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EFFECT OF BASAGRAN AND STARANE HERBICIDES ON CHEMICAL COMPOSITION AND CROP CHARACTERS OF SORGHUM GRAINS.

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ABSTRACT

Two field experiments were conducted during seasons 1999 and 2000 to study the effect of the rate and time of application of two herbicides basagran (bentazone) and starane (fluroxypyr) on the crop characters and chemical composition of sorghum grains cultivar (Shandaweel –1 hybrid) Basagran and starane were used at rate of 400, 500ml/ feddan and 100, 200ml/ feddan after 7, 15 days from sowing and hand hoeing twice after 20, 30 days form sowing. The results showed that all treatments gave a significant increase in protein and oil contents of the grains while decrease in phenols and tannins contents. Also all treatments affected slightly on carbohydrates, amino acids contents and fatty acids composition, relative percentage of unsaponifaible matter and electorphoretic protein patterns of sorghum grains comparison with the control. On the other hand, all treatments except basagran 400ml/ feddan after 15 days from sowing and hand hoeing gave a significant increase in plant height, whereas all treatments except basgran 400 and 500ml/ feddan after 15 days from sowing and hand hoeing gave a significant increase in ear length, while all treatments gave a significant increase in weight of grain / ear and 1000 grain weight whereas all herbicidal treatments except basagran 400 ml/ feddan after 15 days from sowing gave a significant increase in grain yield.

Keywords: Sorghum, herbicides, Basagran (bentazone), Starane (Fluroxypyr), Chemical composition.

INTRODUCTION

Sorghum (*Sorghum bicolor* L) is the fifth leading position among cereal crops in Egypt and on the world level. It provides the stable diet for low income people of Africa and Asia. It is widely cultivated in Egypt for human consumption, animal feeds, poultry nutrition and for industrial production (alcohol, malt, starch, oil). High yielding varieties have been introduced by plant breeders, who have been hybridized with local varieties to introduce higher yield hybrids. Weeds culminate forage or dry matter yield reduction to an extent of 15-54% (Singh *et al.,* 1988; Raghuvanshi *et al*., 1990). Competition for light is one of the major factors that cause weeds to adversely affect crops (Patterson, 1985). Improvement of the crop with respect to both productivity and quality is highly desirable. Weed control is one of the potential approaches for achieving this goal. For many field crops, including sorghum there is a critical period during which weed control is essential to prevent substantial yield losses. Usually, this critical period of weed control begins a few days or weeks after the emergence of the crop and lasts for variable lengths of time depending on the crop and the environmental conditions. For post-emergence herbicides, in particular, adjusting the time of herbicide application in accordance with the critical period presents a useful option to increase the efficacy and / or reduce the amount of herbicide used in agricultural systems. In practice, however, post-emergence herbicides are applied at certain stages of the development of the target weed species or crops at the rates suggested by the manufacturers.

Many investigators have studied the effect of herbicides on crop characters, weed control, and chemical composition of the grains. Snel *et al.* (1987) mentioned that fluroxypyr gave excellent control in cereal crops dicotyledonous weeds. Allans and Zhang (1997) reported that in general, bentazon/atrazine applied at early stages (7days after emergence) of the development of corn seedlings at high or intermediate rate (1.6 or 0.8 kg a.i./ha) maintained low weed densities, with a relatively small range of variation over years. Delay in time (14 or 21 days after emergence) or reduction in herbicide rate (0.4 kg a.i./ha) increased the risk of high weed pressure, although it was not always associated with yield loss.

Chavan *et al.* (1980) studied the soluble proteins of sorghum grains of two low and high tannin varieties by polyacrylamide electrophoresis. They detected 16-17 bands in low tannin varieties, but no bands have been detected in high tannin varieties. Soluble proteins of dehulled grains of high tannin varieties resolved into 9-10 components indicating that seeds coat tannins were responsible for the failure of separation. Shaban *et al.* (1991) showed that the herbicidal combinations involving metribuzin or bentazon were slightly effect in protein and oil content in maize and soybean seeds. El-Metwally (2002) reported that bentazone at 0.75 L/feddan and fluroxypyr at 0.2 L/feddan sprayed after 3 weeks from sowing significantly increased grain protein and oil percentage of maize.

Therefore the objectives of this investigation were to study the effect of rate and time of application of two herbicides namely: Basagran and Starane on yield, yield components and chemical composition of sorghum grain (Shandaweel-1 hybrid).

MATERIALS AND METHODS

Two field experiments were carried out at the Agricultural Experimental station, Faculty of Agriculture, Cairo University, Giza, Egypt, during summer 1999 and 2000 seasons. The soil was clay loam in texture and was ploughed twice, ridged and divided into plots. Each plot consisted of 5 rows, recommended rates of phosphorus and nitrogen fertilizer and irrigation for sorghum crop were used. A randomized complete block design with four replicates was used in all experimental seasons. The various treatments in both experimental seasons were presented in Table (2).

MATERIALS:

1- Sorghum grains: (*Sorghum bicolor* CV.) cultivar Shandaweel –1 were obtained from the crops research division, agricultural research center, Giza, Egypt .

2- Herbicides: The common, trade and chemical name of the herbicides used in both experiments are shown in Table (1),

Table (1): The common, trade and chemical name of the herbicides used in both experiments

Common name	Trade name	Chemical structure
1- Fluroxypyr	Starane 20%	2- amino 3, 5-dichloro-6- fluro- 2- Pyridyl oxy acetic acid.
2- Bentazone	Basagran 48%	3- (1-methylethyl) –1 H-2, 13-benzothiadiazin -4 (3H) one 2,2-dioxide.

