EFFECT OF SOME HERBICIDES ON SORGHUM SEEDLING CHARACTERS, WEED CONTROL AND SEED BORNE FUNGI

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Abstract

Two field experiments were conducted at Sakha Agriculture Research Station, Agriculture Research Center, Kafr El-sheikh Governorate, Egypt during 2012 and 2013 seasons to determine the effect of some herbicides on seedlings characters and its reflection on plant growth and yield of sorghum. Each experiment included seven treatments in a complete randomized block design. Results revealed that five herbicides i.e. acetochlor at 900 g a.i/fed (Vern 90% EC), acetochlor at 840 g a.i/fed (Harness 84% EC), pendimthalin at 773.5 g a.i./fed (Stomp Extra 45.5% CS), butralin at 1200 g a.i./fed (Amex 48% EC) and metribuzin at 210 g a.i./fed (Metribuzin El-Nasr 70% WG) increased germination percentage and seedlings growth of sorghum. These herbicides gave satisfactory effect in controlling both annual broadleaf and grassy weeds and had wide spectrum for controlling weed species grown with sorghum plants at more than 80 % which reflected on increasing plant growth and yield, and was superior than hand hoeing (twice) during the two growing seasons. Therefore, such herbicides can be applied in sorghum field. The above mentioned herbicides at 0, 1000 and 2000 µg ml^{-1} were used to treat sorghum grains after harvest. The results showed also that acetochlor at 900 g a.i./fed (Vern 90%), acetochlor at 840 g a.i./fed (Harness 84%), pendimethalin at 773.5 g a.i./fed (Stomp Extra 45.5%) at 2000 µg ml^{-1} level, were very effective in inhibiting the growth of grain-born fungi.

Key word: Weeds, Sorghum bicolor, seed-borne fungi

INTRODUCTION

Sorghum is an important crop, used for food as grain; sorghum syrup or "sorghum molasses"; and fodder. In Egypt, sorghum is one of the most important summer cereals for both human and animal consumption, grown for grain and forage. The cultivated area is about 380000 feddans producing about 6.5 million ardab of grain yield in 2012 year[1]*. Damping off and seedling blight of sorghum caused by several soil borne fungi i.e *Pythium sp.*, *Fusarium moniliforme, Fusarium semitectum, Fusarium Alternaria alternate, Alternaria solani, Epicocum nigrum and Nigrospora*

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oryzae are the most important fungal diseases in Egypt (Samar El-sayed 2014), Altman and Campppbell (1977); Pupavizas and Leuris (1979) reported that herbicides may affect pathogen growth, sporulation, propagules germination, inoculum density, survival in soil and competitive saprophytic ability. These effects could be brought about by several mechanisms, such as direct effects on the pathogen and virulence, on host susceptibility and on other competitive or inhibitory microorganisms. Hance (1980) indicated that the majority of field studies revealed that many herbicides decrease soil –borne diseases. There is a wide variety of physiological and biochemical effects which herbicides can have on crops at doses below those which are deference's to yield or health. The apparently minor effects may influence the crops susceptibility to disease. Cook and Hutter (1981), Shebayan (1982) and Govedarica *et al* (2001) reported that, herbicides affect soil microbes indirectly, through different mechanisms. Lynch (1983) showed that, herbicides derived from carbamic acid are decomposed microbiologically, chemically, and photochemically. Among the fungi affected by herbicides *Rhizopus spp., Aspergillus spp., and Penicillium spp.* and among the bacteria are *Pseudomonas sp.* and *Bacillus sp*. In general, herbicides mode of action depend on concentration, and chemical composition. Moreover, Lipsa *et al* (2010). found that, the populations of soil fungi and bacteria were affected by treatment with herbicide (S-metolachlor). Significant decreases in soil biological activity with all herbicide applied, and the increase of herbicide dose may kill some soil microorganisms. Ishaya *et al*. (2007) found that, pretilachl or+dimethametryne at 2.5 kg a.i./ha, cinosulfuron at 0.05 kg a.i./ha and piperophos + cinosulfuron at 1.5 kg a.i./ha effectively controlled weeds and increased crop vigour, plant height and grain yield of sorghum. Raghuvanshi *et al*. (1990) and layoke *et al*. (1990) showed that weeds reduced 14 – 54 and 40 - 86% of sorghum forage yield and grain yield by 14-54% and 40-86 % respectively. In Egypt, there is no official recommendation of herbicides for weeds in sorghum, therefore, the present investigation aims to find some suitable herbicides to control weeds in sorghum fields and to study their effects on grain-borne fungi.

