Assiut J. of Agric. Sci., 42 (Special Issue)(The 5th Conference of Young Scientists Fac. of Agric. Assiut Univ. May,8, 2011) (507-528)

Moisture Regime and Nitrogen Fertilizer for Maize Production Concerning the Environmental Impact

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Abstract

The present investigation was carried out at the experimental farm, Faculty of Agriculture, Al-Azahar University, Assuit, Egypt, to protect the Environment and reduce water and soil pollution by minimizing the leached amount of nitrate-N (NO_3) and ammonium-N (NH_4), find out the best irrigation regime, the best source and level of nitrogen and their combinations for minimizing corn production. In the summer seasons of year 2009 and 2010, corn (zea mays L.) variety Tri hybrid cross Nefertiti3 was planted under three irrigation regimes (25, 50 and 75% of soil moisture depletion of the available water, SMD) and fertilized by three different sources of nitrogen (Urea 46.5% N, Ammonium nitrate 33.5% N and the slow release fertilizer Enciabeen 40% N) at three levels (90,120 and 150 kg N/fed.).

The obtained results indicated that increasing SMD, raised the NO_3-N and NH_4-N concentrations in the ground water. Since the 75% of SMD produced highest concentration of nitrogen in the soil water. Comparing the nitrogen sources, Enciabeen fertilizer gave the least concentration of NO_3-N and NH_4-N in the ground water which is good for the environment protection. The higher rate of nitrogen applied caused more losses of NO_3- N and NH_4-N. Maize growth was positively affected by all combination (irrigation regimes and sources and rates of nitrogen). The results suggest that best agriculture management is to use Enciabeen fertilizer at a rate of 150 kg N/ fd with 50 % SMD since this practice gave the highest corn yield with good quality as well as it minimized the hazardous effect on the environmental.

Key words: Irrigation regime, Nitrogen fertilizer, Maize production, Leaching of nitrate, NO_3 and ammonia, NH_4.

Introduction:

Nutrient loss from ecosystems is among the top environmental threats to ecosystems worldwide, leading to reduced plant productivity in nutrient-poor ecosystems and eutrophication of surface water near nutrient-rich ecosystems. Hence, it is of pivotal importance to understand which factors influence nutrient loss. With increasing

Received on: 11/4/2011 **Accepted for publication on:** 27/4/2011

Referees: Prof. Dr. Hassanen G. Hassanen Prof. Dr. Hussein M. A. Ragheb

amounts of nitrogen (N) being added to farmland in the form of fertilizer to optimize crop yields, and more broadly, to meet the growing demands for food, feed and energy, there are public concerns regarding its possible negative impact on the environment. An optimal balance between N requirements for production versus efficient N use is required, so as to minimize N losses from the agricultural system (Hatfield and Prueger 2004).

Increasing leached NO_3-N may cause undesirable hazard consequences in terrestrial, freshwater and marine ecosystems, and detrimentally affect human health and work abilities (Vitousek et al., 1997). Howarth, (1988) reported that accumulation of NO_3^- in water bodies, such as lakes, rivers and estuaries can result in eutrophication (over growth of algal bloom and death of aquatic life). He also reported that consumption of high concentrations of NO_3^- and its immediate reduced form, nitrite, NO_2^- may pose several human-health risks, including methemoglobinemia, gastric cancer, thyroid hypertrophy, reproductive toxicity and ulceration of mouth and/or lining of the stomach.

Nitrate (NO_3^-) leaching from agricultural land has long been recognized and remains a growing concern due to application of N fertilizers (Tan et al., 2002). El-Sayed (2001) showed that NO_3-N concentration in ground water increased by increasing nitrogen fertilizer rate. He also, stated that ammonium nitrate fertilizer gave the highest concentration of NO_3-N in drainage water followed by using urea and ammonium sulphate. Ragab et al. (2002) reported that the irrigation at 50 to 55% depletion of available soil moisture was the suitable irrigation regime for maize. And the maize grain yield decreased with increasing water stress. Ghazy (2004) reported that there was a significant effect of water regime on maize yield and its components and irrigation at 55% depletion of available soil moisture produced the highest maize yield and its components. While the irrigation at 85% depletion of available soil moisture gave the lowest maize yield. Increasing nitrogen fertilization level up to 130 kg-N/fed. significantly increased the maize yield and its components.

