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EFFECT OF WEED CONTROL TREATMENTS AND TWO SOWING METHODS ON WEEDS AND SORGHUM [*Sorghum bicolor* (L.) Moench]

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ABSTRACT

Two field experiments were carried out at Mattaana Agricultural Research Station, Esna, Qena Governorate, during 2000 and 2001 summer seasons to study the effect of two sowing methods(afir A_1 and false irrigation pre-afir A_2) and weed control treatments *i.e.* untreated, fluroxypyr, tribenuron-methyl, fluroxypyr plus one hand hoeing, tribenuron-methyl plus one hand hoeing and hand hoeing twice on weeds and sorghum yield. Results showed that fresh weight of broad –leaf, grassy and total weeds were lower under A_2 than under A_1 sowing method, and the reduction percentages were 35, 26.5 and 32.7 % in the 1st season and 23.2, 38.2 and 27.9 % in the 2nd season, respectively. The highest reduction of fresh weight of broad –leaf, grassy and total weeds was obtained from hand hoeing twice ; being 96.7, 94.5 and 96.4% in the 1st season and 97.6, 91.6 and 96.9 % in the 2nd season, respectively compared to the control. Plant height, panicle length, panicle diameter, panicle weight, number of grains/ panicle,1000-grain weight, grain yield/plant and grain yield/fed under A_2 method were higher than under A_1 method in both seasons. The highest grain yield/fed under A_2 method was obtained from hand hoeing twice by 2.13 tons in the 1st season and 2.17 tons in the 2nd season. Hand hoeing twice under afir method after false irrigation (A_2 method) was the best treatment, where it gave the highest reduction in fresh weight of broad–leaf, grassy and total weeds and the highest grain yield / fed. Therefore, this treatment is

promising either for weed control or for high grain yield of sorghum followed by using tribenuron- methyl plus one hand hoeing under A_2 method, which gave 1.85 and 1.82 ton/fed in the 1st and the 2nd season, respectively.

Key words: *sowing methods(irrigation pre-afir method and afir method),weed control treatment (fluroxypyr, tribenuron- methyl) and sorghum.*

1.INTRODUCTION

In Egypt,grain sorghum [*Sorghum bicolor* (L.) Moench] is an important summer cereal crop after wheat,rice and maize.In recent years, all types of annual (broad-leaf and grassy) and perennial weeds became widespread and troublesome in sorghum fields.The presence of heavy weed infestation and uncontrolled, cause a reduction in grain yield ranging between 15-85% (Kochhar 1986, Singh *et al.*, 1988, Balyan *et al.* 1993, Everaats 1993 and Kasole *et al.*, 1994).Weed control in sorghum is difficult due to slow crop growth, heavy weed infestation and limited herbicide options(Limon-Ortega *et al.*, 1998).Sorghum grain yield increased by using weed control treatments *i.e.* herbicides (atrazine, metolachlore and alachlore) or hand hoeing (Singh *et al.* 1988, Raghuvanshi *et al.* 1990,Balyan *et al.* 1993,Kasole *et al.* 1994 and Limon-Ortega *et al.* 1998). Broad-leaf weeds can be effectively controlled by fluroxypyr in maize (Moshtohry *et al.* 1995) and in sorghum (Webb and Feez 1987) and by tribenuron-methyl in wheat (Bassiouny *et al.* 1993). In Egypt, the recent options for reduction of using herbicides are pressing for using some cultural practices as an alternative for weed control. For improving these practices, early weed elimination and sowing method *i.e.* weed seedlings appear before sowing and weed competition can be reduced by a presowing cultivation. Before crop seeding, weed seeds can be stimulated for germination by an irrigation and weed seedlings will be eliminated by cultivation. The irrigation is named as Kaddaba or False irrigation, because it is not for crop seed germination. The sowing method is Afir method.

Thus, this research aimed to study the effect of weed control treatments and sowing methods(false irrigation pre-afir and afir methods) on weeds and sorghum yield.

