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EFFECT OF WEED CONTROL TREATMENTS AND N-FERTILIZER LEVELS ON WEEDS AND SUGAR CANE (*Saccharum* sp.)

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ABSTRACT

Two field experiments were carried out at El-Mattaana Agricultural Research Station , Esna, Qena Governorate during 1999 / 2001 and 2000/ 2002 seasons to study the effect of weed control treatments i.e. metribuzin at 300 g/fed, glufosinate at 2L + 2L/ fed, hand hoeing 4 times and untreated (control) under N-fertilizer rates (180,210 and 240 kg/fed) on weeds and sugar cane yield. Results showed that hand hoeing 4 times was the best weed control treatment for controlling the weeds (broad-leaved weeds and grasses) at 90 and 150 days after planting in both seasons followed by metribuzin and glufosinate compared with control. Hand hoeing 4 times gave the highest yield of sugar cane (49.67 t/fed) increasing 26.71 % in the 1st season,and (50.82 t/fed) increasing 24. 96 % in the 2nd season. Yield of sugar cane was significantly increased with increasing N-fertilizer rates in both seasons. N-fertilizer at the rate 240 kg/fed gave the highest yield of sugar cane; 44.82 and 45.91 (t/fed) in the 1st and the 2nd seasons, respectively. From this study it is considered that hand hoeing 4 times and N-fertilizer at a rate of 240 kg/fed are excellent treatments in controlling the weeds and give the highest sugar cane yield. Weeds and sugar cane yield were not affected by the interaction between N-fertilizer rates and weed control treatment.

Key words: *nitrogen rates , sugar cane , weed control treatments.*

1. INTRODUCTION

In Egypt, sugar cane *(Saccharum* sp.) is a very important sugar crop. It is cultivated in about 300000 feddans where the total production is still insufficient to cover the local consumption. Therefore, the increase of its productivity is necessary to cover the local demand for sugar by using high yielding varieties with recommended cultural practices. Factors affecting the productivity of new sugar cane varieties are weeds, soil moisture, soil fertility and poor drainage (Kakde 1985).

Weeds directly compete with sugar cane for environmental resources (space, sun light, water and nutrients) causing a serious reduction in yield. Yield losses are greater than 50% at uncontrolled high weed infestation level (Nour and Allam 1988, Abd El-Latif 1990, Abd El-Latif *et al.*, 1994, Attalla *et al.*, 1995 and Thakur *et al.*, 1995).Weed control treatments *i.e.* ,hand hoeing or herbicides increase the yield of sugar cane. Many herbicides become available in this situation *i.e.*, metribuzin and glufosinate that they are effective against weeds (Ahmed *et al.*, 1989,Santo 1989, Abd El-Latif *et al.*, 1994 and Mahadevaswamy *et al.*, 1994).

Nitrogen fertility is the primary factor limiting sugar cane crop production. In Egypt, the economic optimum dose of nitrogen is 210 kg/fed. Cane and sugar yields were significantly increased with increasing N-fertilizer up to 210 kg/fed (El-Geddawi *et al.*, 1988 a, Abd El - Gawad *et al.*, 1992, El-Geddawi *et al.*, 1997, Abd El-Latif and El-Koliey 1998, Abd El-Latif *et al.*, 1999 and Azzazy and Dorgham 2000). Stalk height and stalk diameter increased with increasing N-fertilizer up to 240 kg/fed (Abd El-Latif *et al.*, 1999 and Azzazy and Dorgham 2000).

Nowadays, many studies are needed to find out the suitable doses of herbicides and N-fertilizer rates for sugar cane under local conditions of Egypt. The present work was conducted to study the effect of weed control treatments and N-fertilizer rates on weeds and yield of sugar cane variety G 85/37.

