

**EFFECT OF WEED CONTROL TREATMENTS AND
N-FERTILIZER RATES ON WEEDS AND SORGHUM**
(*Sorghum bicolor* L.)

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ABSTRACT

Two field experiments were carried out at Mattaana Agricultural Research Station, Esna, Qena Governorate during 2000 and 2001 seasons to study the effect of weed control treatments *i.e.* Fluroxypyr at 200cc/fed, fluroxypyr at 200cc/fed plus one hand hoeing, hand hoeing twice and untreated control under three N-fertilizer rates (80, 100 and 120 kg/ fed) on weeds, some agronomic characters and grain yield of sorghum. Hand hoeing twice was the best weed control treatment in controlling grassy weeds, while fluroxypyr controlled broadleaf weeds in both seasons. Hand hoeing twice gave the best control of total weeds followed by fluroxypyr plus one hand hoeing in both seasons. The highest N-fertilizer rate (120 kg) and hand hoeing twice interaction had a significant effect on yield and yield components. All characters of yield and yield components were increased by increasing N-fertilizer rates.

Key words: *nitrogen rates, sorghum, weed control.*

1. INTRODUCTION

Grain sorghum (*Sorghum bicolor* L. Moench) belongs to the family Poaceae. In Egypt, it is the 4th important cereal crop after wheat, rice and maize. Factors affecting sorghum productivity include weeds, soil moisture, soil fertility and drainage (Kochhar 1986).

Weeds compete with sorghum for space, light, water and nutrients causing a serious reduction in grain yield. Yield losses due to weed competition ranged between 15-55% (Singh *et al.*, 1988 and Everaats 1993). Weed control treatments *i.e.* hand hoeing or herbicides significantly increased the yield of sorghum (Singh *et al.* 1988, Raghuvanshi *et al.*, 1990 Balyan *et al.*, 1993 and Kasole *et al.*, 1994).

N-fertilization is considered the primary factor for crop production. The main fertility problem of Egyptian soils, especially in Upper Egypt is lack of most nutrients such as N and P (Attia, 1999). For sustainable agriculture, it is desirable to obtain high yields of grain sorghum using the least amount of N-fertilization and weed control. The optimum dose of nitrogen was found to be 100 kg/fed. Deasthale *et al.*, (1972). Carr *et al.*, (1992) found that the application of N-fertilizer up to 100 kg N/ha increased the grain yield. Similarly, Singh *et al.* (1986&1987) found that the application of N-fertilizer up to 150 kg N/ha increased the grain yield. Hobbs and Krogman (1981), Balyan and Singh (1985), Bagayoko *et al.*, (1992), Carsky *et al.*, (1995) and Kanna-Chopra and Kumari (1995) mentioned that the application of N-fertilizer up to 40 kg N/ha increased the grain yield. Ragheb and El-Nagar (1997) found that the maximum grain yield was obtained by using 125 kg N/fed. Attia (1999) found that the grain yield increased by 120 kg N/fed (organic or inorganic) which was used alone or combined.

The aim of this work was to study the effect of weed control treatments and N-fertilizer rates 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 N-fertilizer rates on weeds and grain yield of sorghum. Sorghum cultivar Dorado (dwarf) was used at a rate of 10kg/fed in both seasons. The soil texture of the experiment fields is clay loam in the two seasons. It had 22 and 25 ppm available nitrogen in 1st and 2nd season, respectively. The plot size was 1/400 fed consisting of 6 rows each of which 3m. Rows were spaced 60 cm apart and plants spaced 20 cm within each row. Sorghum grains were sown on May 12th and May 14th of 2000 and

2001 seasons, respectively. Plants were thinned after 3 weeks leaving two plants/hill. The normal cultural practices were carried out. The treatments were arranged in a split plot design with 4 replications in both seasons. N-fertilizer rates (80, 100 and 120 kg/fed) as urea (46 % N) were arranged at random in the main plots. N-fertilizer was added in two equal doses before 1st and 2nd irrigation, respectively.

Weed control treatments were arranged in subplots as follows:

- Fluroxypyr (Starane 20% E.C.) applied at a rate of 200 cc/fed, as post-emergence (3 weeks after sowing).
- Fluroxypyr at a rate of 200 cc/fed plus one hand hoeing at 35 days after sowing (DAS) before 2nd irrigation.
- Hand hoeing twice at 18 and 35 DAS before the 1st and 2nd irrigation.
- Untreated (control).