MATERIALS AND METHODS

Two field experiments were conducted at Sakha Agricultural Research Station, Kafer El-Sheikh during 2012 and 2013 seasons. The aim of this investigation, is to study the effect of herbicides on some seedlings characters as well as grain yield of sorghum hybrid 888 (*Sorghum bicolor*, L. Moench), using six weed control treatments. Sorghum

was sown on 15 and 10 June in the 2012 and 2013 seasons, respectively, and harvested on 20, September in 2012 and 2013 seasons.

The experimental design used was randomized complete block design, with four replicates. The plot area was 6.3 m^2 ((3.0m length and 2.1 m width) and included three ridges with 70 cm distance. Each ridge contained 15 hill at 20 cm distance and 3 seeds/ hill. Seedlings were thinned to secure the required number of plants before the second irrigation. The weed control treatments used were as follows:

A. Acetochlor [2-chloro-*N*-(ethoxymethyl)-*N*-(2-ethyl-6-methylphenyl) acetamide], known commercially as Harness 84% EC, was applied at 840.0 g a.i./fed.

B. Acetochlor [2-chloro-*N*-(ethoxymethyl)-*N*-(2-ethyl-6-methylphenyl) acetamide], know commercially as Vern 90% EC, was applied at 900.0 g a.i./fed.

C. Pendimethalin[*N*-(1-ethylpropyl)-3,4-dimethyl-2,6-dinitrobenzenamine], known commercially as Stomp Extra 45.5% CS, was applied at 773.5 g a.i./fed.

D. Butralin [4-(1,1-dimethylethyl)-*N*-(1-methylpropyl)-2,6-dinitrobenzenamine], known commercially as Amex 48% EC, was applied at 1200.0 g a.i./fed.

E. Metribuzin [4-amino-6-*tert*-butyl-4,5-dihydro-3-methylthio-1,2,4-triazin-5-one;4-amino-6-*tert*-butyl-3-methylthio-1,2,4-triazin-5(4*H*)-one], known commercially as Metribuzin El-Nasr 70% WG, was applied at 210.0 g a.i./fed.

All herbicides were applied as surface spraying after sowing.

F. Hand weeding (twice) after at 15 and 30 days from sowing.

G. Untreated check.

Table (a). Chemical group and mode of action of the herbicides used according to Ashton and Crafts (1981).

Herbicides	Chemical group	Mode of action in plants
Acetochlor (Vern 90% EC) Acetochlor (Harness 84% EC)	Chloroacetamides	meristem mitotic disruptors in root cell division.
Pendimethalin (Stomp Extra 45.5% CS) Butralin (Amex 48 % EC)	Dinitroanilines	meristem shoot inhibitors in shoot cell growth and division.
Metribuzin (Metribuzin El-Nasr 70% WG)	Triazines	photosynthesis II inhibitors block the hill reaction within light cannot be converted to chemical energy.

The herbicides were sprayed by knapsack sprayer CP3 prepared in water volume of 200 liters per faddan immediately prior of irrigation. The preceding winter crop in the two seasons was barley. The cultural practices for sorghum were applied accordance to local recommendations.

The collected data recorded were as follows:

A- Effect of herbicidal treatments on germination percentage and seedlings growth of sorghum under field conditions:

One week after planting, the germinated seeds was recorded and estimated as described by Gopinath *et al*. (1987) as follow:

$$\text{I- Germination \%} = \frac{\text{No. of emerged seedlings}}{\text{No. of planted seeds}} \text{ X100}$$

II- Length (cm) and dry weight of shoot and root (g)/ 15 seedlings were also estimated.

III- Vigour index (VI) of seedlings was estimated according to the method adapted by Purushotham *et al*. (1996) as follow:

Vigor index (VI) = (mean root length + mean shoot length) X percentage of seed germination.

B – Dry weight of weeds (g/m^2):-

Weeds were randomly hand pulled from one square meter of each plot after 45 and 75 days from sowing and separated into broadleaf and grassy.

Weight was determined as (g/m^2) after drying in a forced draft oven at 70 C° for 48 hours.

Reduction percentage (R %) in annual weeds, was calculated according Topps and Wain (1957): R% = (A-B)/A X100

Where: A =dry weight of weeds in untreated plot.

B = dry weight of weeds in treated plot.

C –Weeds susceptibility to herbicides:

The susceptibility of weeds species to herbicides was measured after 45 days from sowing depending on the reduction percentage of the dry weight of each species compared to the un-weeded check according to Frans and Talbert (1977) as: Susceptible (S) = > 90 %, Moderately susceptible (MS) =80 - 89 %, Moderately tolerant (MT) = 60 -79 %, and Toleran (T) = < 60% .

Five broadleaf and two grassy weeds were evaluated.