2. MATERIALS AND METHODS

Two field experiments were carried out at El-Mattaana Agricultural Research Station , Esna,Qena Governorate during 1999/2001 and 2000/2002 seasons to study the effect of weed control treatments and N-fertilizer rates on weeds and sugar cane yield. The soil texture of the experiment fields is clay loam in the two seasons. It had 28 and 30 ppm available nitrogen in the 1^{st} and the 2^{nd} seasons, respectively. New sugar cane cultivar G 85/37 was planted on November, 18^{th} and November, 22^{nd} in 1999 and 2000 seasons, respectively. The dry method of sugar cane planting was used. The plot size was $35m^2$ (5X7 m) contained 5 rows and one meter apart. Twenty five from three budded sets of cuttings were planted in each row. The normal cultural practices were carried out. The treatments were arranged in a split plot design with 4 replicates in both seasons.Three N-fertilizer rates (180,210 and 240 kg/fed) as urea (46 % N) were arranged at random in the main plots. N-fertilizer was added in 3 equal doses after hand hoeing (45,75 and 105 days after planting (DAP).

Weed control treatments were arranged in subplots as follows:

-Metribuzin (Sencor 70% WP) applied at 300 g/fed,post-emergence, 30 DAP.

-Glufosinate (Basta 20 % EC) applied at 2L+2L/fed,post-emergence, 30 + 60 DAP .

-Hand hoeing 4 times at 45,75,105 and 140 DAP.

-Untreated (control).

The herbicides were applied with knapsack sprayer equipped with one nozzle boom and water volume of 200 L/fed.Weeds were hand pulled from 1 m^2 ,chosen at random from each subplot at 90 and 150 DAP. Weeds were classified into broad-leave weeds and grasses.Dry weight (g/m^2) of each group and the total weeds were determined. Phosphorus was applied at the rate of 60 kg (P_2O_5)/fed at soil preparation (before planting).Potassium was applied at the rate of 48 kg (K_2O)/fed with the 2^{nd} nitrogen addition.

Sugar cane yield was harvested on February,20^{th} and February, 25^{th} of 2001 and 2002 seasons, respectively. Samples of 20 stalks were chosen at random from the 2 inner rows of each subplot to study the following characters :

1- Stalk height (cm) was measured from land level till dewlap.
2-Stalk diameter (cm) was measured from the 6^{th} or 7^{th} internode (at the middle part of the stalk).
3-Total soluble solid percentage (TSS % - Brix %) was determined by using hand refractometer from the 6^{th} internode.
4-Sucrose g/100cm^3 of juice was determined by using a sacharemeter according to AOAC (1995).
5-Purity percentage was calculated according to the following equation: Purity % = Sucrose % X (100 / Brix %)
6-Cane stalks of the three guarded rows were harvested, topped, cleaned, weighed and cane yield (t/fed) was calculated.
7-Sugar yield (t/fed) was estimated according to the following equation :

Raw sugar production = Cane yield (t/fed) X Sugar recovery % *

* Sugar recovery percentage (SR%) was calculated as follows :

[SR% = Richness % X Purity %] where

Richness % = (Sucrose in 100 g X Factor)/ 100

Factor = 100 – [Fiber % + physical impurities + water free from sugar %]

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

3.RESULTS AND DISCUSSION

3. 1. Effect of N-fertilizer rates on weeds

The major widespread weed species at the experimental fields were grassy and broad-leaf weeds in the two seasons.The dominant grassy weeds were *Avena* sp.,*Lolium* sp.,*Phalaris* sp. and *Cyperus rotundus* L. The dominant broad-leaf weeds were *Amaranthus viridis* L., *Beta vulgaris* L., *Chenopodium album* L., *Convolvulus arvensis* L., *Hibiscus trionum* L., *Melilotus indicus* L. *and Portulaca olereaceus* L.

Results in Table (1) show that N-fertilizer rates had a significant effect on dry weight (g/m^2) of grassy, broad-leaf and total weeds at 90 and 150 DAP in both seasons. Dry weight of grassy, broad-leaf and the total weeds significantly increased with increasing N- fertilizer rates at 90 and 150 DAP in both seasons. Dry weight of grassy weeds increased with 210 and 240 kg N/fed by 17.79