Table (2) The various herbicides, rates and time of application used during two seasons.

Treatments	Rate ml/fed	Time of application
1- Basagran	400	7 days from sowing
2- Basagran	500	7 days from sowing
3- Starane	100	7 days from sowing
4- Starane	200	7 days from sowing
5- Basagran	400	15 days from sowing
6- Basagran	500	15 days from sowing
7- Starane	100	15 days from sowing
8- Starane	200	15 days from sowing
9- Hand hoeing	twice	20 & 30 days from sowing
10- Unweeded (control)		

Crop characters and yield components:

Sorghum plants were harvested after four months from planting. A sample of 10 plants was taken from each plot. Plant height. (cm), Plant weight (g), ear length (cm), ear weight (g), Weight of Grain / ear (g), Weight of 1000 grain in (g) and Grain yield / fed (Ardab / feddan)

Chemical Analysis:

1- Determination of crude protein in the grain:

The total nitrogen was determined by Microkjeldahl method according to (A.O.A.C, 2000) by distilling the ammonia into 4% boric acid and titration with standard HCl (0.01N). The nitrogen content was multiplied by the factor 5.70, to obtain the protein content.

2- Determination of oil content:

The oil content of the grains was determined according to the procedures reported in the A.O.A.C (2000).

3- Determination of total hydrolysable, soluble and insoluble carbohydrates:

Carbohydrates were determined colourimetrically according to the method of Smith *et al.* (1956)

4- Determination of starch:

Starch content of sorghum grains was determined according to the direct acid hydrolysis method of A.O.A.C. (2000).

5- Determination of total Polyphenols:

Phenolic compounds were determined by colourimetric method described by Snell and Snell (1953)

6- Determination of tannins:

Tannins of the grain were determined using the modified vanillin hydrochloric acid (MV-HCL) method as reported by Maxson *et al.* (1972).

7- Determination of total amino acids:

Protein hydrolysis was carried out according to the method of Gehrke *et al.*, (1985). Amino acids analysis were performed on an Eppdrof-Germany Lc 3000 Amino Acid Analyzer.

8- Oil content:

Oil was extracted from the grains and determined according to the procedure reported in A.O.A.C. (2000).

8.1 Identification and determination of fatty acids and unsaponifiable matters by gas liquid chromatography (G.L.C.)

Portions from the extracted oil were converted into their fatty acid methyl ester (FAME) according to the method of Egan *et al.* (1981). Fatty acid composition was performed by Gas Liquid chromatography (Schimadzu Gas chromatograph Model 4 CM, Kyoto, Japan) equipped with a Flame Ionization Detector (FID). A wide boro (id= 00.5 mm) chrome packed glass column was used (SP 2340 silica). The chromatographic conditions were as follows: Injection port temperature, 270 °C, flame ionization detector (FID), 270 °C, initial oven temperature 150 °C rising to 240 °C at 5 °C/min. The carrier gas used was nitrogen at flow rate of 25 ml/min. Standard FAME (Nu – check – Prep, Elyssia, MN, USA) were routinely chromatogaphed. The fatty acid composition and unsaponifiable matters of the grains were identified by comparison their retention time with the retention times of known standards.

9- Sodium dodecyl sulphate polyacrylamide gel electrophoresis (SDS) of grains protein:

Sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE) was used to fractionate the protein of the grains performed according to the method described by Laemmli (1970).

10- Statistical analysis:

The obtained data were analyzed according to the method described by Snedecor and Cochran (1980).

RESULTS AND DISCUSSION

Effect of herbicides on yield and yield components:

Effect of different herbicides treatments on yield and yield components of sorghum (Shandaweel-1) were studied in two consecutive seasons. The average of two years values of plant height, plant weight, ear length, ear weight, weight of grain / ear, 1000 grain weight and yield ardab / feddan were summarized in Table (3).

1- Plant height:

Data in Table (3) show that all treatments except basagran 400 ml/feddan after 15 days from sowing and hand hoeing gave a significant increase in plant height. Starane 200 ml /feddan after 7 days from sowing gave the highest increase (164.1 cm), followed by basagran 500 and 400 ml /feddan after 7 days from soiwng (163.0 cm and 160.3 cm). While basagran 400 ml / feddan after 15 days from sowing gave the lowest increase in plant height (152.3 cm) in comparison with the control. (149.6 cm).

2- Plant weight:

Data in Table (3) show that all treatments except hand hoeing significantly increased plant weight, compared with the control. Starane 200 ml / feddan after 7 days from sowing gave the highest increase in plant weight (534.8 g), followed by basagran 500 ml /feddan after 7 days from sowing (532.9 g) and starane 200 ml / feddan after 15 days from sowing (520.0 g). While hand hoeing gave a non significant increase (495.1 g) compared to the control (481.3 g).

3- Ear length:

All treatments except basagran 400 and 500 ml /feddan after 15 days from sowing and hand hoeing gave a significant increase in ear length of Shandaweel-1. Starane 200 ml/feddan and basagran 500 and 400 ml/feddan after 7 days from sowing gave the highest increase in ear length. (30.93, 3065 and 30.24 cm) compared to the control (28.98 cm). Whereas, basagran 400 ml/feddan after 15 days from sowing, gave the lowest increase in ear length (29.31 cm).