Abdel-Mawly and Zanouny (2005) reported that evapotranspiration values was gradually increased by increasing nitrogen levels up to 140 kg N/ fd and as the available soil moisture increased in the root zone of maize plants. Nofal-Fatma et al. (2005) found that water use efficiency decreased as water depletion increased. Meleha (2006) found that water consumptive use was increased due to increasing amount of applied water. Sarhan (2006) showed that increasing nitrogen level up to 180 kg N/ fd were significantly increased both grain and stover for maize yield. Increasing nitrogen levels increased nitrite and ammonium concentrations in the ground water. Abdel-Hafez et al. (2008) stated that the idea of applying too much water in irrigation to achieve maximum crop yield is not always correct where, it causes losses of water and fertilizers through leaching.

Therefore, this investigation aimed to study how to protect the Environment and reduce pollution, by minimizing the leached amount of nitrate-N (NO_3) and ammonium-N (NH_4) to find out the best irrigation regime, the best source and level of nitrogen and their combinations during corn production.

Materials and Methods:

A field experiment was conducted at The Experimental Farm, Fac. Agric., Al-Azahar Univ., Assuit, during the two successive growth seasons of 2009 and 2010. The soil is clay loam, free of salts and not alkaline (some physical and chemical properties, are given in table 1.

The experiment was laid out in split split plots design with four replications and consisted of 27 combinations. The variables were three levels of soil moisture depletion SMD, three N fertilizers sources and three rates of N fertilization. The main plots were used to express irrigation regimes (25, 50 and 75% of SMD) and were bounded with buffer zone (3 m width) to avoid the horizontal seepage. The sub- plots were assigned for nitrogen fertilizer sources (Urea 46.5% N, Ammonium nitrate 33.5% N and the slow nitrogen fertilizer Enciabeen 40% N). The sub-sub- plots were assigned for nitrogen fertilizer rates (the recommended dose 120 kg N/ fed, compared with 90 and 150 kg/ fed). The plot size 4 m X 5 m with an area of 20 m^2 (almost 1/200 fad). The plots were prepared for furrow irrigation with 60 cm width of the furrow. In the summer seasons of the year 2009 and 2010, Corn seeds (*zea mays L.*) tri hybrid were planted in the first of June in both seasons. Three seeds were planted in holes at 25 cm apart on one side of the ridge and were thinned to tow plants before the first irrigation. All plots received the recommended rate of P and K fertilizer at rates of 15.5 P_2O_5 and 48 K_2O kg/fd. Super phosphate was broadcasted during soil preparation processes. Potassium sulfate was added as K_2SO_4 at two equal doses, the first dose was added after 20 days and the second dose was added after 75 days from the plantation. All field management practices were conducted following the recommendation practices of the Egyptian Ministry of Agriculture.

Application of nitrogen fertilizer :- Enciabeen fertilizer as slow release fertilizer was add as one dose with the first irrigation (20 days from planting) , Urea and Ammonium nitrate fertilizer were divided into two equal doses one was added with first irrigation (20 day from planting) and the second was added 50 days from planting. The fertilizer was side dressed beside the plants.

Corn plants were harvested after 120 days from planting in each season. The plants of four square meters from each plot were collected as samples for growth and yield measurements.