2. MATERIALS AND METHODS

Two field experiments were carried out at Mattaana Agricultural Research Station, Esna, Qena Governorate during 2000 and 2001 summer seasons to study the effect of weed control treatments and sowing methods (afir A_1 and false irrigation pre-afir A_2) on weeds and yield of sorghum. The variety Dorado (dwarf) was used at 10 kg/ fed seeding rate. The soil texture of the experimental site was clay-loam.The plot area was 1/400 fed ($3.5X3m^2$) consisted of 6 rows, 60 cm apart and plants spaced 20 cm within each row.False irrigation pre-afir method was done by irrigating the field 20 days before sowing then weed seedlings were eliminated and cultivated by afir method . Sorghum grains were sown on the 2^{nd} week of May in both seasons for the two methods. Plants were thinned after 3weeks sowing leaving 2 plants / hill. The normal cultural practices were carried out as usual.The treatments were arranged in a split plot design with 4 replicates where sowing methods (false irrigation pre-afir and afir methods) were allocated in the main plots and weed control treatments in the subplots.

2.1.Weed control treatments were as follows

1-Fluroxypyr (Starane 20% E.C.) applied at a rate of 200 cc/fed., sprayed 20 days after sowing(DAS).

2-Fluroxypyr at 200 cc/fed, sprayed 20 DAS plus one shallow hand hoeing at 35 DAS before 2^{nd} irrigation.

3-Tribenuron-methyl (Granstar 75% DF) applied at a rate of 8 g/fed. sprayed, 20 DAS.

4- Tribenuron-methyl at a rate of 8 g/fed. sprayed,20 DAS plus one shallow hand hoeing at 35 DAS before the 2^{nd} irrigation.

5-Hand hoeing twice at 18 and 35 DAS before the 1^{st} and the 2^{nd} irrigation.

6-Untreated (control).

The herbicides were applied with knapsack sprayer equipped with one nozzle boom and water volume was 200 l/fed. Weeds were hand pulled from 1-m^2 ,chosen at random from each plot at 60 DAS. Weeds were classified into broad-leaf and grassy weeds(annual and perennial). fresh weight (g/m^2) of each group was determined. Sorghum was harvested (120 DAS) in both seasons, samples of 5

plants were chosen at random from the 2 inner rows of each plot to study the following characters :

1-Plant height (cm) 2-Panicle length (cm)
3-Panicle diameter (cm) 4-Panicle weight (g)
5-Grain number/panicle 6-1000-grain weight (g)
7-Grain yield/plant
Grain yield/fed (ton) from whole plots was recorded.

The data were statistically analyzed according to Snedecor and Cochran (1982) and (LSD) at 5% level were used for comparisons between the treatment means.

3. RESULTS AND DISCUSSION

3.1.Effect of sowing methods

3.1.1. Weeds

The experimental field was relatively infested with grassy and broad-leaf weeds and this was observed in both seasons. The dominant grassy weeds were *Echinochloa colonum,Dinebra retroflexa, Cyperus rotundus* and *Cynodon dactylon*. The dominant broad-leaf weeds were *Portulaca oleraceae,Euphorbia geniculata, Corchorus olitorius,Xanthium* sp.,*Hibiscus trionum,Convolvulus arvensis,Sida alba* and *Datura innoxia*.

Results in Table(1) show that sowing methods had significant effects on fresh weight of broad-leaf,grassy and total weeds during 2000 and 2001seasons. Fresh weights of broad-leaf, grassy and total weeds under false irrigation pre-afir method were lower than afir method by 35, 26.5 and 32.6 % in the 1^{st} season and 23.2, 38.2 and 27.9 % in the 2^{nd} season, respectively. This may be due to the fact that some weed seeds had germinated by using false irrigation and as a result, the young emerged weed seedlings were easily destroyed by cultivation. Therefore this method reduced the population of both weeds than afir method. These results are in agreement with those obtained by Salim *et al.*, (1993), Al-Marsafy *et al.*, (1995), Abd El-Samie and El-Bially (1996) and Kholosy *et al.*, (1998).