and 28.83 % at 90 DAP and by 19.59 and 49.18 % at 150 DAP in the 1st season, respectively. Meanwhile in the 2nd season the corresponding increases were 18.63 and 46.73 % at 90 DAP and at 150 DAP by 22.36 and 69.81 %, respectively as compared with 180 kg N /fed. Dry weight of broad-leaf weeds increased with 210 and 240 kg N/fed by 21.37 and 30.41 % at 90 DAP and by 23.56 and 44.43 % at 150 DAP in the 1st season, respectively. Meanwhile in the 2nd season it increased by 23.06 and 39.03 % at 90 DAP and at 150 DAP by 26.94 and 46.56 %,respectively as compared with 180 kg N/fed. Dry weight of total weeds increased with 210 and 240 kg N/fed by 19.81 and 29.72 % at 90 DAP and by 22.14 and 46.13 % at 150 DAP in the 1st season, respectively. Meanwhile in the 2nd season the increases were 21.27 and 42.14 % at 90 DAP and at 150 DAP by 25.36 and 54.56 %,respectively as compared with 180 kg N/fed. Broad-leaf weeds gave a greater response to N-fertilizer rates than grasses in both seasons.

3.2. Effect of N-fertilizer rates on sugar cane yield and juice quality

Results in Table (2) show that N-fertilizer rates had a significant effect on stalk height (cm), sucrose (g/100ml), purity %, sugar cane yield (t/fed) and sugar yield (t/fed), while stalk diameter (cm) and brix % were not significantly affected in both seasons. Stalk height, sucrose, purity %, sugar cane yield and sugar yield were significantly increased with increasing N-fertilizer rates in both seasons. The highest values of these characters were obtained from 240 kg N/fed in both seasons. Sugar cane yield/fed increased with 210 and 240 kg N/fed by 4.05 and 5.48 % in the 1st season, meanwhile in the 2nd season the increases were 5.63 and 6.74 %, respectively as compared with 180 kg N/fed. Sugar yield/fed increased with 210 and 240 kg N/fed by 4.51 and 5.38 % in the 1st season. Meanwhile, in the 2nd season the increases were 5.97 and 6.66 %, respectively as compared with 180 kg N/fed. Cane yield and sugar yield/fed were not significantly different between 210 and 240 kg N/fed in both seasons. These results are in agreement with those obtained by El-Geddawi *et al.*, (1988 a&b),Sharma and Gupta (1990),Abd El-Gawad *et al.*, (1992), El- Geddawi *et al.*, (1997), Abd El-Latif and El-Koliey (1998), Wiedenfeld (1998) and Abd El-Latif *et al.*, (1999).

Table (1): Effect of N-fertilizer rates on the dry weight (g/m^2) of grassy, broad-leaved and total weeds at 90 and 150 DAP during 1999/2001 and 2000/2002 seasons.

Treatments		1999/2001 season			2000 /2002 season		
		Broad-leaves wt. (g/m^2)	Grassy weeds wt. (g/m^2)	Total weeds wt. (g/m^2)	Broad-leaves wt. (g/m^2)	Grassy weeds wt. (g/m^2)	Total weeds wt.(g/m^2)
90 DAP	180 kg N/fed	36.5	28.1	64.6	45.1	30.6	75.7
	210 kg N/fed	44.3	33.1	77.4	55.5	36.3	91.8
	240 kg N/fed	47.6	36.2	83.8	62.7	44.9	107.6
	LSD (5%)	2.5	2.1	5.6	3.1	2.7	3.6
150 DAP	180 kg N/fed	174.0	97.0	271.0	202.3	106.0	308.3
	210 kg N/fed	215.0	116.0	331.0	256.8	129.7	386.5
	240 kg N/fed	251.3	144.7	396.0	296.5	180.0	476.5
	LSD (5%)	7.3	4.0	12.4	9.1	10.2	18.2

Table (2): Effect of N-fertilizer rates on sugar cane yield and juice quality during 1999/2001 and 2000/2002 seasons.