The herbicide was applied with knapsack sprayer equipped with one nozzle boom and water volume 200 L/fed. Weeds were hand pulled from 1 m², chosen at random from each sub plot at 60 DAS. Weeds were classified into broad-leaved weeds and grasses. Fresh weight (g/m²) of each group and the total weeds were determined. At harvest (120 DAS), samples of 5 plants were chosen at random from 2 inner rows of each subplot 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 (g) | 8-Grains/panicle % |

Grain yield/fed (t) was calculated from the weight of grains obtained from each plot. The weight was adjusted at 14% moisture content.

The data were statistically analyzed according to Snedecor and Cochran (1982) and Least Significant Difference (L.S.D.) at 5% level was used for comparisons between the treatment means.

3. RESULTS AND DISCUSSION

3.1. Effect of N-fertilizer rates

3.1.1. On weeds

The experimental field was relatively infested with grassy and broad-leaf weeds in the two seasons. The dominant grassy weeds were *Echinochloa colonum*, *Dinebra retroflexa*, *Cyperus rotundus* and *Cynodon dactylon*. The dominant broad-leaved weeds were *Portulaca*

oleraceae, *Euphorbia geniculata*, *Corchorus olitorius*, *Xanthium* sp. and *Datura* sp.

Results in Table(1) show that N-fertilizer rates had a significant effect on fresh weight of broad-leaf, grassy and total weeds during 2000 and 2001 seasons. Fresh weight of these weeds was increased with increasing N-fertilizer rates in both seasons due to the response of the weeds to nitrogen rates. There were significant differences between N-rates. These results are in agreement with those obtained by Balyan and Singh (1987), Mahalle and Seth (1989), Everaats (1993), Moshtohry *et al.*, (1995), Limon-Ortega *et al.*, (1998) and Salib *et al.*, (1999).

Table(1): Effect of N-fertilizer rates on fresh weight of broad-leaf, grassy and total weeds (g/m²) during 2000 and 2001 seasons.

Treatments	2000 season			2001 season		
	Broad-leaf wt. (g/m ²)	Grassy wt. (g/m ²)	Total weeds wt. (g/m ²)	Broad-leaf wt. (g/m ²)	Grassy wt. (g/m ²)	Total weeds Wt. (g/m ²)
80 kg/fed.	413.0	224.5	637.5	430.5	273.0	703.5
100 kg/fed.	732.5	279.5	1012.0	645.8	310.8	956.6
120 kg/fed.	1010.5	367.3	1377.8	939.8	333.0	1272.8
L.S.D.(5%)	60.9	12.0	61.7	42.4	5.2	47.6

3.1.2. On yield and yield components of sorghum

Results in Table(2) show that plant height, panicle length, panicle diameter and weight, number of grains/panicle, 1000-grain weight, grain yield/plant, grains/panicle % and grain yield/fed were increased with increasing N-fertilizer rates in both seasons. Grain yield/fed increased with 100 and 120 kgN/fed by 4.4 and 9.9 % in the 1st season, meanwhile in the 2nd season the increment was 7.9 and 14.0 %, respectively compared to 80 kg/fed. This result may be due to more vigorous crop growth from using nitrogen causing better competition with weeds. Grain yield /plant was not significantly different between 80 and 100 kg N/fed. in the 1st season. Also, grain yield /plant, number of grains/panicle and 1000-grain weight, were not significantly different between 100 and 120 kgN/fed. in the 1st season.

These results are in agreement with those obtained by Singh *et al.*, (1986, 1987 and 1988), Balyan and Singh (1987), Kasole *et al.*, (1994), Kanna-Chopra and Kumari (1995), Ragheb and El-Nagar (1997), Limon-Ortega *et al.*, (1998), Attia (1999) and Khosla *et al.*, (2000).

Table(2):Effect of N-fertilizer rates on sorghum yield and its components during 2000 and 2001 seasons.