Table (3) Effect of basagran and starane at different concentrations on the yield and yield components of sorgahum crop (Shandaweel- 1 hybrid) average analysis for 1999, 2000 seasons.

Treatment (rates ml/ fed)	Plant height (cm)	Plant Weight (g)	Ear length (cm)	Ear Weight (g)	Weight Of grains/ear (g)	1000 Grains weight (g)	Yield ardab/ fed	Relative yield %
1- Basagran 400 (a)	160.3	518.0	30.24	148.8	59.80	27.29	13.85	128.36
2- Basagran 500 (a)	163.0	532.9	30.65	150.1	60.83	33.89	14.50	134.38
3- Starane 100 (a)	155.8	515.5	29.89	144.3	60.70	32.12	14.09	130.58
4- Starane 200 (a)	164.1	534.8	30.93	154.8	65.18	35.86	15.73	145.78
5- Basagran 400 (b)	152.3	503.8	29.31	136.5	55.99	29.10	11.23	104.08
6- Basagran 500 (b)	154.6	510.8	29.73	138.6	58.24	29.51	12.90	119.56
7- Starane 100 (b)	157.3	509.2	29.97	143.3	59.36	31.58	13.89	12873
8- Starane 200 (b)	157.8	520.0	30.21	148.8	63.36	32.93	14.23	131.88
9- Hand hoeing	153.5	495.1	29.37	131.0	55.21	28.26	10.97	101.67
10- Unweeded (Control)	149.6	481.3	28.98	116.2	50.36	24.00	10.79	100
L.S.D. 0.01%	5.779	23.51	1.049	9.261	4.012	0.4222	1.058	

(i) Spray after 7 days form sowing.
(ii) Spray after 15 days form sowing.

4- Ear weight:

Hand–hoeing and all herbicidal treatments caused a significant increase in ear weight in comparison with the control. The highest increase was observed with starane 200 ml /feddan after 7 days from sowing (154.8 g) followed by basagran 500 and 400 ml /feddan after 7 days from sowing and starane 200 ml /feddan after 15 days from sowing (150.1, 148.8 and 148.8 g) respectively while the lowest increase was with hand hoeing (131.0 g).

5- Weight of grain / ear:

All treatments resulted a significant increase in weight of grain /ear. Starane 200 ml /feddan after 7 days from sowing (65.18 g) recorded a maximum increase in weight of grain /ear followed by starane 200 ml /feddan after 15 days from sowing (63.36 g) and basagran 500 ml/feddan after 7 days from sowing (60.83 g) while hand hoeing gave a minimum increase in weight of grain /ear (55.21 g) compared with the control (50.36 g).

6- 1000 grain weight:

All treatments recorded a significant increase in 1000 grain weight. The maximum increase was showed with starane 200 ml/feddan after 7 days from sowing (35.86 g), followed by basagran 500 ml/feddan after 7 days from sowing, (33.89 g), starane 200 ml/feddan after 15 days from sowing (32.93 g) and starane 100 ml/feddan after 7 days from sowing (32.12 g). While basagran 400 ml /feddan after 7 days from sowing gave a minimum increase in 1000 grain weight (27.29 g) in comparison with the control (24.00g).

7 – Yield ardab / feddan:

All treatments except basagran 400 ml/feddan after 15 days from sowing and hand hoeing gave a significant increase in grain yield in comparison with the control. The highest increase was observed with starane 200ml/ feddan after 7 days from sowing (15.73 ardab) followed by basagran 500 ml /feddan after 7 days from sowing (14.50 ardab) starane 200 ml / feddan after 15 days from sowing (14.23 ardab) and starane 100 ml /feddan after 7 days from sowing (14.09 ardab), whereas hand hoeing gave a minimum increase in grain yield (10.97 ardab) compared to the control (10.79 ardab).

From these results it could be concluded that all treatments significantly increased weight of grain / ear, 1000 grain weight and yield except basagran 400 ml / feddan after 15 days from sowing and hand-hoeing these due to the weed control thus improvement of plant growth. These results are in a good agreement with those of Allans and Zhang (1997) they reported that, in general, bentazone / atrazine applied at early stages (7days after emergence) of the development of corn seedlings or at high or intermediate rate (1.6 or 0.8 kg a.i / ha) maintained low weed densities. Delay in time (14 or 21 days after emergence) or reduction in herbicide rate (0.4 kg a.i./ha) increased the risk of high weed pressure, although it not always associated with yield loss.

Effect of herbicides on the chemical composition of sorghum grain:
1 Protein Content:

Data in Table (4) indicate that hand-hoeing and all herbicidal treatments gave a significant increase in protein content of Shandaweel-1 hybrid grain compared with the control (9.517%). Basagran 500m1/feddan after 15 days from sowing recorded the highest increase in protein content (12.17%) followed by basagran 500m1/feddan after 7 days from sowing (12.04%) and basagran 400m1/feddan after 15 days from sowing (11.69%). While hand hoeing gave the lowest protein cotent (10.45%).

