Journal of Sohag Agriscience (JSAS) 2017, No. (2): 90-103 **ISSN 2357-0725**
Website: https://jsasblog.wordpress.com. **Amira *et al.*, (2017)**

Evaluation of some herbicides efficiency on sugarcane crop

Amira, O. A. Baker[1], Ahmed, A. A. Sallam[2], and Ashraf, O. Abd El-latif[2]

1 Agricultural Research Station, Kom-Ombo, Aswan, Agricultural Research Centre, Dokki, Giza, Egypt- 2Plant Protection Dept. Faculty of Agriculture, Sohag University, Sohag, Egypt

Keywords: Herbicides, efficiency, sugarcane quality, yield

Abstract

The present study was carried out at Kom-Ombo Agricultural Research Station Farm, Aswan Governorate, Agricultural Research Centre, Giza, Egypt, to evaluate the herbicide treatments on different weed species in sugarcane fields and their control methods on yield and quality of sugarcane. The obtained results revealed that, the weed species observed in the sugarcane field were twelve weed species belonging to nine families. Out of them three species belong to the broad leaved perennial weeds (Convolulus arvensis L., Sesbania sesban L., and Ipomoea cairica L.) while six species belong to the broad- leaved annual weeds (Hibiscus trionum L. , Corchorus sp, Euphorbia geniculate L., Portulaca oleraceae L. , Sida alba L., and Datura stramonium L.) were observed. The grass perennial weeds were presented by two species (Cyperus rotundus L. , and Cynodon dactylon L.), while only one grass annual weed species were found (Digitaria sanguinalis L.). Weed control treatments had a significant affected on broad leaved, narrow, and total weeds (g/m^2) in both seasons. The application of herbicides affected the weed type and density but the response of different types of weeds varied to different herbicides. In addition, weeds control by herbicides treatments had a significant effect on cane, and sugarcane yield , brix, sucrose , purity and sugar recovery percentages in sugarcane .

INTRODUCTION

Sugarcane (*Saccharum spp*. L.) is one of the most important field crops in the tropical and

subtropical regions of the world. Sugarcane is grown in more than 105 countries and presently in an average of about 19 million hectares with world production of approximately 1.3 billion metric tons of cane and 127 million tons of sugar (**Malavolta, 1994).** Sugarcane is an important cash and industrial crop of Egypt, occupying 321 thousand feddan with an average yield of 48.7 ton/feddan**. (Anonymous ,2016).** Sugarcane which is mainly cultivated in Upper Egypt (Mania, Sohag, Qena, Luxor and Aswan) is subjected to infestation with many noxious weeds which might interfere with the crop plants through competition for water, nutrients, moisture, light, CO_2, space, and release allelochemicals. Weeds can be classified in numerous ways. Sometimes weeds are classified as broadleaves (dicotyledonous plants) and grasses (monocotyledonous plants). Another common way to classify weeds is by their lifespan – annuals, biennials, and perennials.Weeds compete throughout the life cycle of the main crop but it is more sensitive to the presence of weeds at a specific period during its life cycle which is known as the critical period of weed crop competition. During this period, weeds cause maximum yield losses. The critical period of weed crop competition in sugarcane ranged between 27 and 50 days **(Srivastava *et al.*, 2003).** Sugar yield as well as juice quality greatly affected by application of weed control treatments. The presence of weeds in the sugarcane fields and no control has also led to a decrease in sugar yield **(Roshan *et al.*, 2006.; Patel *et al.*, 2007;Kanchan, 2009)** in proportion of sucrose ,purity and brix **(Bahadar *et al.* , 2004 ; Annual Report, 2012)** . Generally, the increase in by weed growth one kilogram corresponds to a reduction in one kilogram of crop**.** The reduction in cane yield due to weeds ranged from 40-60% **(Kadam *et al.*, 2011).** Herbicides are chemicals used to eliminate plants. They are applied in suitable doses directly on the vegetation for foliar absorption (post-emergence treatment), or on the soil for absorption by the plant tissues formed after the seed germination, before the plant emergence from the soil surface (pre-emergence treatment). They are generally used to control weeds in different agro-ecosystems. To select of which herbicide will be used in weed control, we should always have an ecological focus using this agronomic technique aiming the maximum production. This duality, choice, besides the type, dose, number and mode of

application, should always seek the dichotomy of maximum efficiency and minimum environmental impact, thus maximizing the benefits of their use and minimizing their environmental and toxicological risks. There are many compounds used for weed control in sugarcane crop. Results revealed that all the weed control methods significantly reduced weed flora and weed biomass as compared to weedy check **(Singh *et al*., 2008).**

Based on the knowledge mentioned above the current study aims to:

(1) conduct a survey on weed species that are present in sugarcane fields, (2) evaluate the efficiency of herbicide treatments to control the sugarcane weeds in the fields, (3) study the effect of herbicides treatments on sugarcane yield and yield components and (4) study the effect of herbicides treatments on sugarcane quality.

