutrients, moisture, space, sunlight, carbon dioxide and water. Weeds also serve as host for various pests and deceases that produce chemical substances that can be allergens or toxins to crop plant. There are also indication that weeds limit the choice of crop rotation sequences and culture practices (Patel *et al.*, 2013). Moreover, weeds

constituent one of the major economic important problem for maize growers, because they can reduce yield up 80% (Konnann and Chinnagounder, 2013), 20 - 100 % (Madhaevi *et al.*, 2014), 83% (Ehsas *et al.*, 2016), 18 -855 (Jagadish *et al.*, (2016) and 335 (Kakade *et al.*, 2016). The mechanical method of weed control is however the most commonly used method, very laborious, time consuming and very expensive, especially in the hot. Many previous researchers found that the maximum and minimum weed density and dry weight of all major weed species were recorded in hand hoeing treatments (Ahmed and Susheela, 2103; Kumar *et al.*, 2013; Deshmukh *et al.*, 2014; Samanth *et al.*, 2015; Swetha *et al.*, 2016 and Kumar,2017). On the other hand, chemical control method is quick, more effect, time and labor saving method than others. Herbicides controlled 65 - 90% of weed flora and gave 100 -105% more maize yield than weedy cheek (Nadeem *et al.*, 2005). Consequently, the present study aimed to investigate the effect of weed control on weeds, grain yield and its components of maize (*Zea mays* L.)..

MATERIALS AND METHODS

The present study entitled “effect of weed control on weeds, grain yield and its components of maize (*Zea mays* L.) cv. Single cross-10 was carried out at the

Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt. The experiment was conducted in the summer season 2017 and was repeated in 2018 on the same piece of land to conform previous findings. The experiment design was Randomized Complete Block design (RCBD) having three replications. The net plot area was 10.5m² (5 ridges, 3m long and 70cm apart). The soil type was clay loam in texture having 1.7 organic matter, 48.2ppm available N, 14.5ppm available P, 367.5ppm available K, 7.7 pH and 2.4 mmohs/cm 25c⁰ Ec (average of both seasons). Six treatments include atrazine alone (1.5 kg/ha), glyphosate alone (0.8 kg/ha), atrazine + glyphosate, one hand hoeing after three weeks, hand hoeing twice after three and five weeks from sowing and weedy chick as control were used (Table 1).

Table 1: List of weed control treatments used in both season.

Trade name	Common name	Dose/ha
Atrazine	Basta	1.5 kg
Glyphosate	Touchdown (roundup)	0.8 kg
Atrazine + glyphosate	Basta + Touchdown (roundup)	1.5 kg+ 0.8kg
One hand hoeing	-	-
Two hand hoeing	-	-
Unweeded (control)	-	-

Two grains of Maize (cv. Single cross 10)) were sown manually in each hill at 25cm spacing and irrigation was followed. Date of sowing was in the fourth week of May in both seasons. Thinning to one plant/hill was done before the first irrigation (3 weeks after sowing). The recommended amount of nitrogen (urea 46.5%) and phosphorus (DAP) were applied. Half of nitrogen and the whole of phosphorus were drilled in ridges at the time of sowing and the remaining half of nitrogen was applied before the first irrigation. All other agronomic practices followed uniformly for all treatments through the growing seasons. Herbicides at the recommended doses were applied in the plots at 4th week after sowing of maize followed by irrigation. The herbicides were applied by a knapsack-sprayer using 700 L water/ha. The data on weed biomass was collected at 90 days after sowing from 1m² in each plot. The collected weeds were dried in the sun and then in a electrical oven for 48 hours maintain a constant temperature of 75c⁰. After drying, weight of dry weeds (g/m²) was measured. At harvest, plant height, grain weight/ear, 100-grain weight and grain yield per unit area were estimated. The recorded data were analyzed by using

statistical software package MSTAT-C (Michigan State University, 1990). Least significant differences (L.S.D.) at 0.05% probability was employed to test the significant differences among mean value of each treatment (Steel and Torrie, 1997).

RESULTUS AND DISCUTION

Effect on weeds

The results presented in Table (2) indicated that the experiments were infested with several broad leaf and grasses weeds.. The family Compositae included *Xanthum pogens*, while Ceperaceae included *Cyperus rotundus* and Euphorbiaceae included *Euphorbia geniculala*. The family Poaceae predominated the other families having three species viz. *Brachiaria eruciformis*, *Echinochloa colonum*, , *Cynodon dactylon*. Moreover, *Portulacaceae* and *Tiliaceae* included *Portulacaceae oleracea* and *Corchorus olitorius*, respectively (Table 2).

Table 2: Prevalled weeds in the experimental area in both season.

Botanical name	Family	English name
<i>Amaranthus oleraceae</i> L.	Amaranthaceae	Pigweed
<i>Xanthum pogens</i> L.	Compositae	Cocklebur
<i>Cyperus rotundus</i> L.	Cyperaceae	Purple Nutsedge
<i>Euphorbia geniculala</i> L.	Euphorbiaceae	Spurge
<i>Echinochloa colonum</i> L.	Poaceae	Grass Jungle
<i>Prachiaria eruciformis</i> L.	Poaceae	Broadleaf
<i>Cynodon dactylon</i> L.	Poaceae	Eermoda grass
<i>Portulacaceae oleracea</i> L.	Portulacaceae	Pursian
<i>Corchorus olitorius</i> L.	Tiliaceae	Nalta Jute