Table (4) Effect of basagran and starane at different concentrations on the chemical composition of surghum grain (Shandaweel-1 hybrid)

Treatment (rates ml/ fed).	Protein %	Oil %	Phenols %	Tannins %
Basagran 400 (a)	11.66	5.103	2.625	0.2414
Basagran 500 (a)	12.04	5.223	2.588	0.2303
Starane 100 (a)	11.09	4.818	2.357	0.2065
Starane 200 (a)	11.29	4.835	2.148	0.1675
Basagran 400 (b)	11.69	5.058	2.962	0.2095
Basagran 500 (b)	12.17	5.140	2.648	0.1390
Starane 100 (b)	11.40	4.412	2.772	0.2065
Starane 200 (b)	11.48	4.707	2.253	0.2008
Hand Hoeing twice	10.45	4.458	1.803	0.1460
Unweeded (control)	9.517	4.057	2.978	0.2862
L.S.D. (0.01 %)	0.285	0.0496	1.070	0.0496

(i) Spray after 7 days from sowing.
(ii) Spray after 15 days from sowing.

2- Oil Content:

It is clear from the data in Table (4), that all treatments gave a significant increase in oil content of the grains. Basagran 500 m1/feddan after 7 and 15 days from sowing recorded the highest increase in grain oil content (5.22% and 5.14%) followed by basagran 400 m1/feddan after 7 days from sowing (5.10%), while starane 100 m1/feddan after 15 days from sowing and hand hoeing gave the lowest increase in oil content (4.41% and 4.45%). The other treatments gave a moderate increase in oil content compared to the control (4.05%).

Shaban *et al.* (1991) found that herbicidal combinations involving metribuzin at (0.140Kg a.i./fed.) or bentazone at (0.720Kg a.i./fed) were significantly differed from hand hoeing treatment in protein and oil content in maize and soybean seeds. All weed control treatments including hand hoeing significantly surpassed the unweeded check in seed protein and oil content. El-Metwally (2002) found that bentazone at the rate of 0.75 L/fed and fluroxypyr at the rate of 0.20 L/fed sprayed after 3 weeks from sowing or bentazone at the rate of 0.375 L/fed + urea 1% and fluroxypyr at rate of 0.1 L/fed + urea 1% sprayed after 4 weeks from sowing gave a markedly increase in protein and oil percentage than the unweeded treatment of maize grain cv Single Cross Wattania 4.

3- Phenols Content:

All weed control treatments decreased phenols content of Shandaweel-1 hybrid grains compared with the control (2.978%). Basagran 400 ml/feddan after 15 days from sowing gave a negligible decrease in phenols content (2.962%) in comparison with the control. Hand hoeing gave the lowest value of phenol content (1.803%) followed by starane 200 ml/feddan after 7 days from sowing (2.148%), starane 200 ml/feddan after 15 days from sowing (2.253%) and starane 100 ml/feddan after 7 days from sowing (2.357%), whereas basagran 400 ml/feddan and starane 100 ml/feddan after 15 days from sowing gave the highest value of phenols content in Shandaweel-1 hybrid grains (2.962% and 2.772%) respectively.

4- Tannins Content:

It is obvious from Table (4) that all treatments decreased tannin content of Shandaweel-1 hybrid grains compared to the control (0.286%). Basagran 400 and 500 ml/fedaan after 7 days from sowing gave the highest value of tannins content (0.241% and 0.230%) respectively, while basagran 500 ml/feddan after 15 days from sowing gave the lowest amount of tannin (0.139%) followed by hand hoeing (0.146%) and starane 200 ml/feddan after 7 days from sowing (0.167%). Basagran 400 ml/feddan after 15 days from sowing and starane 100 ml/feddan after 7 and 15 days from sowing gave moderate a value of tannins content of Shandaweel-1 hybrid (0.209%, 0.206% and 0.2065%) respectively.

5- Carbohydrates Content:

The data in Table (5) show that starane 200 ml/feddan after 15 days from sowing, followed by basagran 500 ml/feddan after 7 days from sowing, hand hoeing and starane 100 and 200 ml/feddan after 7 days from sowing, recorded a significant increase in the total hydrolysable carbohydrate of Shandaweel-1 hybrid (72.46%, 72.45%, 71.91%, 71.77% and 71.62%) respectively, compared to the control (70.18%), while starane 100 ml/feddan after 15 days from sowing and basagran 400 ml/feddan after 7 days from sowing gave a non significant increase in total carbohydrates content of Shandaweel-1 hybrid grain (70.55% and 70.44%), whereas, basagran 400 ml/feddan and 500 ml/feddan after 15 days from sowing gave a non significant decrease in the total carbohydrate content (68.68%) and (69.81%) respectively.

5-1 Soluble Carbohydrate:

Only basagran 500 ml/feddan after 7 days from sowing gave a significant increase in the soluble carbohydrates content (7.57%) in comparison with the control (6.92%), while starane 100 ml/feddan after 7 days from sowing gave a non significant increase in soluble carbohydrates content (6.99%). Basagran 400 ml/feddan after 7 days from sowing (6.41%) and starane 200 ml/feddan after 7 days from sowing (6.48%) gave a non significant decrease in soluble carbohydrates, whereas, the other treatments significantly decreased the soluble carbohydrate content of Shandaweel-1 hybrid. Starane 100 ml/feddan after 15 days from sowing gave the lowest value of soluble carbohydrates (3.74%) in comparison with the control (6.92%).