3.1.2.Yield and its components of sorghum

Results in Table(2) show that sowing methods had significant effects on yield and its components *i.e.*, plant height, panicle length, panicle diameter,panicle weight, number of grains/panicle, yield/plant

and yield/ fed. in both seasons.Meanwhile, no significant effects on 1000 grain weight during the 1st season. Plant height, panicle length,

Table(1):Effect of sowing methods(afir A_1 and false irrigation pre-afir A_2)on fresh weight of broad-leaf, grassy and total (annual and perennial) weeds (g/m^2) in sorghum during 2000 and 2001 seasons.

Treatments	2000 season			2001 season		
	Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)	Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)
A_1	900.50	363.83	1264.33	751.33	343.67	1095.00
A_2	585.33	267.29	852.63	577.00	212.50	789.50
LSD 5%	49.32	15.62	62.80	26.00	21.18	45.68

panicle diameter, panicle weight, number of grains /panicle and yield /plant under false irrigation pre-afir sowing method were higher than under afir sowing method by 2.0, 0.9, 3.1, 4.4, 5.7 and 6.7 %, respectively in the 1st season and by 3.8, 1.1, 2.6, 1.0, 0.3 and 1.2 % ,respectively in the 2nd season. False irrigation pre-afir method increased grain yield/fed compared to afir method by 7.3 % in the 1st season and 6.3 % in the 2nd season. This result may be attributed to less weed competition that resulted in increasing number of grains /panicle and 1000 grain weight. These results are in agreement with those obtained by Salim *et al.*, (1993),Abd El-Samie and El-Bially (1996). Al-Marsafy *et al.*, (1996), and Kholosy *et al.*, (1998).

Table(2):Effect of sowing methods(afir A_1 and false irrigation pre-afirA_2)on plant height, yield and yield components of sorghum during 2000 and 2001 seasons.

Treatments	2000 season			2001 season		
	A_1	A_2	LSD 5%	A_1	A_2	LSD 5%
Plant height (cm)	109.3	111.5	0.5	108.2	112.3	0.8
Panicle length (cm)	21.3	21.5	0.07	21.3	21.5	0.1
Panicle diameter (cm)	6.1	6.3	0.08	6.2	6.4	0.04
Panicle weight (g)	53.5	55.9	0.1	54.3	54.9	0.1
No of grains/panicle	1156.8	1223.3	10.1	1167.8	1171.8	0.9
1000 grain weight (g)	30.6	30.8	NS	30.8	31.1	0.1
yield/plant (g)	35.5	37.8	0.4	36.1	36.5	0.04
yield/fed (ton)	1.583	1.698	0.05	1.525	1.621	0.05

3.2.Effect of weed control treatments

3.2.1.Weeds

Results in Table(3) show that weed control treatments had significant decrease in fresh weight of broad-leaf,grassy and total weeds as compared with control in both seasons. The highest reduction of fresh weight of broad-leaf, grassy and total weeds were obtained from hand hoeing twice by 96.7, 94.5 and 96.4%, respectively in the 1st season and 97.6, 91.6 and 96.9 %, respectively in the 2nd season compared to the control. The lowest fresh weight of weeds was obtained by hand hoeing twice followed by tribenuron-methyl plus one hand hoeing and fluroxypyr plus one hand hoeing in both seasons. There were significant differences between the treatments and control. The results showed that an integration of herbicides with hoeing was better than herbicides alone. These results are in agreement with those obtained by Webb and Feez (1987),Singh *et al.*, (1988), Shelke and Bhosle (1989), Balyan *et al.*,(1993),Kasole *et al.*, (1994) and Limon-Ortiga *et al.*, (1998).

Table(3) : Effect of weed control treatments on fresh weight of broad-leaf, grassy and total weeds(g/m^2) in sorghum during 2000 and 2001 seasons.

