Response of maize hybrid to nitrogenous fertilization and weed control

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ABSTRACT:

Two filed experiments were carried out at the Experimental Farm of the Faculty of Agriculture (Saba Basha) Alexandria University during 2010 and 2011 summer seasons. This study was conducted to investigate the effect of nitrogen application and weed control on growth attributes, yield and yield components of maize hybrid cultivar namely three way cross 310 (T.W.C. 310).The obtained results indicated that the application nitrogen at 120 kg N/fed, had positive significant effects on some of the studied characters. The application nitrogen rate at 160 kg N/fed., was the best treatment to obtain yield, yield components and weed characters of T.W.C. 310. The highest grain yield/fed.,total dry weight and weed characters were obtained from atrazine + one hand hoeing fertilized at 160 kg N/fed., than application nitrogen at 40 kg N/ fed with unweeded treatments (Control) in both seasons.
Key Words: T.W.C.310 (Maize), yield, yield components, nitrogen levels, weed control, atrazine

INTRODUCTION:

Corn (*Zea mays*, L.) is one of the most important cereal crops in Egypt and the world. It is used for bread industry (mix 80% wheat flour with 20%, maize flour) in order to reduce wheat importation and animal feeding. Increasing maize production depends upon many factors. Nitrogen is the key element in increasing productivity. It is an integral component of many compounds essential for plant growth processes including chlorophyll and many enzymes. Some growth and yield characters were affected by application of nitrogen fertilizer (Radwan, 1998; Soliman*et al.*, 2001; El-Moselhy and Zahran, 2003; Nofal and Mobarak, 2003 and Gomaa, 2008).

Weeds are one of the most important factors in maize production. They cause important yield losses worldwide with an average of 12.8% despite weed control application and 29.2% in the case of no weed control (Hussein, 1996 and Mosalem and Shady, 1996).Therefore, weed control is an important management practice for maize production that should be carried out to ensure optimum grain yield (Dogan*et al.*, 2004; David *et al.*, 2005 and Abo Zien*aet al.*, 2008). Weed control in maize was carried out by mechanical and/or chemical methods.

Therefore, the aim of this study was to investigate the response of maize hybrid to nitrogen fertilization and weed control on growth and yield of corn plants (*Zea mays*, L.).

MATERIALS AND METHODS:

Two field experiments were carried out at the experimental farm, Faculty of Agriculture (Saba Basha), Alexandria University, at Abees-

Alexandria, Egypt during the two successive summer seasons of 2010 and 2011. The experimental design was a split plot with four replicates, the main plots were conducted for the nitrogen fertilization treatments (40,80,120 and 160kg N/ fed.). The N- fertilizer applied in the form of urea (46% N) at the abovementioned Levels after sowing and just before the sowing seed treatments 100kg superphosphate (15% P_2O_5). The sub-plots were assigned to six weed control treatments.

1- Unweeded (Control)
2- Atrazine (Gesaprim80% w.p) (2- chlorat 4- ethyl amino-6- isopropyl amino – 5- triazine) was applied after sawing and pre- emergence at the rate of 0.75 kg/ fed.
3- Fluroxypr(20%) 4 g a.i./ fed.: E.C. (4- amino- 3.5 dicholro-6- fluoro – 2 – pyridyloxy – acetic acid), Known commercially as "starane", it was applied in the rate of 0.2L/ fed. after 21 days from sowing.
4- Atrazine at 600 g a.i./fed. + one hand- hoeing, before the second irrigation.
5- one hand- hoeing, before the first irrigation after 21 days from sowing + fluroxypyr (Starane) at 4 g a. i/fed., after 21 days from hand hoeing.
6- hand – hoeing (twice) where the first was done before the first irrigation and the second one before the second irrigation.

The experimental soil was clay loam in texture, poor in organic matter (1.40%) with pH=8.0. Available phosphorus was 3.70 mg/kg available nitrogen was 145mg/kg.

Grains of corn (*Zea mays*, L.) hybrid are the Three ways cross 310 (T.W.C. 310). The sowing date was on 30 May in both seasons. Each experimental unit consisted of four ridges 3m length and 0.7 m width. The preceding crop was wheat in the two growing seasons.

Data recorded

Data wererecorded from the two middle redges for growth characters and to determine yield components.

A- Growth characteristics

At 55, 70 and 85 days after sowing a sample of five guarded plants from each sub-plot were taken at random to measure plant height (cm), stem diameter (cm), leaf area index (cm^2) and dry weight (g)/plant.