MATERIALS AND METHODS

The present study was carried out at Kom-Ombo Agricultural Research Station Farm, Aswan Governorate, to study the effect of different herbicides on different weed species in sugarcane fields and study their effect on yield and quality of the sugarcane. The work was conducted during the two plant-crop seasons of 2014/2015 and 2015/2016.

2.1. Sugarcane planting

The experimental field was prepared following the mechanical tillage practices to fine seed bed before planting the crops. In accordance with the specifications of the design, a field layout was prepared. After preparing the layout, the plots were leveled manually. The commercial sugarcane cultivar G.T. 54-9 Known as C9, was planted on 23 and 15th of March in 2014/2015 and 2015/2016 seasons and harvested after 12 months in both seasons. The dry method of sugarcane planting was used. Each plot consisted of 10 rows (6m long and 70 cm width) with a plot area of 42 m^2 (1/100 feddan).

2. 2. Survey of different weed species in sugarcane fields

Weed species survey were conducted randomly from one meter square from each plot of experimental field . Green weed plants were cut out of the soil surface from the same site in the experimental unit .The weed species that were easy to identify were recorded in the field, those species which could not be identified in the field were brought to the laboratory and were identified using the weed identification guide **(Stroud and Parker, 1989)**. Weeds were then identified and classified into four groups: (a) Annual broad-leaved, (b) Annual narrow-leaved, (c) Perennial broad-leaved, and (d) Perennial narrow- leaved**.**

2.3. Herbicides Treatments:

Four herbicides were tested, (1) Diuron (Devo 90% WP), (Pre-emergence) was applied after planting and before irrigation at rate of 2.5 kg /fed., (2) Triclopyr (Garlon 48% EC), (post-emergence) at rate of 400 cm^3/fed , and was applied of 30 days after planting, (3) Furoxypyr (Starane 20% EC), (post-emergence) at rate of 200 cm^3/fed , 30 days after planting, and (4) Triclopyr (Super garlon 27% EC), (post-emergence) was applied of 30 days after planting at rate of 600 cm^3/fed. These herbicides were applied at different rates using Knapsack spray, (20 liter capacity), while, (control plots were treated by water only.)

2.4. The effect of herbicides on weeds

Weeds from one meter square were taken from the middle furrow of each plot after 75 days from planting by hand pulling of weeds. Weeds were separated to grass and broad - leaved weeds and were air-dried followed by oven dried at 65^0C for 48 hrs. and weighed. The effect of tested herbicide on the following parameters were recorded: (1) Dry weight of grass weeds (g/m^2), (2) Dry weight of broad leaved weeds (g/m^2), and (3)Dry weight of total weeds (g/m^2).

The reduction percentage in the dry weight was calculated according to the following equation:

$$\text{Reduction percentage} = \frac{A - B}{A} \times 100$$

Where, A = Dry weight of weed in control, and B = Dry weight of weed in treatment.

2.5. Effect of herbicides treatments on cane yield and sugar yield (tons/fed.)

- Cane yield (tons/fed.): it was determined from the weight of the three rows of each plot converted into value per feddan.

- Sugar yield (tons/fed.): it was estimated according to the following equation: **Sugar yield (tons/fed.)** = Cane yield (tons/fed.) x Sugar recovery

2.6. Effect of herbicides treatments on the juice of sugarcane quality:

A sample of 25 stalks from each plot were randomly taken from the center lines of each experimental unit to extract the juice, and the following sugarcane juice quality parameters were estimated at the Sugar and Integrated Industries Company, Kom-Obo according to the method of (**Mathur**, **1981**) as follow:

2.6.1. Brix: the percent of total soluble solids (T.S.S) in 100 cm^3 juice as brix in sugarcane juice was estimated by using brix hydrometer according to the method described by **Spancer and Meade, (1963) .**Temperature of the juice was noted. These brix readings were corrected with the help of Schmitz's table.