D - Growth characters and yield components:

At harvest time:

1-Samples of ten plants were collected at random from the central ridges of each plot to assess the following: plant length (cm); plant weight (g) and leaf area index (LAI) .Leaves of the fresh samples of wheat plants were separated and used in leaf area determination. Leaf area was measured using leaf area meter (Model LI.3000 A).

2- Forage yield kg/plot and grain yield kg/plot. were determined from each plot and was extrapolated to yield per Fadden.

E- Effect of the tested treatments on seed health:

After harvest, samples (1/2 kg) of sorghum grain hybrid 888 (susceptible hybrid to seed rot diseases) were taken from each replicate and surface sterilized using 1% sodium hypochlorite solution for 3 minutes. It, washed several times in sterilized water, and blotted between two sterilized filter papers. One hundred seeds were treated by each tested herbicide for each concentration (1000 and 2000 µg ml^{-1}). Twenty five grains were transferred in each of four 9cm Petri dishes on moist filter paper and incubated at 27º ± 1 C° for 7 days [ISTA, 1999]. The development fungi was counted as the number of seeds contaminated with growth of each fungal / Petri dish according to Gopinath *et al*. (1987) and percentages were calculated.

Statistical analysis:

The obtained data were subjected to analysis of variance according to Gomez and Gomez (1984). Treatment means were compared by Duncan's Multiple Range Test (Duncan, 1955). All statistical analysis was performed using analysis of variance technique by means of MSTAT-C computer software package.

RESULTS AND DISCUSSION

A: Effect of herbicidal treatments on seedling characters in sorghum:

Data presented in Table (1) showed that all the tested herbicides significantly increased the germination %, comparing with control treatment. Soil treatment with acetochlor at 900 g a.i./fed, acetochlor at 840 g a.i./fed, pendimethalin at 773.5 g a.i./fed were the most effective in increasing germination percent (96.0, 93.0 and 91.7 % during 2012 and 94.0, 92.3 and 90.3 % during 2013, respectively) as compared with control treatment which recorded 80.0 and 82.0 germination percentage during 2012 and 2013 growing seasons, respectively. Similar, findings were obtained by Govedarica *et al* (2001), who found that, herbicides affect soil microbes indirectly. Herbicides may be a source of nutrition for microbes, in this case, they significantly affect microbial growth and multiplication. However, herbicides also affect the microbes physiologically by changing their biosynthetic mechanism, by affecting protein biosynthesis, by affecting plant growth regulators and if they applied in high doses, they may kill microorganisms.

With regard to seedling growth characters (length, fresh and dry weight of shoot and root), soil herbicides treatment with acetochlor at 900 g a.i./fed, acetochlor at 840 g a.i./fed , pendimethalin at 773.5 g a.i./fed were the most effective and suitable way for producing healthy and strong seedling, because the soil treatment by them led to increase shoot and root length (the length of shoot and root were 31.67 and 13.83 cm with acetochlor at 840 g a.i./fed, 31.17 and 13.00 cm with pendimethalin at 773.5 g a.i./fed was 35.33 and 14.83 cm with acetochlor at 900 g a.i./fed, respectively during season 2012. Dry weight of shoot and root were 1.57 and

0.50 g with acetochlor at 840 g a.i./fed, 1.37 and 0.54 g with pendimethalin at 773.5 g a.i./fed and 2.74 and 0.78 g with acetochlor at 900 g a.i./fed, respectively during 2012 growing season. Seedling vigour index (VI) were 42.01, 40.04 and 47.99 with acetochlor at 840 g a.i./fed, pendimethalin at 773.5 g a.i./fed and acetochlor at 900 g a.i./fed, respectively, during season 2012. On the other hand, the soil treatment with butralin at 1200 g a.i./fed and metribuzin at 210 g a.i./fed, had low effect in increasing germination percentage and were also had low effect in enhancement of growth seedling characters as comparing with control treatment, during 2012 growing season. In the same line and recorded similar trends for the effect of soil treatment by tested herbicides on increasing of germination % and also effect of them on enhancement of seedling growth characters, during 2013 growing season. Similar, results were obtained by Lipsa *et al*. (2010) in that, the population of soil fungi and bacteria were affected by treatment with the herbicide (S- metalochlor). The analysis of the total number of microorganisms in the sampling soils, before (the control soil) and after herbicide application, shown significant decreases of soil biological activity in all variants where herbicide was applied. The increase of herbicide dose may kill most soil microorganisms.

Table 1. Effect of some herbicides on germination %, length, fresh and dry weight of shoot and root of sorghum seedling during 2012 and 2013 seasons.