B- Yield and its components

At harvest, ten guarded plants were taken from the 2nd and 3rd ridges in each sub-plots to determine ear length (cm), ear diameter (cm) ear height (cm), number of rows/ear, number of grains/row, weight of grains/ear, Shelling%, 100 grains weight (g) and grain yield (ton)/fed, which was adjusted to 15.5% moisture content.

Weed characters were recorded at 85 days after sowing where weed were hand pulled from one square meter taken at random in each plot and classified into different species. For each species the number and dry weight of weeds (at 70°C for 48 hours) were recorded.

Data of growth characters, yield components and weed characters were statistically analyzed using split plot design according to method described by Snedecer and Cochran (1982). The means were compared using L.S.D. values at 5% probability level.

RESULTS AND DISCUSSION:

A- Effect of nitrogen fertilization

Data in Table (1) showed that plant height and leaf area index at different growth stages in the two growing seasons of 2010 and 2011 were affected by 120 kg N/fed treatment, except the dry weight (g)/plant was not significant at all growth stages in both seasons Stem diameter gave the highest mean value with application nitrogen at 40 kg N/ fed at the 55 DAS in the first season. The enhancement of nutrient uptake and its translocation increased photosynthetic rate and accumulation of photosynthetic in shoot (Radwan, 1998). These results are in agreement with those obtained by Atta-Allah (1998), Soliman et al (2001), Badr et al (2003) and El-Arefe*t al.* (2004).

Data in Tables (2 and 3) showed that yields obtained by application 160kg N/fed, were significant higher than those of the other of the other treatment. Ear length, weight of grains/ear, and grain yield/fed., were significantly increased by the application at 160kg N/fed.in both seasons. It can be stated that the treatment (160kg N/fed.), had promoted the production of maize grains. Similar results were obtained by Solimane*t al.* (2001), El-Moselhy and Zahran (2003) and Nofal and Mobarak (2003).

B- Effect of weed control

Tables (1 and 2) showed that the growth attributes characters responded significantly to weed control treatments at different growth stages in both seasons. The following three treatments starane, starane + one hand hoeing and hand hoeing twice had higher growth character than the unweeded treatment at different growth stages in both seasons.The results are in agreement with those obtained by Shabane*t al.* (1990), El-Bially (1995) and Mosalem and Shady (1996). While Schans and Weide (1999) and Abdel-Samie (2001) obtained maximum growth attributes by hand hoeing twice.

There are significant increases in the average of yield and its components with each weed control treatment in both seasons (Tables 2 and 3).The one hand hoeing + atrazine and hand hoeing twice gave the highest grain yield (5.38and 5.03 ton/fed) in the first and second seasons, respectively. While the unweeded (control) gave the lowest grain yield. These results indicated that hand hoeing twice and a combination of pre-emergence herbicides application with one hand hoeing ensure a broad spectrum for weed control over a longer period of time. The provide a long term weed-free environment for maize, soil herbicides are applied in many cases and mechanical control and post-emergence herbicide application

are often repeated several times. Similar trend was reported by Hussein (1996), Digits (1997) and Jat et al (1999) stated that yield of maize was significantly by hand weeding and pends methalin. Knezevic*et al.* (2003) reported that hand spraying with standard treatment at a half recommended rate (atrazine 1.5 liter/fed) combined with mechanical weed control brought a satisfactory total weed reduction (83-87%).

Average total number of broad and grassy weeds and total dry weight of weeds as affected by weed control treatments at 85DAS in both seasons with regard to the effect of nitrogen fertilization on the number of broad leaved weeds/m2, number of narrow leaved weeds/m^2 and total number of weeds/m2 were significantly increased by the application at 160 kg N/fed, in the first season. While the application 40 kg N/fed, significantly decreased total number of broad leaves and grassy weeds in the first season only (Tables 4, 5).

Table (1): Effect of nitrogen fertilization and weed control on some growth attributes of maize plants at three growth stages during 2010 and 2011 seasons