Treatments	2000 season				2001 season			
	80 kg	100 kg	120 kg	L.S.D.	80 kg	100 kg	120 kg	L.S.D.
Plant height (cm)	102.8	108.8	112.5	0.86	87.1	101.9	106.4	1.70
Panicle length (cm)	20.9	21.3	21.7	0.06	19.7	20.6	21.2	0.19
Panicle diameter (cm)	5.8	6.2	6.5	0.11	5.3	5.6	5.9	0.17
Panicle weight (g)	52.2	53.8	54.4	0.52	49.4	51.5	52.8	0.42
No of grains/panicle	1098.8	1176.3	1243	76.4	1059.5	1136.5	1201.8	11.90
1000grains weight(g)	30.0	30.6	30.8	0.34	28.6	29.5	29.7	0.07
Grain yield/plant (g)	33.8	36.2	38.5	2.61	30.5	33.7	35.9	0.46
Grain yield/fed (t)	1.47	1.535	1.615	0.01	1.323	1.428	1.508	0.07
Grains/panicle %	64.4	66.9	69.4	1.90	61.4	65.1	67.6	0.49

3.2. Effect of weed control treatments

3.2.1. On weeds

Results in Table (3) show that fresh weight of broad-leaf, grassy and total weeds decreased significantly with all weed control treatments as compared with control in both seasons. Hand hoeing twice and fluroxypyr plus one hand hoeing caused a significant reduction in fresh weight of grassy and total weeds in both seasons. Fluroxypyr plus one hand hoeing gave the best control of broad-leaf weeds followed by hand hoeing twice and fluroxypyr only in both seasons indicating that the integration of herbicide with hand hoeing was better than herbicide 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) and Kasole *et al.*, (1994).

Table(3) : Effect of some weed control treatments on fresh weight of broad-leaf, grassy and total weeds(g/m²) during 2000 and 2001 seasons.

Treatments	2000 season			2001 season		
	Broad-leaf wt.(g/m ²)	Grassy wt. (g/m ²)	Total weeds wt. (g/m ²)	Broad-leaf wt.(g/m ²)	Grassy wt. (g/m ²)	Total weeds wt. (g/m ²)
Control	2660.0	498.0	3158.0	2485.0	529.7	3014.7
Hand hoeing twice	74.3	30.3	104.6	71.3	35.7	107.0
Starane	83.7	505.0	588.7	78.3	546.7	625.0
Starane+hand hoeing	56.7	128.3	185.0	53.3	110.3	163.6
L.S.D. (5%)	236.5	62.1	163.9	126.6	42.1	155.2

3.2.2. On yield and yield components of sorghum

Results in Table (4) show that plant height, panicle length, panicle diameter, panicle weight, number of grains/panicle, 1000-grain weight, grain yield / plant, grains / panicle % and grain yield / fed were

increased significantly with all weed control treatments as compared with the control in both seasons. Hand hoeing twice was the best treatment compared with the other treatments in both seasons. On other hand, panicle length, panicle diameter and grain yield/fed. had no significant differences between fluroxypyr plus one hand hoeing and hand hoeing twice, fluroxypyr and control and fluroxypyr plus one hand hoeing and fluroxypyr, respectively in the 1st season. Plant height, 1000-grains weight, grain yield/plant and grain yield/fed were not significantly different between fluroxypyr plus one hand hoeing and fluroxypyr alone. Plant height and panicle diameter were not significantly different between fluroxypyr and control in the 2nd season. Also, hand hoeing twice gave the highest grain yield/fed. followed by fluroxypyr plus one hand hoeing and finally fluroxypyr alone. Hand hoeing twice increased grain yield by 70.3 and 73.2 % as compared with the control in both seasons, respectively. These results are in agreement with those obtained by Panwar *et al.*, (1987), Kasole *et al.*, (1994) and Moshtohry *et al.*, (1995).