Treatments	2012 season					
	Germination %	Seedling growth				
	Seed germination %	Length (cm)		Dry weight (g)		VI
		Shoot	Root	Shoot	Root	
Acetochlor (840.0 g a.i./fed)	93.00 b	31.67b	13.83ab	1.57c	0.50b	42.01b
Acetochlor (900.0 g a.i./fed)	96.00 a	35.33a	14.83a	2.74a	0.78a	47.99a
Pendimethalin (773.5 g a.i./fed)	91.67 b	31.17b	13.00b	1.37c	0.50b	40.04b
Butralin (1200.0 g a.i./fed)	87.33 c	29.00c	11.17c	0.81d	0.42bc	34.23c
Metribuzin (210.0 g a.i./fed)	87.33 c	27.33d	9.83d	0.75d	0.38c	32.45c
Hand hoeing twice	82.33 d	29.33c	11.17c	2.10b	o.46bc	33.48c
Untreaded check	80.00 d	28.99c	11.00c	2.00b	0.44c	32.5c
	2013 season					
Acetochlor (840.0 g a.i./fed)	92.33 b	30.33b	13.17b	1.52c	0.47b	39.89b
Acetochlor (900.0 g a.i./fed)	94.00 a	34.33a	14.50a	2.41a	0.71a	45.63a
Pendimethalin (773.5 g a.i./fed)	90.33 b	29.67b	12.17c	1.33d	0.43bc	37.58c
Butralin (1200.0 g a.i./fed)	87..67 c	28.00c	10.50d	0.75e	0.38cd	33.55d
Metribuzin (210.0 g a.i./fed)	86.00c	27.00c	9.50e	0.71e	0.35d	31.22f
Hand hoeing twice	82.67 d	28.00b	10.83d	1.87b	o.42bc	31.67e
Untreaded check	82.00 d	27.99c	10.00de	1.83b	0.40bc	31.5e

Means followed by the same alphabetical letters were not statistically significant according to Duncan;s multiple range test. VI= seedling vigour index

B -Effect of weed control treatments:

I – On weeds:-

Table (2) showed that the infestation rates with the annual broadleaf and grassy weeds (dry weight g/m^2) were 2.64 ton and 4.55 ton/fed. with total 7.19 of total weeds respectively after 75 days from sowing in 2012 season, while it were 3.77 ton and 2.60 ton with total weeds by 6.37 ton/fed., respectively, in 2013 season. In general, all weed control treatments gave significant reduction on the two categories of the annual weeds (dry weight g/m^2). However, the herbicidal treatments were superior than hand hoeing treatment compared to untreated control. That was true in two assessments and both seasons. acetochlor at 900 g a.i./fed (Vern 90%), acetochlor at 840 g a.i./fed (Harness 84%), pendimethalin at 773.5 g a.i./fed (Stomp Extra 45.5%) and at butralin at 1200 g a.i./fed (Amex 48%), metribuzin at 210 g a.i./fed (Metribuzin El-Nasr 70%) followed by hand hoeing twice gave the significant reduction on broadleaf weeds by 87, 82, 80.5, 75, 74.3 and 73.1%, respectively; in after 45 days from sowing survey and 90.8, 88.1, 83.3, 79, 77.3 and 74.3%, repetitively; in after 75 days from sowing survey in first season. While, the previous respective treatments gave the redaction percentage on the grassy weeds by 86.6, 85.1, 82.8, 77.1, 76.1 and 74.5%, respectively, after 45 days from sowing survey; and 90, 87, 85.4, 80.8, 75.5 and 72.4%, respectively, after 75 days from sowing survey. The same trend was observed on reduction two categories of the annual weeds in the second season. acetochlor at 900 g a.i./fed, acetochlor at 840 g a.i./fed, pendimethalin at 773.5 g a.i./fed and at butralin at 1200 g a.i./fed, metribuzin at 210 g a.i./fed and hand hoeing twice treatments gave reduction percentage on the broadleaf weeds by 85.1, 82.5, 79.2, 73.3, 72 and 71.7%, respectively, in 1st after 45 days from sowing survey, 90.9, 89, 87, 80.4, 77.8 and 77.2%, respectively, in 2nd after 75 days from sowing survey. Meanwhile; the reduction percentage for grassy weeds by the previous respective treatments reached to 87.8, 84.6, 83, 79.7, 76.8 and 73.7%, respectively, in 1st survey, and 89.5, 87.3, 84.2, 79, 74.7 and 74.4%, respectively, in 2nd after 75 days from sowing survey.

Table 2. Effect of treatments on dry weight of broadleaf, grasses and total annual weeds ($g/m^{2)}$ after 45 and 75 days from sowing in 2012 and 2013 seasons.