Treatments	Plant height (cm)						Stem diameter (cm)					
	2010			2011			2010			2011		
	Days after sowing			Days after sowing			DAS			DAS		
	55	70	85	55	70	85	55	70	85	55	70	85
A) Nitrogen fertilizer												
40 kg N/fed	103.17	123.67b	138.67	122.28	188.06	190.17	1.52a	1.45	1.63	1.82	2.07	1.93
80 kg N/fed	101.78	133.89ab	132.67	119.72	176.67	178.50	1.32b	1.38	1.51	1.73	2.31	1.81
120 kg N/fed	100.50	140.33a	143.83	123.67	171.94	173.5	1.34b	1.46	1.62	1.84	1.91	1.92
160 kg N/fed	106.00	133.50ab	146.94	123.67	178.33	180.40	132b	1.54	1.63	1.77	2.09	1.93
L.S.D.$_{0.05}$	ns	13.92	ns	ns	ns	ns	0.16	ns	ns	ns	ns	ns
B) Weed control												
Unweeded control	105.17	132.00ab	136.33	114.67ab	170.00	172.00	1.33bc	1.39	1.48bc	1.70b	2.41	1.78bc
Atrazine (80%)	102.75	131.67ab	142.83	124.75ab	190.41	192.42	1.13c	1.48	1.58bc	1.71	2.24	1.88ab
Starane	105.75	143.58a	141.83	143.33a	177.50	178.60	1.57a	1.41	1.81	2.08a	2.02	2.11a
Atrazine + one hoeing	102.83	123.50b	143.08	114.17ab	183.75	185.00	1.57a	1.38	1.41c	1.73b	2.18	1.71c
Starane + one hoeing	101.58	123.67b	126.92	125.00ab	175.83	177.90	1.50ab	1.55	1.63ab	1.74b	1.93	1.93ab
Hand hoeing twice	99.08	143.67a	143.17	112.08b	145.00	147.50	1.31bc	1.53	1.69ab	1.77b	1.82	1.99ab
L.S.D.$_{0.05}$	ns	17.04	ns	26.83	ns	ns	0.20	ns	0.21	0.35	ns	0.31
Interaction A × B	ns	*	ns	*	ns	ns	*	ns	*	*	ns	ns

*Significant at 0.05 probability Level.
ns = not significant.
DAS = Days after sowing.

Table (1): Cont.

Treatments	Dry weight/plant (g)						Leaf area index			
	2010			2011			2010		2011	
	Days after sowing			Days after sowing			DAS		DAS	
	55	70	85	55	70	85	(55-70)	(70-85)	(55-70)	(70-85)
A) Nitrogen fertilizer										
40 kg N/fed.	15606	141.61	119.22	143.89	188.06	123.89	2.93	2.95b	3.54ab	3.72
80 kg N/fed.	139.50	160.00	123.28	135.00	176.67	125.00	2.95	3.18ab	3.74a	2.36
120 kg N/fed.	161.22	161.89	119.94	139.44	171.94	119.44	3.10	3.03b	3.74a	3.52
160 kg N/fed.	179.28	165.44	115.17	127.78	178.33	117.78	3.11	3.58a	3..34b	3.38
L.S.D.$_{0.05}$	ns	ns	ns	ns	ns	ns	ns	0.51	0.25	ns
B) Weed control										
Unweeded control	138.00b	146.67	177.00a	125.23b	170.00	177.00	2.66b	2.83cd	3.60a	3.71ab
Atrazine (80%)	149.58ab	151.58	185.67a	138.33ab	220.41	195.10	2.80b	2.53d	3.72a	3.46ab
Starane	197.17a	186.33	148.92b	176.67a	177.50	159.70	3.56a	3.60ab	3.68	3.83a
Atrazine + one hoeing	123.67ab	138.42	167.17a	120.83b	183.75	171.17	2.75b	3.07bcd	3.66a	3.65ab
Starane + one hoeing	149.67ab	158.00	73.50b	127.50b	175.83	75.70	3.19ab	3.79a	3.62a	3.29ab
Hand hoeing twice	196.00a	175.92	65.67b	130.00b	145.00	70.80	3.18ab	3.29abc	3.28b	3.03b
L.S.D.$_{0.05}$	45.32	ns	43.98	41.61	ns	ns	0.61	0.62	0.31	0.63
Interaction										
A × B	ns	ns	*	*	ns	ns	*	*	*	*

*Significant at 0.05 probability Level.
ns = not significant.
DAS = Days after sowing.