5-2 Insoluble Carbohydrate:

All weed control treatments except basagran 400 ml/feddan after 15 days from sowing (63.05%) gave a significant increase in insoluble carbohydrates of Shandaweel-1 hybrid compared to the control (63.26%). It is clear that starane 100 and 200 ml/feddan after 15 days from sowing recorded the highest increase in insoluble carbohydrate content (66.81% and 66.73%) respectively, followed by hand hoeing (65.82%) and starane 200 ml/feddan after 7 days from sowing (65.14%).

5-3 Starch Content:

Data in Table (5) indicat that starane 200 ml/feddan after 15 days from sowing, starane 100 ml/feddan after 15 days from sowing and hand hoeing gave a significant increase in starch content of Shandaweel-1 hybrid grain (55.95%, 55.87% and 53.95%) respectively in comparison with the control (52.95%). Starane 200 ml/feddan after 7 days from sowing gave a non significant increase in starch content (53.61%), while the other treatments decreased the starch content. Basagran 400 ml/feddan after 15 days from sowing gave the lowest value of starch content (51.58%). From the obtained results it can be concluded that herbicides treatments kill broadleaf weeds and stimulate photosynthesis activity thus increased the total hydrolysable carbohydrates and starch contents.

Table (5) Effect of basagran and starane at different concentrations on carbohydrates and starch contents of surghum grains (Shandaweel-1 hybrid).

Treatment (rates ml/ fed)	Total hydrolysable carbohydrates %	Soluble carbohydrates %	Insoluble carbohydrates %	Starch %
Basagran 400 (a)	70.44	6.41	64.03	51.97
Basagran 500 (a)	72.45	7.57	64.88	52.65
Starane 100 (a)	71.77	6.99	64.79	52.76
Starane 200 (a)	71.62	6.48	65.14	53.61
Basagran 400 (b)	68.68	5.63	63.05	51.58
Basagran 500 (b)	69.81	5.41	64.40	52.64
Starane 100 (b)	70.55	3.74	66.81	55.87
Starane 200 (b)	72.46	5.74	66.73	55.95
Hand Hoeing twice	71.91	6.09	65.82	53.74
Unweeded (Control)	70.18	6.92	63.26	52.95
L.S.D. (0.01 %)	0.632	0.566	0.424	0.686

(a)Spray after 7 days from sowing.
(b) Spray after 15 days from sowing.

6- Effect of herbicides on amino acids composition of sorghum grain:

Data in Table (6) show that all weed control treatments increased proline and valine content of Shandaweel-1 hybrid compared to the control, also all weed control treatments except basagran 500 ml /feddan after 7 days from sowing and starane 200 ml /feddan after 7 and 15 days from sowing increased phenylalanine. All weed control treatments except basagran 500 ml /feddan after 7 and 15 days from sowing increased histidine.

T6

Lysine content increased with all herbicidal treatments except starane 100m1/feddan after 15 days from sowing , while basagran 500 ml /feddan after 7 and 15 days from sowing, starane 100 and 200 ml /feddan after 15 days from sowing and hand hoeing increased glutamic acid (18.76, 15.00, 14.79, 14.26 and 15.76) respectively compared to the control (13.86) also basagran 400 ml /feddan after 7 days from sowing, starane 100 and 200 ml /feddan after 15 days from sowing and hand hoeing increased leucine content (14.71 , 12.71 , 12.74 and 13.12) respectively compared to the control (12.121) whereas, isoleucine increased only with basagran 400 ml /feddan after 7 days from sowing and hand hoeing (4.858 and 4.029) in comparison with the control (3.939). Methionine also increased only with basagran 400 ml /feddan after 15 days from sowing (0.593) compared to the control (0.584) whereas cystine decreased with all treatments compared to the control.

These results are in a good agreement with those of Sharaky and Ashour (1982), who reported that stomp at (0.8 kg a.i /fed) gave the highest contents of glycine, valine, serine, tryptophan and lysine of maize grains. While atrazine (0.8 kg a.i. / fed) increased alanine, isoleucine, leucine, cysteine, tyrosine, aspartic, arginine and histidine amino acids of maize grains. Atrazine + stomp combination gave the highest increases in phenylalanine, threonine and cystine. Herbicides caused profound changes of most essential and non-essential amino acids. Glycine, valine lysine and histidine amino acid content increased as stomp dose increased, whereas, alanine, leucine, isoleucine, systeine, methionine, tyrosine, aspartic, glutamic and arginine contents decreased as the herbicide dose increased. Hoeing treatment had a favourable effect on the content of glycine, alanine, leucine, isoleucine, serine, cystine, tyrosine, arginine and histidine, amino acids in comparison to unweeded and hand weeded treatments.

Electrophoretic pattern of protein in Shandaweel-1 hybrid sorghum grains:

From the results obtained in Table (7) and Figure (1) it is clear that electrophoretic pattern of Shandaweel-1 hybrid was affected by basagran and starane at different rates. The number of separated protein bands ranged from 13 -17 bands in Shandaweel-1 hybrid with M.W. ranged from 7.594 to 101.43 KDa. Four new bands appeared with basagran 500 ml/feddan after 7 days from sowing with M.W. (7.59, 55.58, 91.03 and 99.63 KDa) compared to the control which gave 13 band with M.W ranged from (9.80 to 76. 13 KDa) whereas starane 200 ml /feddan after 7 days from sowing gave two additional bands compared to the control with M.W. 91.03 and 101.43 KDa. At the same time, basagran 500 ml /feddan after 15 days from sowing gave three additional bands compared to the control with M.W. 78.28, 91.39 and 100.53 KDa, also starane 200 ml /feddan after 15 days from sowing gave three additional bands with M.W. 52.03, 77.05 and 90.31 KDa. These new bands which appear with the herbicides treatments may results from the over expression of genes, which my involve in the resistance mechanisms. These results are not agreement with Kobeasy (1994), he found that applying herbicides (pendimethalin and linuron) with different doses had no effect on the electrophoretic profile pf the total soluble proteins of maize and soybean seeds.