Treatments	Rate/fed.	2000 season			2001 season		
		Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)	Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)
Control		3575.5	541.5	4117.0	3184.0	417.0	3601.0
Hand hoeing	Twice	118.5	30.0	148.5	78.0	35.0	113.0
Fluroxypyr	200cc	210.0	654.5	864.5	202.5	696.5	899.0
Tribenuron-methyl	8 g	190.0	599.0	789.0	176.5	447.5	624.0
Fluroxypyr + hand hoeing	200cc+ 1	194.0	34.1	228.1	183.0	36.5	219..5
Tribenuron-methyl + hand hoeing	8 g + 1	169.5	34.3	203.8	161.0	36.0	197.0
LSD 5%	--	98.3	32.0	26.9	51.6	36.6	60.6

3.2.2. Yield and its components of sorghum

Results in Table(4) show that weed control treatments significantly increased yield and its components *i.e.*, plant height,panicle length, panicle diameter, panicle weight, number of grains/panicle,1000 grain weight, yield/plant, and yield/fed compared to the control in both seasons. The highest increases of plant height,

Table(4) : Effect of weed control treatments on plant height, yield and yield components of sorghum during 2000 and 2001 seasons.

Season	Treatments	Control	Hand hoeing twice	Flur-oxypyr	Fluroxypyr + hand hoeing	Tribenuron -methyl	Tribenuron - methyl + hand hoeing	LSD 5%
2000	Plant height (cm)	91.5	121.5	108.5	113.0	111.8	115.0	8.1
	Panicle length (cm)	19.5	22.9	21.2	21.6	21.4	21.8	0.1
	Panicle diameter (cm)	5.9	6.8	6.1	6.4	6.2	6.5	0.04
	Panicle weight (g)	49.3	59.5	54.0	55.0	54.5	55.5	0.2
	No of grains/panicle	1036.0	1293.0	1131.0	1189.5	1166.0	1203.5	6.9
	1000 grain weight (g)	27.5	34.0	30.6	31.2	30.9	31.5	0.1
	yield/plant (g)	28.3	43.9	34.6	37.2	36.0	37.9	1.0
	yield/fed. (ton)	1.029	1.975	1.455	1.64	1.565	1.775	0.1
2001	Plant height (cm)	99.0	118.5	109.3	111.8	110.8	113.0	0.3
	Panicle length (cm)	19.5	22.5	21.3	21.7	21.5	21.9	0.1
	Panicle diameter (cm)	6.0	6.5	6.1	6.3	6.2	6.4	0.1
	Panicle weight (g)	49.1	58.6	53.4	55.6	54.8	56.6	0.6
	No of grains/panicle	1047.5	1307.0	1165.0	1207.5	1186.5	1227.0	6.7
	1000 grains weight(g)	28.1	33.5	30.2	30.8	30.4	31.2	0.9
	yield/plant (g)	29.5	43.8	35.2	37.2	36.0	38.3	0.4
	yield/fed. (ton)	1.14	2.035	1.54	1.71	1.635	1.78	0.1

panicle length, panicle diameter, panicle weight, number of grains/ panicle,1000 grain weight, yield/plant and yield/fed were obtained by hand hoeing twice as compared with the control in both seasons. Hand hoeing twice gave the best grain yield followed by tribenuron-methyl plus one hand hoeing and fluroxypyr plus one hand hoeing in both seasons, which may be attributed to their effect in controlling the weeds, also decreaseing the period of weed-compitition with sorghum plants for space, light, nutrients and water. Therefore, the growth of sorghum increase, followed by increase in yield and its components .These results are in agreement with those obtained by Panwar *et al.*, (1987), Kasole *et al.*, (1994) and Moshtohry *et al.*, (1995).

3.3.Weed control treatments and sowing method interaction

3.3.1.Weeds

Results in Table (5) show that the interaction between weed control treatments and sowing methods had significant effects on fresh weight of broad-leaf, grassy and total weeds during 2000 and 2001seasons. The highest reductions in fresh weight of broad-leaf, grassy and total weeds were obtained by hand hoeing twice as compared with the control under two sowing methods in both seasons. Hand hoeing twice under false irrigation pre-afir sowing method reduced effectively the fresh weight of broad-leaf, grassy and total weeds compared to afir method by 56.4, 12.5 and 49.2 % in the 1st season and 40.8, 15.8 and 33.8 in the second season, respectively. Using false irrigation pre-sowing and weed control treatments decreased total weeds. These results are in agreement with those obtained by Al-Marsafy *et al.*, (1996)and Kholosy *et al.*, (1998).