Table (2): Effect of nitrogen fertilization and weed control on yield and its components of maize plants during 2010 and 2011 seasons

Treatments	Ear length (cm)		Ear height (cm)		Ear diameter (cm)		Number of rows/ear		No. of grains/row		Weight of grains/ear	
	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011	2010	2011
A) Nitrogen fertilizer												
40 kg N/fed.	14.89b	15.30b	93.00c	94.00c	3.99	4.00	13.64	14.50	28.36	30.10	212.68c	203.08
80 kg N/fed.	15.33ab	15.85ab	93.94b	94.94b	4.01	5.10	13.70	14.90	28.94	30.20	241.10b	216.10
120 kg N/fed.	16.00a	16.50a	98.11a	99.11a	4.05	5.15	13.67	14.60	29.04	31.00	252.14	226.39
160 kg N/fed.	16.17a	16.70a	93.05c	94.03c	4.05	5.20	13.94	15.00	29.69	31.30	241.00b	216.59
L.S.D.$_{0.05}$	1.03	1.04	0.85	0.90	ns	ns	ns	ns	ns	ns	2.49	ns
B) Weed control												
Unweeded control	14.75c	15.20c	89.83bc	90.83bc	4.10	5.20	13.43b	14.33b	26.56b	28.40b	195.72e	156.09e
Atrazine (80%)	15.17bc	15.67bc	106.92a	107.92a	3.98	4.99	13.83a	14.90a	30.08ab	32.10ab	239.06c	230.82b
Starane	17.00a	17.50a	98.75ab	99.75ab	3.96	4.97	13.72a	14.78a	30.59a	32.60a	216.18d	195.05d
Atrazine + one hoeing	14.92bc	15.42bc	92.50bc	93.50bc	4.00	5.01	13.67a	14.80a	27.08ab	29.10ab	260.45a	245.40a
Starane + one hoeing	16.17ab	16.67ab	85.42c	86.42c	4.07	5.08	13.75a	14.77a	27.83ab	31.90ab	243.45b	211.72c
Hand hoeing twice	15.58bc	16.10bc	93.75bc	94.70bc	4.04	5.10	14.00a	14.30a	???	31.94ab	261.35a	241.36a
L.S.D.$_{0.05}$	1.27	1.20	10.27	10.30	ns	ns	0.54	0.52	3.51	3.60	3.90	6.40
Interaction												
A × B	*	ns	*	*	ns	ns	ns	ns	ns	ns	*	ns

*Significant at 0.05 probability Level.
ns = not significant.

Table (3): Effect of nitrogen fertilization and weed control on shelling %, 100- grain weight and grain yield (ton/ fed) during 2010 and 2011 seasons

Treatments	Shelling%		100-grainsweight (g)		Grain yield (ton/fed)	
	2010	2011	2010	2011	2010	2011
A) Nitrogen fertilizer						
40 kg N/fed.	84.40	84.65	23.00	24.56c	4.63c	4.36b
80 kg N/fed.	84.60	84.04	23.72	25.74c	4.88a	4.55a
120 kg N/fed.	84.24	84.09	25.56	27.87ab	4.92a	4.53a
160 kg N/fed.	84.34	84.39	22.94	28.89a	4.73b	4.60a
L.S.D.$_{0.05}$	ns	ns	ns	1.00	0.09	0.13
B) Weed control						
Unweeded control	84.08c	83.04c	22.75	23.10e	3.84d	3.62e
Atrazine (80%)	84.77a	84.87a	26.17	27.30a	4.88b	4.89b
Starane	83.31b	83.74b	24.50	25.60b	4.44c	3.98d
Atrazine + one hoeing	84.90a	84.85a	21.67	23.70d	5.38a	5.03a
Starane + one hoeing	84.46b	83.93c	22.58	24.60c	4.94b	4.57c
Hand hoeing twice	84.37b	84.45b	23.67	25.80b	5.37a	5.00ab
L.S.D.$_{0.05}$	0.16	0.18	ns	0.27	0.11	0.12
Interaction						
A × B	*	ns	ns	ns	*	ns

*Significant at 0.05 probability Level.
ns = not significant.

Table (4): Effect of nitrogen fertilization and weed control on control on number of broad, narrow leaved weeds/m^2 and total weed/m^2 in 2010 and 2011 seasons

Treatments	Number of broad leaved weeds/m^2		Number of narrow leaved weeds/m^2		Total number of weeds/m^2	
	2010	2011	2010	2011	2010	2011
A) Nitrogen fertilizer						
40 kg N/fed	31.25c	7.17	21.50c	24.11	52.75c	31.28
80 kg N/fed	35.29ab	8.89	27.00ab	23.67	62.29b	32.56
120 kg N/fed	33.80b	8.39	25.75b	24.22	59.55b	32.61
160 kg N/fed	36.30a	7.72	28.92a	23.61	67.22a	31.33
L.S.D.$_{0.05}$	2.09	ns	2.35	ns	2.85	ns
B) Weed control						
Unweeded control	89.10	19.72	43.00	43.20	132.10	62.47
Atrazine (80%)	15.20	6.13	23.65	16.40	38.85	22.55
Starane	63.80	8.27	43.25	47.73	107.05	56.00
Atrazine + one hoeing	4.85	3.80	9.60	5.47	14.45	9.27
Starane + one hoeing	13.55	5.73	27.00	23.47	44.55	28.20
Hand hoeing twice	7.15	5.27	7.40	5.73	14.55	11.00
L.S.D.$_{0.05}$	2.85	ns	ns	3.94	3.07	3.18
Interaction						
A × B	*	ns	ns	*	*	ns

*Significant at 0.05 probability Level.
ns = not significant.