2.6.2. Sucrose: was determined according to the method of **Meade**

and Chen, (1977) as follow 50 ml of filtered juice and 5 ml of neutral lead acetate 5% as regent were merged into 250 measuring flask, then diluted to the mark with distilled water. The solution was filtrated and the supernatant was placed in saccharometer (West Germany INSTRNO. 139582 Dr. WONFGANG) tube and the reading was recorded according to **(Anonymous, 1995)**.

2.6.3. Purity: was calculated according to the following equation,

$$\text{Juice purity percentage} = \frac{\text{sucrose percentage}}{\text{brix percentage}} \times 100$$

2.6.4. Sugar recovery percentage: was calculated according to the formula describe by **Yadav and Sharma, (1980) as follow**: **Sugar recovery %** = [sucrose % -0.4 (brix % - sucrose %) × 0.73].

2.6.5. Reducing sugars percentage: was determined using Fehling method according to **Anonymous, (1995)** .

2.7. Statistical analysis: the collected data were subjected to proper statistical analysis of complete randomized block design according to the procedure outlined by **Snedecor and Cochran (1981)**. Analyzing data was performed by using L. S. D. at 5% by **Steel and Torrie (1980)** and averages were compared by **Duncan's test** and a probability value of % 5.

III. RESULTS AND DISCUSSION

Sugarcane is the main crop that supplies sugar, and the second for ethanol production in Egypt. Weeds compete with cultivated sugarcane crops for growth factors (water, light, nutrients, and spaces) and harbor pests and plant pathogens. In addition, weeds exert stress to the cultivated crops through their allelopathic effects and parasitism.

In the current study, a survey of different weed species in sugarcane field and their management using different herbicides were investigated.

3.1. Survey of different weed species in sugarcane fields

Weed survey are useful for determining the occurrence and importance of weeds species in crop production systems documenting the types of weed species and its relative distribution and facilitates the establishment of priorities for research and extension services.

Table (1). Family, scientific name and common name of weed species recorded in sugarcane fields, Kom-Obo, Aswan Governorate , during 20014/2015 and 2015/2016 seasons.

Family	Scientific name	Life cycle	Weed type	Common name
Convolvulaceae	*Ipomoea cairica* L.	Perennial	Broad leaved*	Morning glory
	Convolulus arvensis L.	Perennial	Broad leaved*	Field bind weed
Cyperaceae	*Cyperus rotundus* L.	Perennial	Grass**	Nut-grass
Euphorbiaceae	*Euphorbia geniculate Ortega L.*	Annual summer	Broad leaved*	Mexican fir-plant
Gramineae	*Cynodon dactylon* L.	Perennial	Grass**	Bermudagrass
	Digitaria sanguinalis L.	Annual summer	Grass**	Large-crab grass
Leguminosae	*Sesbania sesban* L.	Perennial	Broad leaved*	Sesban
Malvacae	*Sida alba* L.	Annual summer	Broad leaved*	prickly alba
	Hibiscus trionum L.	Annual summer	Broad leaved*	Venice mallow
Portulaceae	*Portulaca oleraceae* L.	Annual summer	Broad leaved*	Commeon Purslane
Solanaceae	*Datura stramonium L.*	Annual summer	Broad leaved*	Jimson weed
Tilaceae	*Corchorus sp.L.*	Annual summer	Broad leaved*	Nalta jute

Data presented in table (1) revealed the presence of twelve weed species were identified belong to nine families. Out of them three species belong to the broad-leaved perennial weeds (*C. arvensis , S. sesban , I. cairica*) while six species belong to the broad- leaved annual weeds *(H. trionum , Corchorus sp., E. geniculate, P. oleraceae , S. alba , D. stramonium*) were observed, the grass perennial weeds were presented by two species *(C. rotundus , C. dactylon*), while only one grass annual weed species were found (*D. sanguinalis*).