3.3.2.Yield and its components of sorghum

Results in Table (6) show that the interaction between weed control treatments and sowing methods had significant effect on yield and its components in both seasons, except 1000 grain weight was not significant in the 2nd season. The yield and its components were significantly higher with all weed control treatments compared to unweeded check under two sowing methods in both seasons. Hand hoeing twice under false irrigation pre-afir sowing method increased the grain yield compared to afir method by 17 % in the 1st season and 14.2 % in the 2nd season. These results are due to the formation of a dense crop canopy over weeds which gave the crop a strong

competitive advantage over weeds, while poor crop stand is a candidate for increased growth of numerous weeds. Grain yield was reduced by 39.6-55% as a result of weed competition in control and such competition is enhanced by open canopy structure and slow establishment of sorghum plants.

Table (5): Effect of weed control treatments and sowing methods(afir A_1 and false irrigation pre-afir A_2) interaction on fresh weight of broad-leaf, grassy and total weeds(g/m^2) in sorghum during 2000 and 2001 seasons.

Year		2000			2001		
Treatments		Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)	Broad-leaf (g/m^2)	Grass (g/m^2)	Total weeds (g/m^2)
A_1	Control	4262	615	4877	3530	520	4050
	Hand hoeing	165	32	197	98	38	136
	Fluroxypyr	262	827	1089	242	865	1107
	Tribenuron-methyl	248	630	878	225	547	772
	Fluroxypyr + hand hoeing	245	39	284	212	45	257
	Tribenuron-methyl + hand hoeing	221	40	261	201	47	248
A_2	Control	2889	468	3357	2838	314	3152
	Hand hoeing	72	28	100	58	32	90
	Fluroxypyr	158	482	640	163	528	691
	Tribenuron-methyl	132	568	700	128	348	476
	Fluroxypyr + hand hoeing	143	25	168	154	28	182
	Tribenuron-methyl + hand hoeing	118	21	139	121	25	146
LSD 5%		139.1	45.2	38.1	73.0	51.8	85.8

In general, hand hoeing twice under using false irrigation pre-afir sowing method gave excellent weed control and accounted for the consequent increase in the grain yield compared to afir method. False irrigation pre-afir sowing method, tribenuron-methyl plus one hand hoeing and fluroxypyr plus one hand hoeing gave the best weed control. Therefore an integration of herbicide with hand hoeing was better than herbicide alone. These results are in agreement with those

obtained by Salim *et al.*, (1993), Al-Marsafy *et al.*, (1995 & 1996) Kholosy *et al.*, (1998) and Limon-Ortiga *et al.*, (1998).

Table (6): Effect of weed control treatments and sowing method interaction on plant height, yield and yield components of sorghum during 2000 and 2001 seasons.

Season	Treatments		Plant height (cm)	Panicle length (cm)	Panicle diameter (cm)	Panicle weight (g)	No of grains/panicle	1000 grain weight (g)	Yield /plant (g)	Yield /fed. (ton)
2000	A_1	Control	88.0	19.4	6.0	49.0	1050	28.1	29.5	1.100
		Hand hoeing	119.0	22.6	6.8	59.1	1280	33.8	43.3	1.820
		Fluroxypyr	107.0	21.1	6.1	53.8	1135	30.2	34.3	1.420
		Tribenuron-methyl	110.5	21.3	6.3	54.2	1160	30.5	35.4	1.520
		Fluroxypyr + hand hoeing	111.5	21.5	6.5	54.6	1184	30.8	36.5	1.590
		Tribenuron-methyl + hand hoeing	113.0	21.8	6.6	55.3	1198	31.2	37.4	1.700
	A_2	Control	90.0	19.6	5.8	49.5	1022	26.8	27.1	0.958
		Hand hoeing	124.0	23.2	6.7	59.8	1306	34.1	44.5	2.130
		Fluroxypyr	110.0	21.3	6.0	54.1	1127	30.9	34.8	1.490
		Tribenuron-methyl	113.0	21.5	6.1	54.8	1172	31.2	36.6	1.610
		Fluroxypyr + hand hoeing	114.5	21.7	6.3	55.4	1195	31.6	37.8	1.690
		Tribenuron-methyl + hand hoeing	117.0	21.8	6.4	55.6	1209	31.7	38.3	1.850
LSD 5%			11.50	0.17	0.05	0.20	9.75	0.78	1.19	0.14
2001	A_1	Control	98.0	19.4	5.8	48.6	1035	28.0	28.4	1.080
		Hand hoeing	117.0	22.3	6.4	57.6	1275	33.3	43.1	1.900
		Fluroxypyr	108.5	21.2	6.0	52.5	1130	30.1	34.0	1.500
		Tribenuron-methyl	109.5	21.4	6.1	53.2	1145	30.3	34.5	1.590
		Fluroxypyr + hand hoeing	110.5	21.6	6.2	54.1	1170	30.6	35.8	1.680
		Tribenuron-methyl + hand hoeing	112.0	21.9	6.3	54.9	1186	31.1	36.9	1.740
	A_2	Control	100.0	19.5	6.1	49.5	1060	28.2	30.5	1.200
		Hand hoeing	120.0	22.7	6.6	59.6	1339	33.7	44.5	2.170
		Fluroxypyr	110.0	21.4	6.2	54.3	1200	30.3	36.3	1.580
		Tribenuron-methyl	112.0	21.6	6.3	56.4	1228	30.5	37.5	1.680
		Fluroxypyr + hand hoeing	113.0	21.7	6.3	57.1	1245	30.9	38.5	1.740
		Tribenuron-methyl + hand hoeing	114.0	21.9	6.4	58.2	1268	31.3	39.7	1.820
LSD 5%			0.54	0.12	0.08	0.87	9.45	NS	0.56	0.08