Table (6): Effect of nitrogen fertilization and weed control on control on dry weight of broad, narrow leaved weeds/m^2 and total weed/m^2 in 2010 and 2011 seasons.

Treatments	Dry weight of broad leaved weeds/m^2 (g)		Dry weight of narrow leaved weeds/m^2 (g)		Dry weight of total weeds/m^2 (g)	
	2010	2011	2010	2011	2010	2011
A) Nitrogen fertilizer						
40 kg N/fed	135.33	15.02	123.40	68.20	258.77	83.22
80 kg N/fed	131.33	21.80	133.10	119.10	264.43	140.90
120 kg N/fed	135.72	27.60	110.40	121.30	246.12	148.90
160 kg N/fed	143.71	17.80	131.80	97.50	275.41	115.30
L.S.D.$_{0.05}$	ns	ns	ns	ns	ns	ns
B) Weed control						
Unweeded control	205.25a	73.90a	186.10b	199.30b	391.35b	273.20a
Atrazine (80%)	139.17b	9.20c	196.20a	40.10d	335.37a	49.30d
Starane	100.00c	21.30b	171.35c	201.40a	271.35c	222.70b
Atrazine + one hoeing	193.17a	4.40d	42.50e	5.60e	235.67d	10.00e
Starane + one hoeing	79.75c	8.40c	123.50d	86.70c	203.25e	95.10c
Hand hoeing twice	101.50c	5.50d	21.50f	5.90e	123.00f	11.40e
L.S.D.$_{0.05}$	30.26	4.85	8.60	4.70	18.90	3.80
Interaction						
A × B	ns	ns	ns	ns	ns	ns

ns = not segnificant

Control treatments significantly decreased the average total number weds and dry weight of weeds at 85 DAS compared with unweeded check. Atrazine + one hand hoeing has been used for many reasons as major herbicide for weed control in maize in the whole world. The use of atrazine as a major herbicide for maize can be attributed to the great selectivity of the herbicide towards maize composed with other herbicide used in maize field.

The selectivity of atrazien in controlling weeds may be attributed to the effect of atrazine in inhibiting photosynthesis, RNA synthesis and lipid synthesis in susceptible cells but not resistant cells.

The reduction in total dry weight of weed per unit area under weed control treatment as attributed to the decrease in the number of broad and narrow leaves weeds. These results agree with those obtained by Abdel-Samie (2001), Lesnik (2003) and AbouZiena*et al.* (2008).

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الملخص العربي

استجابة هجين الذرة الشامية للتسميد النتروجينى ومقاومة الحشائش

محمود عبد العزيز جمعة – فتحى إبراهيم رضوان – إبراهيم فتح الله رحاب، أحمد عبد الله عبد العاطي

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أجريت تجربتان حقليتان فى المزرعة التجريبية البحثية لكلية الزراعة – سابا باشا – جامعة الإسكندرية بالقرية العاشرة بمنطقة أبيس خلال موسمى 2010، 2011 بهدف دراسة تأثير التسميد النتروجينى ومقاومة الحشائش على صفات النمو والمحصول ومكوناته لهجين الذرة الشامية (هجين ثلاثى T. W. C. 310).

توضح النتائج المتحصل عليها أن إضافة النتروجين بمعدل 120 كجم/فدان كان معنوياً على بعض الصفات المدروسة. وكان إضافة النتروجين بمعدل 160 كجم نتروجين/فدان أفضل المعاملات للحصول على المحصول ومكوناته ومكافحة الحشائش للهجين الثلاثى T. W. C. 310 حيث تم الحصول عليها من المعاملة بمبيد الحشائش Atrazine (أترازين) بالإضافة إلى عزقة واحدة مع التسميد النتروجينى بمعدل 160 كجم نتروجين/فدان مقارنة بإضافة نيتروجين بمعدل 40 كجم نيتروجين/ فدان مع المعاملة بدون عزيق (مقارنة).