Also, Mahmoud (1994) found no difference in protein pattern of corn leaves extracts from plants treated with pendimethalin or diuron.

Table (7) Effect of basagran and starane treatments on number and molecular weight of protein bands of Shandaweel-1 hybrid grains.

Number Of Peak	Peak Molecular Weight (M.W.) KDa.				
	Spray after 7 days from sowing		Spray after 15 days from sowing		Unweeded (control)
	Basagran 500 ml/fed	Starane 200 ml/fed	Basagran 500 ml/fed	Starane 200 ml/fed	
1	99.638	101.436	100.533	90.311	76.139
2	91.031	91.031	91.393	77.051	70.608
3	78.285	78.285	78.285	71.170	48.711
4	71.170	71.738	54.139	68.130	42.621
5	55.588	50.015	42.826	52.036	40.110
6	44.713	44.713	41.745	44.642	38.111
7	42.485	42.826	39.982	42.689	36.677
8	40.110	39.982	38.355	40.110	35.017
9	38.355	38.172	36.502	38.233	33.753
10	36.795	36.560	35.129	36.385	32.535
11	35.354	35.298	33.915	34.961	30.864
12	34.078	34.024	32.535	33.592	26.476
13	32.849	32.744	30.815	32.432	9.808
14	31.062	30.914	27.174	30.717	
15	27.056	9.556	9.598	26.939	
16	9.766			9.639	
17	7.594				

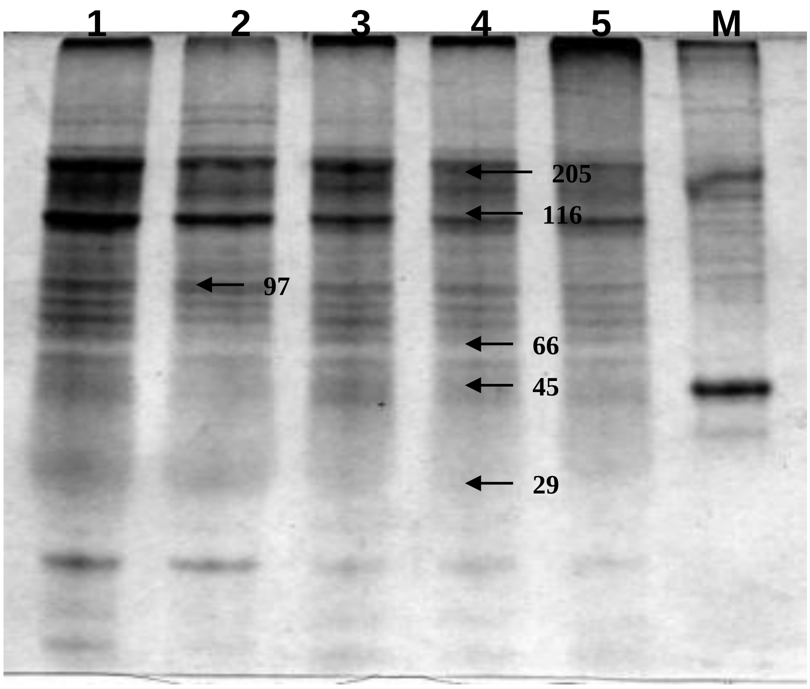

Figure (1): SDS-PAGE (electrophorogram) the effect of different concentrations of basagran and starane herbicides and different times of treatments on total soluble proteins of sorghum grains. .

1. **Basagran 500ml/fed.spray after 7 days from sowing.**
2. **Starane 200 ml/fed.spray after 7 day from sowing.**
3. **Basagran 500ml/fed.spray after 15 days from sowing.**
4. **Starane 200 ml/fed.spray after 15 day from sowing.**
5. **Unweeded (control).**
6. **Protein marker.**

Effect of herbicides on fatty acid composition of sorghum grains oil

As shown in Table (8) it is obvious that basagran 500 ml /feddan after 7 days from sowing increased lauric acid (C12:0) (0.122), oleic acid (C18:1) (37.239), linolenic acid (C18:3) (2.858) and Tu/Ts (6.017) compared to the control (0.0562, 33.415, 2.669 and 5.29) respectively while the other fatty acids were decreased. Starane 200 ml /feddan after 7 days from sowing increased lauric acid (C12:0) (0.0802), oleic acid (C18:1) (34.437) and Tu / Ts (6.190) while decreased the other fatty acids compared to the control. Whereas basagran 500 ml/feddan after 15 days from sowing increased lauric acid (C12:0) (0.0943), linoleic acid (C18:2) (51.804) and Tu / Ts (6.337). finally starane 200 ml /feddan after 15 days from sowing increased lauric acid

(C12:0) (0.374), linolenic acid (C18:3) (2.875) and Tu /Ts (5.815) while decreased the other fatty acids compared to the control.