Water samples from groundwater were collected twice a week from soil hole to depth of 130cm which was supported by a 5 inches PVC plastic pipe to prevent water runoff into the hole. The water depth in the hole decreased with the time after irrigation. The water in the hole was sucked by glass pipe (100 cm3 of water in each time) from depth of 10cm below the decreasing water surface in the hole. The Water samples were subjected to nitrate and ammonium analysis according to Jackson (1973). Soil samples from the same depth and time of water samples were collected by soil Auger from each treatment. The collected soil samples were air-dried and prepared for chemical analysis. Available nitrogen was extracted by K-sulfate and determined using the micro-kjeldahl method according to Jackson (1973). Also Soil physical and chemical analysis were conducted according to Klute (1986) and Page et al. (1982).

Table 1: Some soil chemical and physical properties of the experimental site before cultivation.

a-Chemical propertie

Soil depth (cm)	ECe (dS/m)	Water soluble ions (meq/L) in the soil paste extract						
		CO_3+HCO_3	Cl	SO_4	Ca	Mg	Na	K
0-30	0.99	2.50	1.25	6.15	2.70	1.35	5.74	0.11
30-60	0.95	2.34	1.16	6.00	2.60	1.15	5.53	0.22
60-90	0.90	2.2	1.25	5.55	2.45	1.12	5.24	0.19
90-120	1.25	3.4	3.00	6.10	3.20	1.30	7.75	0.25
120-150	1.35	3.6	3.30	6.60	3.50	2.20	7.53	0.27
mean	1.17	2.86	2.23	6.58	3.37	1.90	6.24	0.21

Soil depth (cm)	pH (1:1)	S.P	O.M (%)	$CaCO_3$ (%)	Available nitrogen (ppm) in soil	
					NO_3	NH_4
0-30	7.89	84	1.20	3.50	40	35
30-60	7.88	83	1.10	3.20	35	30
60-90	7.92	82	0.95	2.70	32	25
90-120	7.95	82	0.85	2.35	25	20
120-150	7.90	82	0.69	2.25	24	18
mean	7.92	82	0.90	2.68	31	26

b- Physical properties

Soil depth (cm)	Percentage			Texture class	A.W (%)	*Pb* (g/cm^3)
	Sand	Silt	Clay			
0-30	25.00	39.65	35.35	C.L.	23.0	1.29
30-60	24.65	39.00	36.35	C.L.	22.8	1.30
60-90	25.90	38.80	35.30	C.L.	22.5	1.33
90-120	26.50	41.00	32.50	C.L.	21.8	1.37
120-150	25.85	40.70	33.45	C.L.	21.6	1.42
mean	25.48	39.78	34.74	C.L.	22.0	1.36

Maize yield and its components (plant height, seed index, grain yield and straw yield) were determined at harvest time. Nitrogen content in grain and straw was determined using kjeldahl method according to Jackson (1973). The data were subjected to statistical analysis according to Sendocor and Cochran (1980).

Results and Discussion

1- Effect of irrigation regime on nitrogen concentration in soil water

The concentration of nitrogen in soil water in forms of NH_4 and NO_3 at different soil moisture depletion with various depths levels are presented in fig.1-9 (average of two seasons). In general, there is a slight change in NH_4 and NO_3 concentrations in the soil water as the water level went down to depth of 130 cm with time, either in each of the nitrogen source or nitrogen level. However the nitrogen concentrations varied greatly according to the three studied variables (fertilizer levels, sources and SMD %). The concentration of nitrogen in form of NO_3 were much higher than those of nitrogen in form of NH_4. This is may be due to the nature of NO_3 anion as negative ions which makes it very easy to be leached to soil water and consequently to the drainage water. While the NH_4 cation may be adsorbed on clay exchange sites. Also, it can be recognize that for all treatments, nitrogen concentration was increased in the soil water with increasing soil moisture depletion percentage from 25 to 75% SMD. The concentration of NO_3-N in soil water represents about 60 and 80% when the soil irrigated at 25 and 50 % SMD, respectively compared to that irrigated at 75% SMD regardless of nitrogen sources.