All the recorded species were native plants belonging to the flora of Egypt. These results are consistent with findings of **Attalla (1999)** who recorded the dominant broad leaved weeds were *C. arvensis, Beta vulgaris L., Xanthium brasilicum Vell., Xanthium pungens Wallr, Ipomoea sp., Chenopodium album L., Euphorbia arguta Soland, Hibiscus trionum L., Anagallis*

arvensis L., *Solanum nigrum* L. and *Datura sp*., while the dominant narrow-leaved weeds were *Brachiaria eruciformis*(Smith), *C. dactylon*, *D. sanguinalis*, *I. cylindrical* L. and *C. rotundus*. **Almubarak and Al- Chalabi (2015)** reported the presence of six weed species belong to four families out of them two species belong to the broad-leaved perennial weeds(*Cressa cretica L.*, *Aeluropus littoralis* **Gouan)** ,while two species belong to the broad- leaved annual weeds (*Lactuca serriola* L.,*Sonchu oleraceus* L.), the grass perennial weeds were presented by one species *(C. rotundus*), while only one grass annual weed species were found(*Phalaris minor Retz*).

3.2. Effect of herbicide treatments on weeds in sugar cane fields .

Weeds are known to compete with sugarcane in the early stage resulting in reduction in sugarcane quality and quantity. To reduce competition, chemical control using different herbicides is an economical and effective method. In the current study, the efficiency of four herbicides against sugarcane weeds was evaluated.

3.2.1. Dry weight of both the grassy and the broad-leaved weeds (gm/m^2).

The effect of herbicides treatments on the dry weight of both the grassy and the broad-leaved weeds(gm/m^2) during 2014/2015 and 2015/2016 seasons is presented in table (2). The result revealed the application of all herbicides tested significantly reduced the dry weight of both the grassy and the broad-leaved weeds(gm/m^2) compared to the control treatment after 75 days of application in the both seasons.

Table (2): Effect of herbicide treatments on the dry weight of the grassy and the broad-leaved weeds (g/m^2) at 75 days after planting of sugarcane during 2014/2015 and 2015/2016 seasons.

Treatments	Dry weight of grassy and broad-leaved weeds (g/m^2)		Reduction %	
	2014/2015	2015/2016	2014/2015	2015/2016
Starane	111.76^{d}	126.42^{e}	73.55	74.25
Garlon	134.66^{c}	149.71^{d}	68.13	69.51
Devo	192.15^{b}	175.76^{c}	54.52	64.20
Super garlon	194.79^{b}	205.09^{b}	53.90	58.23
Control	422.53^{a}	490.97^{a}	-	-

Means followed by the same letter in the same column are not significantly different at 5% probability using Duncan's Multiple RangeTest.

The lowest dry weight of the grassy and the broad-leaved weeds (gm/m^2) was achieved when Starane (111.76gm/m^2) was applied followed by Garlon (134.66 gm/m^2) , Devo (192.15 gm/m^2) and Super grlon (194.79 gm/m^2) in 2014-2015 season, respectively. The corresponding value of reduction percentage 73.55, 68.13, 54.52, and 53.90 %.The same trend was achieved in 2015/2016 season as the lowest dry weight of both the grassy and the broad-leaved (gm/m^2) weeds was achieved when Starane (126.42 gm/m^2) was applied followed by Garlon (149.71 gm/m^2), Devo (175.76 gm/m^2) and Super garlon (205.09 gm/m^2).

Our results are in harmony with **Mostafa (2015)** who reported that, the lowest dry weight of weeds were obtained from sugarcane plots treated by triclopyr, diuron, glyphosate and metribuzin with a reduction percentage of 73.44, 71.73, 57.74 and 51.65% respectively**. Raskar (2004)** mentioned that, significant reduction in weed density and weed dry matter at 120 days after planting was obtained with pre-emergence application of metribuzin 1.5 kg/ha..

3.3. Effect of herbicides treatments on yield and yield components (eg. (cane, and sugar yield) of sugarcane.

Data presented in table (3) represent the effect of herbicides treatments on cane and sugar yield. The application of all herbicides led to significantly increase in the cane yield compared to the control treatment in both seasons. The highest cane

yield (48.20 ton/fed.) was achieved when Garlon was applied followed by Starane (42.64 ton/fed) , Devo (36.42ton/fed) and Super garlon (34.46 ton/fed.) in 2014-2015 season . While in 2015-2016 season the highest cane yield (46.40ton/fed.) was achieved when Starane was applied followed by Super garlon (43.02 ton/fed.), Garlon (39.43ton/fed.) and Devo (38.99 ton/fed.).