These results agreed with those obtained by Ahmed *et al.* (1987) who found that bentazone at 0.40 kg a.i./feddan at 60 days from sowing decreased the ratio between total unsaturated fatty acids to saturated fatty acids (Tu /Ts) while bentazone at 0.20 kg. a.i./feddan and (benzoylprop – ethyl + bentazone) at 0.60+0.20 kg. a.i./feddan increased Tu /Ts compared to the control of flax seed oil. There was a negative relation between 18: 1 and 18: 3.

Table (8) Effect of basagran and strane on relative persentage of fatty acid in sorghum oil Shandaweel- 1 hybrid.

Fatty acid %	Spry after 7 days from sowing		Spry after 15 days from sowing		Unweeded control
	Basagran 500 ml/fed	Starane 200 ml/fed	Basagran 500 ml/fed	Starane 200 ml/fed	
Capric (C10 : 0)	---	---	---	---	0.0619
Lauric (C12 : 0)	0.1221	0.0802	0.0943	0.3742	0.0562
Myristic (C14 : 0)	0.0925	0.0449	0.0941	0.0475	0.5522
Palmitic (C16 : 0)	13.8180	13.7137	13.2007	14.1622	15.6696
Stearic (C18 : 0)	0.2170	0.0678	0.23899	0.08923	0.2711
Total Saturated Fatty acids (Ts)	14.2496	13.9066	13.6281	14.6731	16.611
Oleic (C18 : 1)	37.2391	34.4375	32.5995	33.4091	33.4159
Lenoleic (C18 : 2)	45.6531	51.2941	51.8041	49.0426	51.8027
Linolenic (C18 : 3)	2.8582	0.36185	1.96825	2.8752	2.6699
Total unsaturated Fatty acids (Tu)	85.7504	86.0935	86.3719	85.3269	87.889
TU / TS	6.0177	6.1908	6.3378	5.8152	5.2910

Effect of herbicides on unsaponifiable matter of sorghum grain:

The data in Table (9) indicate that the ratio of total sterols (Ts) to total hydrocarbons (TH) decreased with all herbicidal treatments compared to the control (0.5789) Basagran 500 ml /feddan after 7 days from sowing gave the highest value of TS/ TH (0.532), whereas starane 200 ml/ feddan after 15 days from sowing gave the lowest value of TS /TH (0.2176).

These results are in agreement with those of Ahmed *et al.* (1987) who found that bentazone (basagran 4%) at the rate of 0.2 and 0.4kg a.i/fed and benzoyl prop-ethyl (suffix 20%) at the rate of 0.6 and 1.2 kg a.i./fed applied after 60 days from sowing (post emergence) increased TH /Ts ratio of flax plants compared to the untreated control. The results showed that some new compounds like avenasterol appeared in all treated samples in comparison with the untreated sample (control). These data may be due to the interconversion between the sterols may occur.

Table (9): Effect of basagran and starane on relative persentage of unsaponifiable matter of sorghum grain (Shandaweel- 1 hybrid).

Compounds% treatments	Spry after 7 days from sowing		Spry after 15 days from sowing		Unweeded control
	Basagrane 500 ml/fed	Starane 200 ml/fed	Basagrane 500 ml/fed	Starane 200 ml/fed	
(C12 : 0)	1.05	1.43	1.23	0.41	1.44
(C15 : 0)	0.45	0.08	0.52	0.94	0.35
(C16 : 0)	0.48	0.26	0.07	---	0.25
(C17 : 0)	0.24	0.28	0.66	0.09	0.27
(C18 : 0)	0.16	0.10	0.12	0.25	---
(C19 : 0)	0.42	0.33	0.38	0.25	1.49
(C20 : 0)	1.18	1.07	0.92	1.61	---
(C21 : 0)	0.72	0.43	0.65	0.69	0.49
(C22 : 0)	0.340	0.477	0.409	0.696	0.435
(C23 : 0)	2.24	3.76	2.88	2.59	1.51
(C24 : 0)	3.07	3.27	---	---	1.09
(C25 : 0)	---	3.97	8.85	10.81	2.88
(C26 : 0)	6.51	4.83	6.35	7.92	3.97
(C27 : 0)	4.72	6.64	6.327	6.947	6.027
(C28 : 0)	2.76	4.30	---	5.21	3.97
(C29 : 0)	6.42	8.90	5.11	4.75	5.24
(C30 : 0)	---	---	4.85	5.59	4.44
(C31 : 0)	3.24	3.85	4.34	4.60	4.20
Cholesterol	---	---	---	---	---
Campesterol	8.21	8.20	10.0	5.04	11.29
Stigmasterol	4.91	4.21	5.66	2.93	6.10
B-Sitosterol	1.595	1.453	---	0.970	1.994
avenasterol	1.263	1.144	1.407	0.615	1.534
avenasterol	0.759	0.641	0.840	0.773	1.110
stigmastandiol	1.365	0.695	0.760	1.28	---
TS/TH	0.5324	0.3716	0.4275	0.2176	0.5789

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تـأثير البـازاجران والإسـتارين علـى التركيـب الكيميـائي وصـفات المحصـول لحبـوب الذرة الرفيعة

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أجريت تجربتان حقليتان بمزرعة كلية الزراعة جامعة القاهرة في موسمي ١٩٩٩ – ٢٠٠٠ وذلك بهدف دارسة تـأثير معدل ووقت استخدام مبيدي الحشـائش (البـازاجران والإسـتارين علـى التركيـب الكيميـائي لحبوب الذرة الرفيعة هجين شندويل -١) وصفات المحصول واستخدمت المبيدات المختارة كالآتي:

البازاجران استخدم بتركيز ٤٠٠، ٥٠٠ مل للفدان والإستارين بتركيز ١٠٠، ٢٠٠ مل للفدان وذلك في موعدين هما بعد ٧، ١٥ يوم من الزراعة في قطع تجريبية منفصلة وأجريت أيضـاً معاملـة يدويـة للتخلص من الحشائش وذلك للمقارنة بالإضافة إلى كنترول بدون أي معاملات.