Treatments	1999/2001 season				2000/2002 season			
	180 kg N	210 kg N	240 kg N	LSD 5%	180 kg N	210 kg N	240 kg N	LSD 5%
Stalk height (cm)	221.6	227.1	229.1	4.5	222.6	229.3	231.9	1.3
Stalk diameter(cm)	2.71	2.83	2.88	NS	2.56	2.83	2.84	NS
Cane yield (t/fed)	42.49	44.21	44.82	1.5	43.01	45.43	45.91	1.8
Sugar yield (t/fed)	5.76	6.02	6.07	1.2	5.86	6.21	6.25	0.3
Sucrose (g/100ml)	19.04	19.59	20.42	0.8	19.32	19.88	20.7	0.9
Brix %	23.01	23.46	24.07	NS	23.12	23.59	24.19	NS
Purity %	82.75	83.56	84.84	0.6	83.56	84.27	85.57	1.1

3.3. Effect of weed control treatments on weeds

Results in Table (3) show that weed control treatments had a significant effect on dry weight (g/m^2) of grassy, broad-leaf and total weeds at 90 and 150 DAP in both seasons. Dry weight of grassy, broad-leaf and total weeds significantly decreased with all weed control treatments at 90 and 150 DAP as compared with the control in both seasons. Hand hoeing 4 times gave the lowest dry weight of grassy, broad-leaf and total weeds at 90 and 150 DAP in both seasons. Hand hoeing 4 times was the best weed control treatment followed by metribuzin and glufosinate in both seasons. These results are in agreement with those obtained by Ahmed *et al.*, (1989),Santo (1989), Salunkhe *et al.*, (1990), Mason (1991),Abd El-Latif *et al.*, (1994),Thakur *et al.*, (1995) and Marion (1996).

3.4. Effect of weed control treatments on sugar cane yield and juice quality

Results in Table (4) show that stalk height (cm), stalk diameter (cm), sucrose (g/100ml), brix %, purity %, sugar cane yield (t/fed) and sugar yield (t/fed) were significantly increased with weed control treatments as compared with the control in both seasons. Hand hoeing 4 times gave the highest value of these characters compared with other treatments in both seasons. Hand hoeing 4 times increased sucrose, sugar cane and sugar yields by 10.85, 26.71 and 54.65 % in the 1^{st} season. Meanwhile in the 2^{nd} season the increases were 8.34, 24.96 and 51.48 %, respectively as compared with the control. Cane yield and sugar yield/fed were significantly different between the control and metribuzin, the control and hand hoeing 4 times as well as hand hoeing 4 times and glufosinate in both seasons. These increases may be attributed to the decrease of weeds infestation and decreasing the period of weed-crop competition which was reflected in increasing dry matter accumulation of sugar cane plants and consequently in the yield. These results are in agreement with those obtained by Ahmed *et al.*, (1989), Santo (1989),Salunkhe *et al.* (1990),Mason (1991),Abd El-Latif *et al.*, (1994),Thakur *et al.*, (1995) and Marion (1996).

3.5. Effect of weed control treatments and N-fertilizer rate interaction

The effect of weed control treatments and N-fertilizer rate

Table (3): Effect of weed control treatments on dry weight (g/m^2) of grassy, broad-leaf and total weeds at 90 and 150 during 1999/2001 and 2000/2002 seasons.

treatments		1999/2001 season			2000/2002 season		
		Broad-leaves wt.(g/m^2)	Grassy weeds wt.(g/m^2)	Total weeds wt.(g/m^2)	Broad-leaves wt.(g/m^2)	Grassy weeds wt.(g/m^2)	Total weeds wt.(g/m^2)
90 DAP	Control	139.6	65.5	205.1	171.8	72.6	244.4
	Hand hoeing	5.0	18.7	23.7	6.2	23.2	29.2
	Metribuzin	11.2	21.1	32.3	17.1	26.2	43.3
	Glufosinate	15.4	24.6	40.0	22.6	27.3	49.9
	LSD (5%)	22.5	20.3	30.2	19.1	17.8	25.0
150 DAP	Control	518.3	181.7	700.0	583.3	217.0	800.3
	Hand hoeing	92.0	41.3	133.3	113.0	46.3	159.3
	Metribuzin	116.7	111.3	228.0	142.4	128.7	271.1
	Glufosinate	126.3	142.7	269.0	168.7	162.3	331.0
	LSD (5%)	50.8	15.4	47.2	21.1	23.7	41.7

Table (4): Effect of weed control treatments on sugar cane yield and its juice quality during 1999/2001 and 2000/2002 seasons.