Also, data presented in table (3) the application of all herbicides led to significantly increase in sugar yield compared to the control treatment in both seasons. The highest sugar yield (6.81ton/fed) was achieved when Starane was applied followed by Garlon (6.44 ton/fed.), Devo (5.47ton/fed) and Super garlon (4.76 ton /fed) in 2014-2015 season. While in 2015-2016 season the highest sugar yield (6.61 ton/fed.) was achieved when Starane was applied followed by Super garlon (6.14 ton/fed.) , Devo (6.08 ton /fed.) and Garlon (5.23ton/fed.).

Table (3): Effect of herbicides treatments on cane and sugar yield of sugarcane in 2014/2015 and 2015/2016 seasons.

Treatments	Cane yield (ton/fed.)		Sugar yield (ton/fed.)	
	2014/2015	2015/2016	2014/2015	2015/2016
Starane	42.64^{b}	46.40^{a}	6.81^{a}	6.61^{a}
Garlon	48.20^{a}	39.43^{ab}	6.44^{ab}	5.23^{b}
Devo	36.42^{c}	38.99^{ab}	5.47^{bc}	6.08^{a}
Super garlon	34.46^{c}	43.02^{a}	4.76^{c}	6.14^{a}
Control	26.15^{d}	32.24^{b}	3.09^{d}	3.46^{c}

Means followed by same letter in the same column are not significantly different at 5% probability using Duncan's Multiple Range Test.

3.4. Effect of herbicides treatment on sugarcane quality

Data in table (4) represent the application of all herbicides led to significantly increase in brix (%) compared the control treatment in both seasons. The highest brix (23.63 %) was achieved when Devo was applied followed by Super garlon (23.57), Starane (23.40 %) and Garlon (23.33 %) in 2014-2015 season, without significant differences between their effects . While in 2015-2016 season the highest brix (22.72 %) was achieved when Super garlon was applied followed by Devo (22.68 %), Starane (22.26 %) and Garlon (22.20 %) ,without significant differences between their effects.

Table (4): Effect of herbicides treatments on brix% , sucrose , purity %, and sugar recovery percentages of sugarcane in 2014/2015 and 2015/2016 seasons.

Treatments	Brix %		Sucrose %		Purity %		Sugar recovery %	
	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016	2014/2015	2015/2016
Starane	23.40a	22.26a	20.96a	20.04a	89.56a	90.04ab	14.60a	13.98a
Garlon	23.33a	22.20a	20.99a	19.62a	90.01a	88.33ab	14.65a	13.57a
Devo	23.63a	22.68a	21.45a	20.49a	90.79a	90.37a	15.02a	14.32a
Super garlon	23.57a	22.72ab	21.17a	20.45a	89.83a	90.03ab	14.76a	14.27a
control	20.51b	19.82b	17.43b	17.42b	85.01b	87.81b	11.83b	11.17b

Means followed by same letter in the same column are not significantly different at 5% probability using Duncan's Multiple Range Test.

Data in table (4) the application of these herbicides led to significantly increase in sucrose percentages in both season compared to control treatment. The highest sucrose percentage (21.45%) was achieved when Devo was used followed by Super garlon (21.17%) , Garlon (20.99%) and Starane (20.96%) in 2014-2015 season, without significant differences between their effects .Wherease in 2015-2016 season the highest sucrose percentage (20.49%) was achieved when Devo was used followed by Super garlon (20.45%) , Starane (20.04%) and Garlon (19.62%) without significant differences between their effects.

Also, data presented in table (4) the application of the herbicides led to significantly increase in purity percentage in both seasons compared to control treatment. The highest purity percentage (90.79%) was achieved when Devo was used followed by Garlon (90.01%), Super garlon (89.83%) and Starane (89.56%) in 2014-2015 season without significant differences between their effects. Also in 2015-2016 season the highest purity percentage (90.37%) was achieved when Devo was used followed by Starane (90.04%) ,Super garlon (90.03%) and Garlon (88.33%) without significant differences between their effect.

The effect of herbicide treatments on sugar recovery percentage led to significantly increase in both seasons compared to control treatment (Table 4). The highest sugar recovery percentage (15.02%) was achieved when Devo was used followed by Super garlon (14.76%), Garlon (14.65%) and Starane (14.60%) in 2014-2015 season without

significant differences between their effects. While in 2015-2016 season the highest sugar recovery percentage (14.32%) was achieved when Devo was used followed by Super garlon (14.27%),Starane (13.98%) and Garlon (13.57%) without significant differences between their effects.