وقد أظهرت النتائج ما يلي:

١- أدت المعاملـة بمبيـدات الحشـائش إلـى زيـادة معنويـة فـي نسـبة البـروتين والزيـت وانخفـاض فـي نسـبة الفينـولات والتانينـات فـي الحبـوب مقارنـاً بـالكنترول وأيضـاً أدت جميـع المعـاملات إلـى زيـادة نسـبة الكربوهيدرات القابلـة للتحليل المـائي ونسبة النشـا وذلك للمقاومـة الجيدة للحشـائش وتحسين عمليـة البنـاء الضوئي.

٢- عند فصل الأحماض الأمينية والتعرف عليها بجهاز Amino acid analyzer أوضحت النتائج أن جميع المعـاملات أدت إلـى زيـادة بعض الأحمـاض الأمينيـة الضـرورية مثـل الفينايـل ألانـين، الهستيدين، الليسين، الليوسين، أيزوليوسين، المثيونين، وعند إجراء عملية الفصـل الكهربـي للبروتينـات أوضـحت أن المعاملات المختلفة بمبيدات الحشائش لم يكون لهـا تـأثير واضـح علـى البروتينـات المفصـولة وإنمـا حـدثت زيادة طفيفة في بعض بندات البروتينات ذات الوزن الجزيئـي العـالي. كمـا أوضـح الفصـل باستخدام جهـاز التحليل الكروماتوجرافي الغازي للأحماض الدهنية والمواد الغير متصبنة زيادة في نسبة بعض الأحمـاض الدهنيـة الغيـر مشـبعة الضـرورية مثـل اللينوليك واللينولينيك وبعض الهيـدروكربونات. وبالنسبة لصـفات المحصـول أدت جميـع المعـاملات إلـى زيـادة معنويـة فـي صـفات المحصـول مثـل طـول القنـديل ووزن الحبوب للقنديل ووزن ١٠٠٠ حبة والمحصول الكلي للفدان بـالأردب مقارنـاً بالمعاملـة اليدويـة والكنتـرول ولهـذا يوصـى باسـتخدام مبيدي البـازاجران والإسـتارين بالمعدلات المستخدمة فـي مقاومـة الحشـائش فـي حقول الذرة الرفيعة لما لها من صفات مرغوبة في زيادة المحصول ورفع القيمة الغذائية للحبوب.

Table (6) Effect of basagran and starane at different concentrations on amino acids composition of sorghum grains (Shandaweel –1 hydrid) (g/100g protein).

Amino acids g/100 g protein	Spry after 7 days from sowing				Spry after 15 days from sowing				Hand hoeing	Unweeded (control)
	Basagran 400 ml/fed	Basagran 500 ml/fed	Starane 100 ml/fed	Starane 200 ml/fed	Basagran 400 ml/fed	Basagran 500 ml/fed	Starane 100 ml/fed	Starane 200 ml/fed		
1- Asp.	7.548	5.509	6.152	4.642	7.066	6.200	7.698	7.039	4.369	5.293
2- Threonine	3.665	1.929	2.222	2.278	2.400	2.700	2.722	2.629	3.070	2.864
3- Serine	3.419	3.558	3.159	3.243	3.211	4.600	3.592	2.0059	3.727	3.825
4- Glutamic	11.764	18.763	12.399	11.533	13.447	15.000	14.791	14.268	15.768	13.869
5- Proline	6.055	9.303	10.973	10.579	9.869	7.400	8.008	6.387	6.105	6.010
6- Glycine	3.631	2.128	2.673	4.964	2.640	2.500	3.231	2.779	6.513	3.583
7- Alanine	10.330	6.438	8.130	6.099	8.989	8.190	8.876	10.133	9.234	8.306
8- Cystin	0.052	0.080	---	0.212	0.014	---	0.001	-	-	0.267
9- Valine	6.275	4.723	5.6509	3.329	3.674	4.600	5.066	5.174	5.084	2.167
10- Methionine	0.462	0.364	0.573	0.428	0.593	0.330	0.356	-	0.181	0.584
11- Isoleucine	4.858	2.703	3.525	3.337	3.436	3.500	3.726	3.765	4.029	3.939
12- Leucine	14.714	10.216	11.693	11.432	11.379	11.700	12.714	12.746	13.125	12.121
13- Tyrosine	3.466	1.753	1.969	1.909	1.863	2.500	2.309	3.364	2.239	2.107
14- Phenylalanine	6.272	3.990	5.103	3.541	4.786	4.500	5.529	3.461	5.079	4.433
15- Histidine	2.752	2.183	2.517	4.500	2.661	2.110	2.653	3.371	2.778	2.299
16- Lysine	4.395	4.609	4.690	7.449	6.011	4.840	4.042	4.415	2.812	4.365
17- Arginine	3.845	3.301	3.574	4.874	3.709	3.800	3.101	3.587	3.397	4.304