2- Effect of nitrogen source on nitrogen concentration in soil water

The concentration of nitrogen in soil water resulted from different source of nitrogen were shown in fig. 1-9 (average of two seasons). The concentration of nitrogen in soil water did not change whenever the nitrogen source was urea or ammonium nitrate and almost have the same distribution through 130 cm soil depth. While the concentration of nitrogen in soil water resulted from enciabeen fertilizer was varied between one half to one third of those values for Urea and ammonium nitrate. This may be due to slow release of enciabeen. The Enciabeen as Nitrogen fertilizer was suggested by El-Atawy,(2007) as continuous nitrogen supply for plnts. On average basis, the concentration of NO_3-N in soil water was 223, 213 and 89 ppm form ammonium nitrate, urea and enciabeen, respectively.

3- Effect of nitrogen fertilizer level on the nitrogen concentration in soil water

Regarding nitrogen fertilizer levels, in all treatments, the data in fig. 1-9 (average of two seasons) show that the concentration in soil water of NH_4 and NO_3 increased as the nitrogen level was increase. The average concentration of NH_4 in soil water was 12.77, 9.65 and 6.62 ppm when fertilized with 150, 120 and 90 kg N/ fd, respectively. However the average of NO_3 was 210.39, 174.37 and 136.85 ppm when 150, 120 and 90 kg N/ fd, were applied respectively.

From these results it is clear that the groundwater is being exposed to a high risk of NO3-N pollution depending the studied variables.