The increase in sugarcane yield by using herbicides might be due to increase in number of tillers in the early stages of crop growth and production of high amount of photosynthetic products. Also the improved sink capacity on account of increase in number of canes may be related to weakened growth of weeds under herbicide treatments. Therefore, the stage of tillers composition must be accompanied by absence of weeds that compete with crop **(Thakur *et al.*, 1996).** Presence of a competition for weeds had a clear effect on crop growth and development .It has been found that survival of weeds without control during the early stages of crop growth is a determinant factor in the growth and production of crop in the later stages **(Chauhan and Srivastava, 2002).** Therefore, the absence of weed competition by reducing weed density and raise proportion of control for green weeds and increase of tillers number of sugarcane **(Almubarak *et al.*, 2012).** The length of weed control period for the most part of crop growing season by use of herbicide may have a role in determining the final number of millable cane or its number per unit area. The decrease in weed growth and increase number of tillers by using of herbicide since at the early stages until maturity led to better consumption and optimum utilization by sugarcane plants for main growth requirements.

El- Shafai *et al.* (2010) noted that Garlon 90% EC at the rate of 200cm^3/feddan as post-emergence followed by hand hoeing once at 30 days after planting can be recommended for getting the highest cane and sugar yields/fed. There for the presence of a competition for weeds had a clear effect on crop growth and development .It has been found that survival of weeds and not control during the early stages of crop growth is a determinant factor in the growth and production of crop in the later stages **(Chauhan and Srivastava, 2002) . Fakkar *et al.* (2009)** found that weed control treatments significantly affected stalk height and diameter, number of internodes/stalk, brix, sucrose and sugar recovery percentages as well as millable cans, cane and sugar yields. **Meschede *et al.* (2010)** noted that the treatments with glyphosate and sulfometuron-methyl provided improved technological quality of the raw material, with significant increases

in broth purity and brix. On the other hand, **Almubarak and Al-Chalabi (2014)** reported that, herbicides had no effect on the brix sugarcane juice. **Chambers (1983)** reported that using herbicides is very effective method in the management of sugarcane compared with other control methods, however the author expressed his notion that no single chemical could give effective control of all weed species**. Tejera *et al.*(2007)** reported that using herbicides decrease weed growth and increase the number of millable cane or number of its per unit area resulting high sugarcane yield.

IV. Conclusion

Based on our results it may be concluded that Starane was the most effective herbicides in reducing sugarcane weeds followed by Garlon with no significant differences. All the tested herbicides significantly increased the cane yield and the sugar yield compared to the control treatment with no significant differences between the used herbicides. The sugarcane quality has been significantly increased when the tested herbicides were applied with no significant differences between the tested herbicides. Thus Starane and Garlon could be recommended for the control of weeds in sugarcane fields.

REFERENCES

Almubarak, N. F. and F. T. AL-Chalabi (2015). Effect of growth regulators and herbicides on sugar yield, quality and attendant weeds of sugarcane *Saccharum Officinarum* L. grown in dhuluiya region. Diyala Agricultural Sciences Journal. 7 (1**)** 16-29.

Almubarak, N. F. and T. Al-Chalabi (2014). Evaluate the efficacy of herbicides for weed control, improvement of Sugar yield and quality of Sugarcane in Dhuluiya region. Euphrates Journal of Agriculture Science. 6(3): 65-77.

Almubarak,N. F. ; F.T. Al-Calabi ; A. Al-Janabi and I. Singh(2012). Effect of herbicides on weed control and yield of sugarcane. Indian Journal of Weed Scienc. 44(4): 255–258.

Annual Report (2012). Directorate of Weed Science Research. Jabalpur (Madhya Pradesh). India .

Anonymous (1995). Official methods of analysis. Association of Official Agricultural Chemists (A.O.A.C.), Washington D.C., USA. Reported January.pp.232.

Anonymous (2016). Sugar crops and production. Annual

Report Ministry of Agriculture, Egypt.

Attalla, S. I. (1999). Weed flora distribution in sugar cane *(Saccharum officinarum* L). fields at Esna, Quena. Bulletin of Faculty of Agriculture, University of Cairo. 50, (1): 33-40.