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

Treatments		Control	Hand hoeing twice	Starane	Starane+ hand hoeing one	L.S.D. 5%
2000 season	Plant height (cm)	98.3	117.3	105.7	110.7	2.2
	Panicle length (cm)	19.4	22.3	21.4	22.0	0.5
	Panicle diameter (cm)	5.9	6.3	6.0	6.2	0.1
	Panicle weight (g)	48.7	57.6	53.3	54.3	0.5
	No of grains/panicle	1045.0	1291.3	1152.3	1201.7	16.0
	1000 grains weight(g)	28.1	33.7	29.9	30.2	0.2
	Grains yield/plant (g)	29.4	43.5	34.7	37.1	0.8
	Grains yield/fed (t)	1.147	1.953	1.500	1.560	0.18
	Grains/panicle %	60.0	75.1	64.5	68.1	0.8
2001 season	Plant height(cm)	92.4	107.3	94.9	99.2	6.3
	Panicle length(cm)	18.5	21.7	20.7	21.1	0.2
	Panicle diameter(cm)	5.4	5.8	5.5	5.7	0.1
	Panicle weight(g)	46.3	55.6	51.1	51.8	0.6
	No of grains/panicle	1009.0	1248.0	1112.0	1161.0	21.9
	1000 grains weight(g)	26.8	32.6	28.8	28.9	0.2
	Grains yield/plant (g)	27.0	40.7	32.0	33.6	5.0
	Grains yield/fed (t)	1.055	1.827	1.383	1.414	0.06
	Grains/panicle %	58.3	73.1	62.6	64.8	1.0

3.3. Effect of weed control treatments and N-fertilizer rates interaction

3.3.1. On weeds

Results in Table (5) show that weed control treatments and N-fertilizer rate interaction had a significant effect on fresh weight of broad-leaf, grassy and total weeds during the two seasons. Fresh weight of weeds decreased significantly with all weed control treatments as compared with control under all N-fertilizer rates. The highest control percentage of broad-leaf, grassy and total weeds were obtained with using fluroxypyr plus one hand hoeing under 100 kg N/fed, hand hoeing twice under 120 kg N/fed and hand hoeing twice under 100 kg N/fed, respectively in both seasons. This effect may be due to the effect of herbicide or hand hoeing on weeds. These results are in agreement with those obtained by Singh *et al.*, (1988), Okafor and Zitta (1991), Kasole *et al.*, (1994) and Moshtohry *et al.*, (1995).

Table(5): Fresh weight of broad-leaf, grassy and total weeds (g/m^2) as affected by interaction between weed control treatments and N-fertilizer rates during 2000 and 2001 seasons.

Treatments		Broad-leaf wt. (g/m^2)			Grassy wt. (g/m^2)			Total weeds wt. (g/m^2)		
		80 kg	100 kg	120 kg	80 kg	100 kg	120 kg	80 kg	100 kg	120 kg
2000season	Control	1541	2755	3684	410	460	624	1951	3215	4308
	Hand hoeing twice	38	53	132	28	33	30	66	86	162
	Starane	45	80	126	420	470	625	465	550	751
	Starane+hand hoeing	28	42	100	40	155	190	68	197	290
	L.S.D. (5%)	136.6			35.9			283.9		
2001season	Control	1600	2420	3435	495	510	584	2095	2930	4019
	Hand hoeing twice	42	51	121	36	43	28	78	94	149
	Starane	48	75	112	510	550	600	558	625	712
	Starane+hand hoeing	32	37	91	51	160	120	83	197	211
	L.S.D. (5%)	219.2			73.0			268.8		

3.3.2. On yield and yield components of sorghum

Results in Table (6) show that weed control treatments and N-fertilizer rates interaction had a significant effect on panicle length, panicle diameter, panicle weight, number of grains/panicle, 1000-grain weight, grain yield/plant, grains/panicle% and grain yield/fed. Meanwhile, plant height was not significantly affected in both seasons. The highest values of panicle length, panicle weight, number of grains/panicle, grain yield / plant, and grains / panicle % were obtained from

Table(6):Yield and its components as affected by the interaction between weed control treatments and N-fertilizer rates during 2000 and 2001 seasons.