Treatments		Control	Hand hoeing 4 times	Metribuzin	Glufosinate	LSD (5%)
1999/2001 season	Stalk height (cm)	185.8	249.7	241.8	226.4	36.6
	Stalk diameter (cm)	2.57	2.93	2.89	2.83	0.2
	Cane yield (t/fed)	39.2	49.67	48.0	43.47	5.7
	Sugar yield (t/fed)	4.52	6.99	6.48	5.12	1.6
	Sucrose (g/100ml)	18.81	20.85	20.17	19.09	0.9
	Brix %	25.68	23.04	23.11	22.29	1.7
	Purity %	73.25	90.49	87.28	85.64	4.8
2000/2002 season	Stalk height (cm)	186.0	252.6	244.7	228.3	7.3
	Stalk diameter (cm)	2.44	2.92	2.83	2.79	0.3
	Cane yield (t/fed)	40.67	50.82	49.22	44.82	5.9
	Sugar yield (t/fed)	4.72	7.15	6.75	5.19	1.6
	Sucrose (g/100ml)	19.3	20.91	20.46	19.39	0.9
	Brix %	26.04	23.11	22.84	22.52	1.9
	Purity %	74.03	90.48	89.58	86.1	5.6

interactions on weeds and sugar cane yield and its juice quality were not significant in 1999/2001 and 2000/2002 seasons. Therefore, the data of the interaction were excluded.

In general, it is clear that hand hoeing 4 times gave the best weed control treatment in decreasing the dry weight of weeds (broad-leaves and grasses) and it gave the highest yield of the new sugar cane variety G 85/37 followed by metribuzin and glufosinate in both seasons. The results show that (210 kg N/fed) is the best N-fertilizer rate where it gave the highest yield of sugar cane. From this study it is conduded that hand hoeing 4 times and N-fertilizer rate (210 kg N/fed) is the best treatrment for controlling weeds and increasing sugar cane yield.

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تاثير طرق مكافحة الحشائش ومستويات التسميد النيتروجينى على الحشائش ومحصول قصب السكر

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ملخص

اجريت تجربتان حقليتان فى محطة بحوث المطاعنة الزراعية- اسنا- محافظة قنا خلال موسمي ١٩٩٩/٢٠٠١ و٢٠٠٠/٢٠٠٢ لدراسة تاثير بعض معاملات مقاومة الحشائش (مثل مبيد مترايبزين بمعدل ٣٠٠ جم/ فدان ــ جلوفسينت بمعدل ٢ لتر+٢لتر/ فدان ــ العزيق ٤ مرات ــ بدون معاملة) تحت تأثير ٣ مستويات من السماد النيتروجينى (١٨٠ ــ ٢١٠ ــ ٢٤٠ كجم/فدان) على نبات قصب السكر والحشائش المصاحبة. اظهرت النتائج أن العزيق ٤ مرات افضل معاملة لمقاومة الحشائش (النجيلية والعريضة) بعد ٩٠ و١٥٠ يوماً من الزراعة فى كلا الموسمين، تلاه مبيد مترايبزين وجلوفسينت مقارنة بمعاملة المقارنة. كما تفوقت ايضا معاملة العزيق ٤ مرات فى إنتاجية محصول قصب السكر وكان مقدار محصول قصب السكر هو٤٩,٦٧ طن/ فدان ونسبة زيادته ٢٦,٧١ % فى الموسم الأول و٥٠,٨٢ طن/ فدان ونسبة الزيادة ٢٤,٦٧ % فى الموسم الثاني. زاد محصول قصب السكر زيادة معنوية بزيادة التسميد النيتروجينى فى كلا الموسمين. كان أعلى مستوى تسميد نيتروجينى هو ٢٤٠ كجم / فدان وكان مقدار محصول قصب السكر هو ٤٤,٨٢ و٤٥,٩١ طن /فدان للموسم الأول والثاني على التوالي. وقد ثبت عدم وجود تفاعل معنوي بين معاملات مقاومة الحشائش ومستويات ا لتسميد النيتروجينى على الحشائش ومحصول قصب السكر ومكوناته وصفات العصير. نخلص من هذه الدراسة ا ن العزيق ٤ مرات مع التسميد النيتروجينى ٢١٠ كجم/فدان هي افضل معاملة لمقاومة الحشائش و إعطاء أعلى محصول.

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