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تأثير طرق مكافحة الحشائش مع طرق الزراعة على الحشائش ونبات الذرة الرفيعة

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المعمل المركزى لبحوث الحشائش- مركز البحوث الزراعية – الجيزة.

ملخص

أجريت تجربتان حقليتان فى محطة البحوث الزراعية بالمطاعنة – اسنا – محافظة قنا خلال موسمى ٢٠٠٠و٢٠٠١ لدراسة تاثير بعض معاملات مقاومة الحشائش (بدون معاملة – ستارين – جرنستار – ستارين + عزقة واحدة – جرانستار + عزقة واحدة – عزيق مرتين) تحت تأثير طريقتين للزراعة (الاولى الزراعة العفير- والثانية رية كدابة قبل الزراعة العفير) على الحشائش ونبات الذرة الرفيعة .

أظهرت النتائج ان المعاملة الثانية من طرق الزراعة ادت إلى إنقاص الوزن الرطب لكل من الحشائش عريضة الاوراق والنجيلية والكلية عن المعاملة الاولى بمقدار ٣٥ –٢٦,٥ –٣٢,٦ % على التوالى فى الموسم الاول وبمقدار ٢٣,٢ – ٣٨,٢ – ٢٧,٩ % على التوالى فى الموسم الثانى .

العزيق مرتان هو افضل معاملة لمقاومة الحشائش العريضة والنجيلية والكلية فى الذرة الرفيعة وقد قللت كمياتها عن معاملة الكنترول بمقدار ٩٦,٧ – ٩٤,٥ – ٩٦,٤ % على التوالى فى الموسم الأول بمقدار ٩٧,٦ – ٩١,٦ – ٩٦,٩ % على التوالى فى الموسم الثانى.

أظهرت النتائج أيضا أن طريقة الزراعة الثانية تفوقت على الأولى فى صفات المحصول ومكوناته فى كلا الموسمين.

وقد تحصل على افضل محصول للفدان وافضل مقاومة للحشائش من الزراعة بالطريقة الثانية (العفير مع رية كدابة) مع العزيق مرتين حيث كان المحصول ٢,١٣ و٢,١٧ طن/فدان فى الموسم الأول والثانى،على الترتيب. ويلى ذلك فى الأفضلية استخدام مبيد الجرانستار مع عزقة واحدة حيث كان المحصول ١,٨٥ و١,٨٢ طن/فدان فى الموسم الأول والثانى،على الترتيب.

المجلة العلمية لكلية الزراعة – جامعة القاهرة – المجلد (٥٣) العدد الرابع (أكتوبر ٢٠٠٢) ٥٣٩-٥٥٢ .