Treatments		N Rates	Control	Hand hoeing Twice	Starane	Starane+ hand hoeing one	L.S.D.
2000 season	Plant height	80 kg	95.0	112.0	100.0	104.0	Ns
		100kg	98.0	118.0	107.0	112.0	
		120kg	102.0	122.0	110.0	116.0	
	Panicle length	80 kg	19.3	21.9	20.8	21.6	0.8
		100kg	19.4	22.2	21.4	22.1	
		120kg	19.5	22.8	21.9	22.4	
	Panicle diameter	80 kg	5.5	6.0	5.7	5.9	0.2
		100kg	6.0	6.2	6.1	6.3	
		120kg	6.3	6.8	6.2	6.5	
	Panicle weight	80 kg	48.0	55.8	51.9	53.2	0.9
		100kg	49.0	57.6	53.9	54.6	
		120kg	49.0	59.4	54.1	55.2	
No of grains / panicle	80 kg	1000.0	1195.0	1090.0	1110.0	27.6	
	100kg	1050.0	1280.0	1155.0	1220.0		
	120kg	1085.0	1400.0	1212.0	1275.0		
1000-grain weight	80 kg	27.9	33.3	29.2	29.7	0.3	
	100kg	28.1	33.8	30.2	30.3		
	120kg	28.3	33.8	30.4	30.7		
Grain yield/plant	80 kg	27.9	39.8	32.4	35.2	1.5	
	100kg	29.6	43.3	35.0	36.9		
	120kg	30.7	47.4	36.9	39.1		
Grain yield/fed	80 kg	1.100	1.850	1.445	1.485	1.45	
	100kg	1.160	1.920	1.490	1.570		
	120kg	1.180	2.090	1.565	1.625		
Grains/panicle %	80 kg	58.1	71.4	62.4	65.7	0.03	
	100kg	60.2	75.1	64.9	67.6		
	120kg	61.6	78.9	66.2	70.9		
2001 season	Plant height	80 kg	88.5	94.8	81.4	83.7	NS
		100kg	92.2	110.4	100.1	104.7	
		120kg	96.5	116.8	103.2	109.1	
	Panicle length	80 kg	18.1	20.7	19.9	20.1	0.4
		100kg	18.6	21.9	20.7	21.3	
		120kg	18.9	22.6	21.6	21.8	
	Panicle diameter	80 kg	5.0	5.5	5.4	5.5	0.2
		100kg	5.5	5.7	5.5	5.6	
		120kg	5.8	6.3	5.6	5.9	
	Panicle weight	80 kg	45.6	53.2	49.3	49.5	1.1
		100kg	46.2	55.7	51.3	52.6	
		120kg	47.1	57.9	52.8	53.3	

hand hoeing twice under 120 kg N/fed in the two seasons. The highest values of grain yield/fed were 2.09 and 1.981 tons in the 1st and the 2nd seasons, respectively. These results may be attributed to their effectiveness in controlling weeds, so decreasing the period of weed competition with sorghum plants for light, water, nutrients and space. Increasing N-fertilizer rates not only increase yield and its components but also the growth of weeds, thus altering the competitive balance between crop and weeds. These results are in agreement with those obtained by Singh *et al.*, (1988), Kasole *et al.*, (1994) and Moshtohry *et al.*, (1995).

In general, hand hoeing and N-fertilizer rate (120 kg N/fed) showed an excellent weed control and gave the highest yield of grain sorghum. The integration of herbicide with hand hoeing was better than herbicide alone.

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تأثير طرق مكافحة الحشائش ومستويات التسميد النيتروجيني على الحشائش ومحصول الذرة الرفيعة

صفوت ابراهيم عطاالله

قسم بحوث مقاومة الحشائش - معهد بحوث المحاصيل الحقلية
مركز البحوث الزراعية - الجيزة

ملخص

اجريت تجربتان حقليتان خلال موسمي ٢٠٠٠ و ٢٠٠١ لدراسة تأثير بعض معاملات مقاومة الحشائش تحت ٣ مستويات من السماد النيتروجيني على نبات الذرة الرفيعة والحشائش المصاحبة . أظهرت النتائج ان افضل معاملة لمقاومة الحشائش النجيلية والكلية هي العزيق مرتين في كلا الموسمين بينما كانت افضل معاملة لمقاومة الحشائش عريضة الأوراق هي ستارين + عزقة واحدة في كلا الموسمين . وقد اتضح من التجارب أن أعلى مستوى تسميد نيتروجيني (١٢٠ كجم/فدان) مع معاملة العزيق مرتين كان لهما افضل تفاعل معنوي في مقاومة الحشائش وصفات المحصول ومكوناته وقد لوحظ كذلك زيادة المحصول ومكوناته بزيادة معدل التسميد النيتروجيني تحت ظروف هذه التجربة .

المجلة العلمية لكلية الزراعة - جامعة القاهرة - المجلد (٥٣) العدد الثالث
(يوليو ٢٠٠٢) : ٣٦٥-٣٧٦ .