Weed control treatments	2012 season					
	45 days after sowing			75 days after sowing		
	Broadleaf g/m^2	Grasses g/m^2	Total g/m^2	Broadleaf g/m^2	Grasses g/m^2	Total g/m^2
Acetochlor (840.0 g a.i./fed)	64.3 c	38.8 c	98.00 d	74.8 bc	141.3 cd	216.0 cd
Acetochlor (900.0 g a.i./fed)	42.8 d	35.0 c	77.75 d	57.8 c	108.3 d	166.0 d
Pendimethalin (773.5 g a.i./fed)	64.3 c	44.8 bc	109.00 cd	105.0 bc	157.8 bcd	262.8 cd
Butralin (1200.0 g a.i./fed)	81.8 bc	59.5 b	141.25 bc	131.8 bc	208.0 bcd	339.8bc
Metribuzin (210.0 g a.i./fed)	84.5 b	62.3 b	146.75 b	142.5 bc	265.0 bc	407.5 b
Hand hoeing twice	88.5 b	64.0 b	154.75 b	161.0 b	298.3 b	459. 3 b
Untreaded check	316.8 a	260.3 a	589.50 a	627.5 a	1083 a	1710 a
	2013 season					
Acetochlor (840.0 g a.i./fed)	36.8 c	26.8 cd	63.5 de	98.3 b	78.8 c	177.0 d
Acetochlor (900.0 g a.i./fed)	31.3 c	21.3 d	52.5 e	81.8 b	65.3 c	147.0 d
Pendimethalin (773.5 g a.i./fed)	43.7 bc	29.5 cd	73.3 cde	108.8 b	98.3 bc	214.5 cd
Butralin (1200.0 g a.i./fed)	56.0 b	35.3 bcd	91.3 bcd	176.3 b	130.0 bc	306.8 bc
Metribuzin (210.0 g a.i./fed)	58.8 b	40.3 bc	99.0 bc	198.8 b	157.0 b	335.8 b
Hand hoeing twice	59.5 b	45.8 b	105.3 b	204.3 b	159.0 b	363.3 b
Untreaded check	210.0 a	173.8 a	383.8 a	897.0 a	620.0 a	1517 a

Means followed by the same alphabetical letters were not statistically significant according to Duncan;s multiple range test.

As for the decreasing dry weight of the total weeds, it was noticed that the herbicidal treatments as well as hand hoeing were significantly effective and identical the result obtained on each individual weeds class without change in arrange in both seasons.

Weed control treatments depressed the total dry weight weeds which could be arranged in a descending order as follows: acetochlor at 900 g a.i\fed, acetochlor at 840 g a.i\fed , pendimthalin at 773.5 g a.i.\fed, butralin at 1200 g a.i.\fed and metribuzin at 210 g a.i.\fed and hand hoeing twice (73.7%) treatments at after 45 days from sowing, and 90.3, 87.4, 84.6, 80.1, 76.2 and 73.1%, respectively, at after 75 days from sowing, in the first season; and whilst, the reduction percentage by the previous respective treatments were 86.3, 83.5, 80.9, 76.2, 74,2 and 72.6%, at after 45 days from sowing, and 90.3, 88.3, 85.9, 79.8, 76.5 and 76.1%, respectively, at after 75 days from sowing, in the second season. Similar results were obtained by Mahelle and Seth (1992) who found that applying pre-emergence herbicides decreased dry weight of weeds in sorghum field by 43 – 75%.

C - Weed species susceptibility to herbicides:

The susceptibility scores of seven weed species to six herbicides according to the scale used by Frans and Talbert (1977) was measured depending on the reduction % of the dry weight of each species in g/m^2 of any herbicide compared with untreated

check was measured as mentioned in Table (3), that through 2012 and 2013 seasons, *Corchorus olitorius*, *Xanthium strumarium*, *Amaranthus album*, *Portulaca olerocea*, and *Ammania aegyptiaca* as annual broadleaf and *Echionchloa colona* and *Dinebra retroflexa*, as annual grassy weeds were susceptible (S) and moderate susceptible (MS) to acetochlor at 900.0 g a.i./fed. and acetochlor 840.0 g a.i./fed ranged between 86-97%. The other herbicides such as pendimethalin at 773.5 g a.i./fed, butralin at 1200.0 g a.i./fed. and metribuzin at 210.0 g a.i./fed. gave the moderate susceptible response (MS) to the previous weeds species meaning that the 5 herbicides had wide spectrum of weed control.

Table 3. Susceptibility score of seven weed species to used herbicidal weeds after 45 days from application during 2012 and 2013 summer seasons.