Bahadar, K.;M. Jama and H. Azim(2004). Effect of weeds on cane yield and content of sugarcane. Pak. J. Weed Sci. Res**.** 10(1-2): 47-50.

Chambers, G. M. (1983). Perspectives and new developments for agro-chemical in sugarcane .The Sugarcane. 1:2-3.

Chauhan, R.S and T.K. Srivastava (2002). Herbicidal-cum-integrated weed management in spring planted sugarcane. Indian J. Sugarcane Tech. 17(1/2): 29-31.

El-Shafai , A.M.A.; A.A.O. Fakkar and M.A. Bekheet (2010). Effect of row spacing and some weed control treatments on growth, quality and yield of sugarcane. International Journal of Academic Research**.** 2 (4):297-306.

Fakkar, A.A.O.; M.M. Ibrahim and M.A. Bekheet (2009). Effect of some weed control methods on yield and quality of sugarcane under Sohag conditions. Mansoura Univ. J. Agric. Sci. 34(2): 901-911.

Kadam, B.S.; M.M. Suryavanshi; D.M. Veer; K.B. Patil; S.M. More and R.B.Khot (2011). Influence of weed management practices on cane yield and weed intensity of ratoon crop of sugarcane (CO86032). Co-op. Sug. 42: 41-46.

Kanchan, N. (2009). Weed Infestation in sugarcane. (C.F.online) WWW.atsdr.cdc.gov.

Malavolta, E. (1994). Nutrient and fertilizer management in sugarcane. International Potash Institute Bulletin No. 14. International Potash Institute, Basel, Switzerland.

Mathur, R.B.L (1981) Handbook of Cane Sugar Technology 2nd Edn., Oxfored and IBH Publisher Co. Ltd., Janapath, New Delhi, pp:680.

Meade, G.P. and J.C.P. Chen (1977). Meade-Chen cane sugar Hand Book, 10th Ed., New York, John Wiley & sons**,** 745 pp**.**

Meschede, D.K.; E.D. Velini and C.A.Carbonari (2010). Effects of glyphosate and sulfomethuron-methyl on growth and technological quality of sugar cane. Planta Daninha. 28:1135-1141.

Mostafa, M. N. O (2015). Identification of different morning-glory (*ipomoea* spp) weed species and their control methods on sugarcane fields (*Saccharum* spp.) in Sohag Governorate. M. Sc. Thesis, Fac. Agric. Assiut Univ.PP:60.

Patel, C.L.; D.D. Patel and M.N. Patel (2007). Critical period of crop weed competition in sugarcane (Var. Co Lk 8001). Indian Sugar. (12): 27-32.

Raskar, B.S. (2004). Evaluation of herbicides for weed control in sugarcane. Sugar Tech. 6(3): 173-175.

Roshan, L.; S.N.L.Srivastava and M. Chand(2006). Integrated weed management for sugarcane (*Saccharum officinarum* L.) plant-ratoon cropping system. Indian journal of Agronomy. 51 (4): 251-255.

Singh, H.;N. Kumar and D.K. Dwivedi (2008). Efficacy of some new herbicides on weed dynamics and yield of sugarcane. Indian sugar. 58 (9), 71-74.

Snedecor, G.W. and W.G. Cochran (1981). Statistical Methods. Seventh Ed. Iowa State Univ. Press, Ames, Iowa, USA.

Spancer, G. L. and G. P. Meade (1963). Cane sugar hand book. 9 **th** Ed. G. P.

Srivastava, T.K.; H.N. Shahi and M. Lai (2003). Agro-techniques for effective weed control with glyphosate in spring planted sugarcane. Indian J. Sugarcane Tech. 18(1/2): 27-30.

Stroud, A. and C. Parker (1989). A Weed Identification Guide for Ethiopia. FAO, Rome. 278 pp.

Tejera, N.A.; R. Rodes; E. Ortega; R. Campos and C. Lluch (2007). Comparative analysis of physiological characteristics and yield components in sugarcane cultivars. Field Crops Research. 102: 64–72.

Thakur,G.l.; R.K.Sharma and H.D.Verma (1996). Integrated weed management in sugarcane ratoon .Indian Sugar. 46(1):23-26.

Yadav, R.L. and R.K. Sharma (1980). Effect of nitrogen levels and harvesting dates on quality characters and yield of four sugarcane genotypes. India J. Agric. Sic. 50: 581-589.