Concerning dry weight of weeds/m², results in Table (3) showed that atrazine plus glyphosate followed by hand hoeing twice reduced dry weight of weed/m² compared with other treatments. On the other hand, either atrazine alone or glyphosate alone and one hand hoeing were moderate in controlling grassy weeds compared to unweeded (control) in both seasons. Moreover, atrazine + glyphosate, hand hoeing twice, atrazine alone, glyphosate alone and one hand hoeing reduced the dry weight of total weeds by (84.1 and 114.7 gm), (69.7 and 78.5 gm), (34.5 and 35.1 gm), (24.6 and 25.1 gm) and (14.5 and 19.8 gm) than those that in control (112.6 and 135.3 gm) in both season,

respectively. Therefore, weed control (%) over the untreated control were (74.7 and 84.6%), (61.9 and 58.0%), (30.7 and 25.9%), 21.8 and 18.6%) and (12.9 and 14.6%) in both seasons, respectively. Generally, atrazine + glyphosate was the best in controlling weeds in maize followed by hand hoeing twice. On the other hand, glyphosate alone followed by one hand hoeing was the poorest in decreasing dry weight of total weeds in both seasons. The reduction in dry weight of weeds may be due to the phototoxic effect of herbicides on weeds. This findings are in harmony with the previous work of Madhavi *et al.* (2014), Samanth *et al.* (2015),

Stanzen *et al.* (2016), Kumar *et al.* (2017) and Suhoo *et al.* (2017) who reported that the minimum dry weight of all major weed species and the maximum grain yield of maize were recorded in two hand hoeing and application of different herbicides. Moreover, Tahir (2007) indicated that the lower weed dry weight due to herbicide and manual hoeing application over weedy check might have been due to the mortality of weeds in these treatments while, the maximum weed dry weight was found in weedy check due to unchecked weed growth as no weed control practices were applied.

Table 3: Effect of weed control treatments on dry weight of total weeds (gm/m²) and weed control (%) in both seasons.

Treatments	Dry weight of total weeds	Weed control (%)	Dry weight of total weeds	Weed control (%)
	First season (2017)		Second season (2018)	
Atrazine	78.1	30.6	100.2	25.9
Glyphosate	88.0	21.8	110.2	18.6
Atrazine + glyphosate	28.5	74.9	20.6	84.8
One hand hoeing	98.1	12.9	115.5	14.6
Two hand hoeing	42.9	61.9	56.8	58.0
Nunweeded (control)	112.6	00.0	135.3	00.0
L.S.D.	8.3		6.8	

Table 4: Effect of weed control treatments on plant height, ear length, grain weight/ear, 100-grain weight and grain yield in the first season.

Treatments	Plant height (cm)	Ear length (cm)	Grain Weight /ear (g)	100-grain Weight (g)	Grain Yield (t/ha)	Relative increase (%) increase
Atrazine	269.1	21.4	224.1	39.1	3.7	48.0
Glyphosate	267.2	21.2	215.5	36.9	3.3	32.0
Atrazine + Glyphosate	273.3	23.9	230.2	43.1	4.6	84.0
One hand hoeing	265.1	21.0	210.3	37.5	3.9	56.0
Two hand hoeing	271.2	22.9	227.2	41.3	4.2	68.0
Nunweeded (control)	260.0	20.8	160.5	33.2	2.5	00.0
L.S.D.	2.1	1.0	3.0	2.2	0.4	

Table 5: Effect of weed control treatments on plant height, ear length, grain weight/ear, 100-grain weight and grain yield in the second season.

Treatments	Plant height (cm)	Ear length (cm)	Grain weight /ear (g)	100-grain Weight (g)	Grain Yield (t/ha)	Relative increase (%) increase
Atrazine	270.1	20.2	210.1	40.3	3.8	65.2
Glyphosate	268.6	20.1	205.3	38.7	3.5	52.2
Atrazine + Glyphosate	276.2	23.3	225.3	44.1	4.4	91.3
One hand hoeing	266.8	20.3	200.1	35.8	3.1	34.8
Two hand hoeing	272.5	22.7	220.2	42.5	4.1	78.3
Nunweeded (control)	262.1	20.2	165.3	34.2	2.3	00.0
L.S.D.	3.8	2.3	4.3	1.6	0.3	

Effect on grain yield and its related traits

The final grain yield of maize crop is a function of combined effect of ear characters and number of ears per unit area which were affected by the management practices. The results presented in Table (4 and 5) revealed that plant height, ear length, grain weight/ear,

100-grain weight and grain yield per unit area were significantly affected with all tested treatments in both seasons. The tallest plants (273.3 and 276.2 cm), the highest ear length (23.9 and 23.3 cm), the highest grain weight/ear (230.2 and 225.3 gm) the highest 100-grain weight (43.1 and 44.1) and the highest grain yield (4.6 and 4.4 t/ha) were recorded with application of atrazine

+ glyphosate in both seasons, respectively. On the other hand, the other evaluated treatments showed an intermediate effect. Moreover, weed infested plots gave the shortest plants (260.0 and 262.1 cm), shortest ear length (20.8 and 20.2 cm), lowest grain weight/ear (160.5 and 165.3 gm), lowest 100-grain weight (33.2 and 34.2 gm) and the lowest grain yield (2.5 and 2.3 t/ha) in both season, respectively. It is quite clear from the demonstrated results that application of atrazine + glyphosate significantly increased grain yield by 84% in the first season and by 91% in the second one over the infested control. Such results may be due to the better control of weeds by mixture of the two tested herbicides which contribute to higher grain yield. The increment in grain yield was mainly because of more ear length, grain weight/ear and 100-grain weight over weedy check which recorded the lowest grain yield could be attributed to maximum weed density which suppressed the growth and development of maize plants by competing for moisture, light and nutrients (Tahir, 2009). These results are agreement with those obtained by many researchers (Stanzen *et al.*, 2016; Kumar *et al.*, 2017; and Sahoo *et al.*, 2017) who reported that either herbicides or hand hoeing significantly decreased weed population and competition over control and maximum grain yield was obtained.

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