Characteristic	2012 season						
	Controlling % & weeds species susceptibility to herbicides						
Weed species	Species of an annual broadleaf weeds					Species of an annual grassy weeds	
Herbicides	*Corchorus olitorius*	*Xanthium strumarium*	*Portulaca olerocea*	*Ammania aegyptiaca*	*Amaranthus album*	*Echionchloa colona*	*Dinebra retroflexa*
Acetochlor (840.0 g a.i./fed)	94 (S)	86 ((MS)	90 (S)	91 (S)	89 (MS)	90 (S)	91 (S)
Acetochlor (900.0 g a.i./fed)	97 (S)	91 (S)	96 (S)	91 (S)	91 (S)	91 (S)	91 (S)
Pendimethalin (773.5 g a.i./fed)	89 (MS)	82 (MS)	87 (MS)	89 (MS)	88 (MS)	86 (MS)	89 (MS)
Butralin (1200.0 g a.i./fed)	84 (MS)	81 (MS)	82 (MS)	87 (MS)	87 (MS)	81 (MS)	88 (MS)
Metribuzin (210.0 g a.i./fed)	80 (MS)	81 (MS)	80 (MS)	81 (MS)	84 (MS)	81 (MS)	81 (MS)
	2013 season						
Acetochlor (840.0 g a.i./fed)	94 (S)	87 (MS)	96 (S)	95 (S)	88 MS	92 S	92 S
Acetochlor (900.0 g a.i./fed)	97 (S)	91 (S)	96 (S)	95 (S)	90 S	92 S	93 S
Pendimethalin (773.5 g a.i./fed)	89 (MS)	89 (MS)	87 (MS)	89 (MS)	86 MS	88 MS	89 MS
Butralin (1200.0 g a.i./fed)	84 (MS)	85 (MS)	86 (MS)	86 (MS)	84 MS	82 MS	88 MS
Metribuzin (210.0 g a.i./fed)	81 (MS)	81 (MS)	84 (MS)	81 (MS)	83 MS	80 MS	81 MS

Susceptible (S) = > 90 %. Moderately susceptible (MS) = 80 - 89 %
Moderately tolerant (MT) = 60 - 79 %. Tolerant (T) = < 60%

D- Effect of weed control treatments on growth characteristics and yield of sorghum:

It can be seen in table (4) that all herbicides as well as hand hoeing treatments favorably affected growth characteristics and yield of sorghum, with increasing significant effect except with plant height (cm). Also, their values were higher when the weed control treatments were more efficient. That was true in both seasons. Weed control treatments, however significantly affected the plant weight (g) in the both seasons. The increasing values of plant weight (g) was obtained by acetochlor at 900 g a.i.\fed with 164.1 and 242, respectively., acetochlor at 840 g a.i.\fed with 96.9 and 183.1, pendimethalin at 773.5 g a.i.\fed by 85.5 and 158.1; butralin at 1200 g a.i./fed by 59.2 and 91.5 metribuzin at 210 g a.i./fed with 52.8 and 105.7; followed by hand hoeing twice 48.7 and 91, respectively; in the both season. Acetochlor at 900 g a.i./fed gave increasing value for LAI by 6.4 and 8.4; acetochlor at 840 g a.i./fed with 5.4 and 5.9; pendimethalin at 773.5 g a.i./fed by 5.1 and 4.6; butralin at 1200 g a.i./fed by 3.6 and 3.4; metribuzin at 210 g a.i./fed with 2.1 and 2.9; and hand hoeing twice 1.7 and 2.7; respectively.

With regard to forage yield (ton/fed) and grain yield (ardab/fed) in 1st season, the highest increasing values were obtained by acetochlor at 900 g a.i./fed with 3.7 t/fed and 3.3 ardab/fed, respectively; acetochlor at 840 g a.i./fed with 3 t/fed and 2.6 ardab/fed; pendimethalin at 773.5 g a.i./fed by 2.6 t/fed and 2 ardab/fed; butralin at 1200 g a.i./fed by 1.3 t/fed and 1.2 ardab/fed; metribuzin at 210 g a.i./fed with 1.6 t/fed and 1.3 ardab/fed; and hand hoeing twice 1.2 t/fed and 1.2 ardab/fed; respectively.

In the 2013, acetochlor at 900 g a.i./fed gave increasing values for forage and grain yield by 4.1 t/fed and 5.6 ardab/fed, respectively; acetochlor at 840 g a.i./fed with 3.5 t/fed and 3.3 ardab/fed; pendimethalin at 773.5 g a.i./fed by 2.2 t/fed and 3.1 ardab/fed; butralin at 1200 g a.i./fed by 2 t/fed and 1.8 ardab/fed; metribuzin at 210 g a.i./fed with 1.5 t/fed and 2.2 ardab/fed; and hand hoeing twice 1.2 t/fed and 2.2 ardab/fed; respectively. The increases in forage and grain yield are attributed to the increases in plant weight and leaf area index (LAI). This was attributed to the decrease of weed / sorghum competition. Raghuvanshi *et al*. (1990) and layoke *et al*. (1990) showed that weeds reduced 14 – 54 and 40 - 86% of sorghum forage yield or dry matter and the reduction in grain yield reached 85% in the presence of weeds competition. Ismail (2003) indicated that plant height was not significantly affected by weed control treatments in both seasons.

Table 4. Effect of weed control treatments on growth characteristic and yield of sorghum in 2012 and 2013 seasons.

Characteristic / Herbicides	2012 season					2013 season				
	Plant height (cm)	Plant weight (g)	LAI	Forage yield ton/fed	Grain yield ardab/fed.	Plant height (cm)	Plant weight (g)	LAI	Forage yield ton/fed	Grain yield ardab/fed.
Acetochlor (840.0 g a.i./fed)	142.8a	331.4ab	11.9ab	8.2 a	11.9 a	155.5a	410.0 ab	10.7ab	9.3a	10.7 a
Acetochlor (900.0 g a.i./fed)	148.3a	398.6a	12.6a	8.9 a	12.6 a	165.7a	468.9 a	12.3a	9.9a	12.3 a
Pendimethalin (773.5 g a.i./fed)	144.7a	320.0ab	11.6ab	7.8 ab	11.3ab	145.7a	385.0 ab	9.8b	8.0 ab	9.8 ab
Butralin (1200.0 g a.i./fed)	145.7a	293.7b	10.5b	6.5 b	10.5 bc	154.9a	318.4 b	8.9b	7.8b	8.5 b
Metribuzin (210.0 g a.i./fed)	143.9a	287.3bc	9.3b	6,8 b	10.6 bc	155.7a	332.6 bc	8.7bc	7.3b	8.9 b
Hand hoeing twice	147.8a	283.2c	9.0c	6.4 b	10.5 bc	153.6a	317.9 c	8.5bc	7.0bc	8.9 b
Untreaded check	140.5a	234.5d	7.7e	5.2 c	9.3 c	156.6a	226.9 d	6.7c	5.8c	6.7 c

Means followed by the same alphabetical letters were not statistically significant according to Duncan's multiple range test.

Table 5. Effect of herbicides on the % of emerging fungal species from sorghum grains (% grains growing fungal growth).

Herbicides	Concentration µg ml^{-1}	*Fusarium moniliforme*	*Fusarium semitectum*	*Fusarium oxysporum*	*Curvulavia lunata*	*Aspergillus niger*	*Aspergillus flavus*	*Penicilium sp.*	*Alternaria alternata*	*Alternaria solani*	*Epicocum nigrum*	*Nigrospor a oryzae*
Untreaded (control)	0	15.33 a	5.00 a	4.67 a	7.33 a	6.67 a	5.33 a	3.33 a	6.67 a	6.00 a	4.33 a	3.00 a
Acetochlor (Harness 84%)	1000	13.7 cd	4.33 a	3.67 a	4.33 c	4.00 c	3.67 bc	2.67 b	4.33 cd	4.33 cd	2.67 c	1.33 b
	2000	6.67 e	2.00 b	1.33 b	2,33 d	1.67 d	1.67 c	1.33 c	1.67 e	2.00 e	1.33 c	0.00 c
Acetochlor (Vern 90%)	1000	13.0 d	4.00 a	3.67 a	4.67 bc	3.67 cd	3.33 bc	2.33 cb	4.00 d	3.67 d	2.00 c	1.00 b
	2000	5.33 f	1.33 c	1.00 c	2.00 d	1.67 d	1.67 c	1.00 c	1.33 e	1.67 e	1.00 c	0.00 c
Pendimethalin	1000	14.0 bc	4.33 a	4.00 ab	4.67 bc	4.33 bc	4.33 b	3.67 a	4.67 bc	4.33 cd	3.33 ab	1.33 b
	2000	7.33 e	2.00 b	1.33 b	2.33 d	2.00 d	2.00 c	1.67 bc	2.33 bc	2.67 cd	2.00 c	0.00 c
Butralin	1000	14.7 ab	5.00 a	4.33 a	5.00 b	4.33 bc	4.67 b	3.33 a	5.67 b	4.67 cd	4.00 ab	3.00 a
	2000	14.3 ab	4.33 a	3.67 a	4.33 bc	4.33 bc	4.67 b	2.67 b	5.33 cb	4.33 cd	3.00 b	2.00 ab
Metribuzin	1000	15.0 ab	4.67 a	4.33 a	5.67 b	5.67 b	4.67 b	3.33 a	5.67 b	5.67 ab	4.00 ab	3.00 a
	2000	14.3 abc	4.00 a	4.00 a	5.67 b	5.67 b	4.00 bc	3.00 ab	5.67 b	5.33 abc	3.67 ab	2.00 ab

Means followed by the same alphabetical letters were not statistically significant according to Duncan;s multiple range

E- Effect of the tested treatments on seed health:

Data in Table (5) indicated that, herbicidal treatments of sorghum grains at 1000 µg ml-1 was not so effective in reducing the frequency of fungi emerging from grains. With exception of treatments with butralin and metribuzin, tested herbicides, at 2000 µg ml^{-1} excreted an aberrance inhibitive effect on the developing fungi which was significantly reduced . *Aspergillus flavus* and *A. niger* were apparently inhibited, which is important, since these fungi are potentially capable of producing mycotoxins. It could be summarized that metribuzin and butralin were not effective in reducing the growth of almost all fungi. Other herbicides were inhibitive to fungal growth particularly at the 2000 µg ml^{-1} concentration. Moreover, ,*Aspegillus flavus* and *A. niger* were apparently inhibited by the high concentration. This is important because these fungi are potentially capable of producing toxins.

The conclusion from the above results suggested that Acetochlor at 900 g a.i/fed, Acetochlor at 840 g a.i/fed and Pendimthalin at 773.5 g a.i./fed decreased dry weight of weeds, soil- born fungi and increased the germination percent on sorghum comparing with control treatment, that is may be due to kill of most soil borne fungi and can be advised for weed control in sorghum without any phytotoxicity on sorghum growth.

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تأثير بعض مبيدات الحشائش على نمو البادرات و الفطريات المحمولة بالتربة و مكافحة الحشائش فى محصول الذرة الرفيعة

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أجريت تجربتان حقليتان في المزرعة البحثية بمحطة البحوث الزراعية بسخا محافظة كفر الشيخ في عامين ٢٠١٢ و ٢٠١٣م بهدف التعرف على تأثير فاعلية بعض معاملات مكافحة الحشائش على نسبة الإنبات وانعكاس ذلك على صفات النمو وإنتاجية محصول الذرة الرفيعة. وكانت مبيدات الحشائش المستخدمة (مبيد أسيتوكلور ٩٠٠ جرام مادة فعالة /ف واسيتوكلور ٨٤٠ جرام مادة فعالة /ف ومبيد بنديمثالين ٧٧٣,٥ جرام مادة فعالة/ف والبيوترالين ١٢٠٠ جرام مادة فعالة/ف والمتريبوزين ٢١٠ جرام مادة فعالة/ف بعد الزراعة وقبل الري لنبات الذرة الرفيعة) في تصميم قطاعات كاملة العشوائية. أظهرت معاملة التربة بمبيدات الحشائش أسيتوكلور ٩٠٠ جرام مادة فعالة /ف (فيرن بمعدل ١ لتر /ف) واسيتوكلور ٨٤٠ جرام مادة فعالة /ف (هارنس بمعدل ١ لتر /ف) ومبيد بنديمثالين ٧٧٣,٥ جرام مادة فعالة/ف (مبيد ستومب أكسترا بمعدل ١,٧ لتر/ف) تأثير كبير في الحد من موت البادرات قبل وبعد الانبثاق وبالتالي زيادة نسبة الإنبات للحبوب المنزرعة وإنتاج بادرات سليمة وكذلك أدت لزيادة الطول والوزن الجاف للريشة والجذير للبادرات الناتجة وبالتالي زيادة قوة البادرات الناتجة. وأظهرت معاملة بذور الذرة الرفيعة بالمبيدات السابقة تحت الظروف المعملية بتركيز ٢٠٠٠ جزء في المليون أنخفاضا في نمو الفطريات المحمولة بالبذور. أدى استخدام مبيد أسيتوكلور ٩٠٠ جرام مادة فعالة /ف واسيتوكلور ٨٤٠ جرام مادة فعالة /ف ومبيد بنديمثالين ٧٧٣,٥ جرام مادة فعالة/ف إلى نقص كبير في الوزن الجاف للحشائش عريضة وضيقة الأوراق والحشائش الكلية على التوالي كما كانت أنواع الحشائش السبعة المنتشرة في أرض التجارب حساسة إلى هذه المبيدات لذلك يمكن التوصية باستخدام مبيدات أسيتوكلور ٩٠٠ جرام مادة فعالة /ف واسيتوكلور ٨٤٠ جرام مادة فعالة /ف ومبيد بنديمثالين ٧٧٣,٥ جرام مادة فعالة/ف لمكافحة الحشائش الحولية في محصول الذرة الرفيعة كلا موسمي الزراعة وذلك مقارنة بمعاملة الكنترول. كما أحدثت هذه المبيدات السابقة زيادة كبيرة في محصول العلف و محصول الحبوب وتفوقت إنتاجيتها على باقي المعاملات ويرجع ذلك لتحسين صفات الإنبات وقوة البادرا ت الناتجة والنمو.