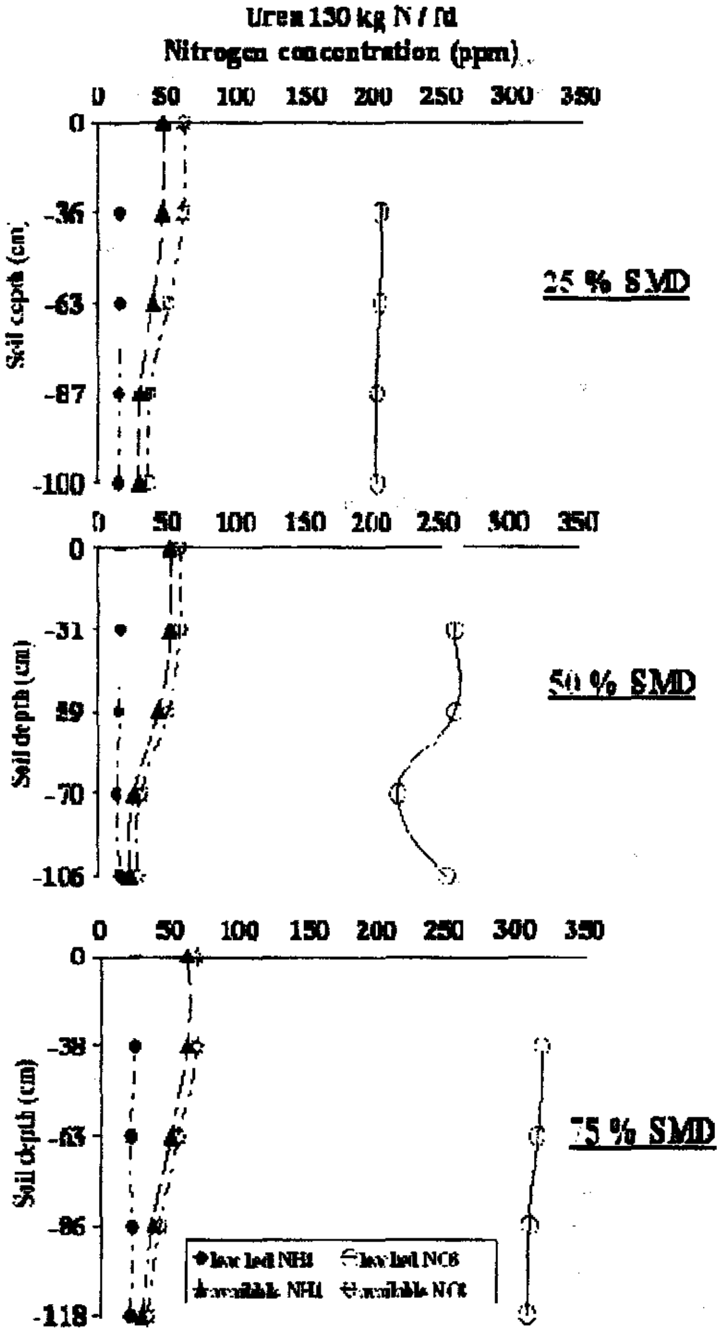

Fig. (1). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 150 kg N/ fd of Urea.

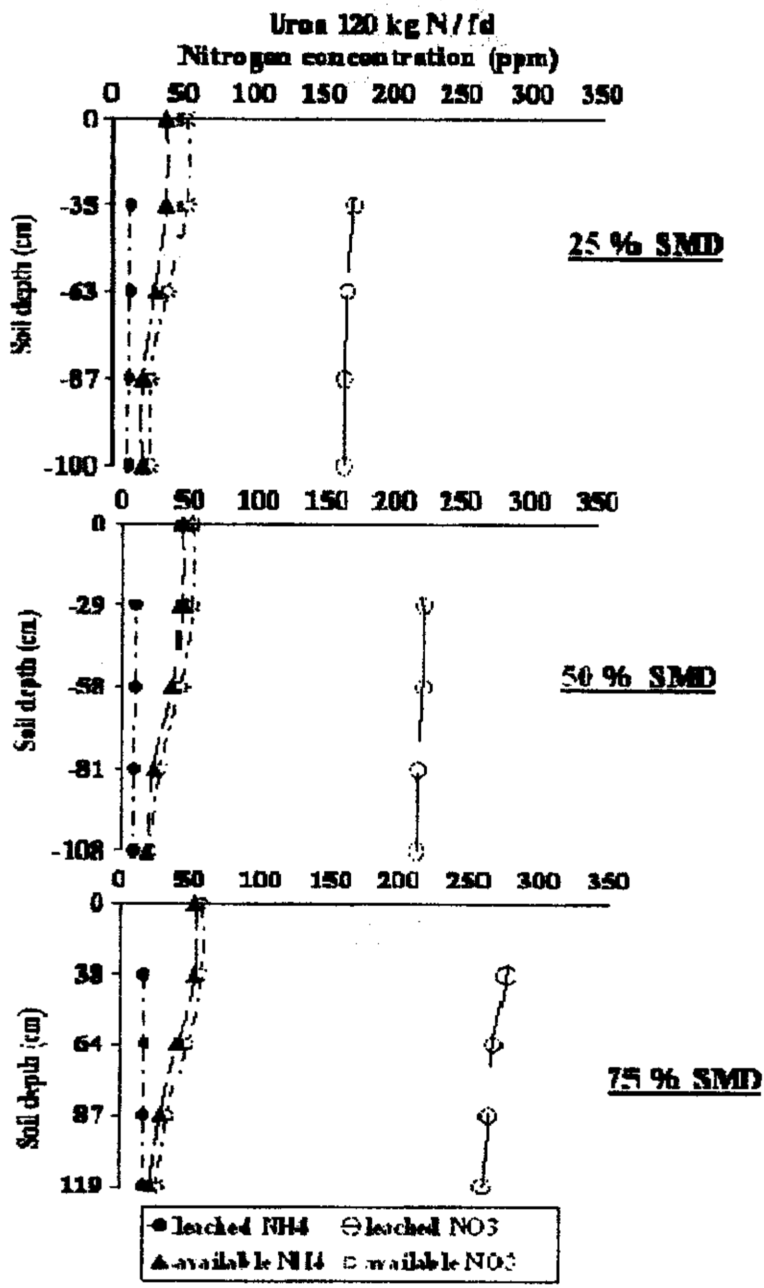

Fig. (2). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 120 kg N/ fd of Urea.

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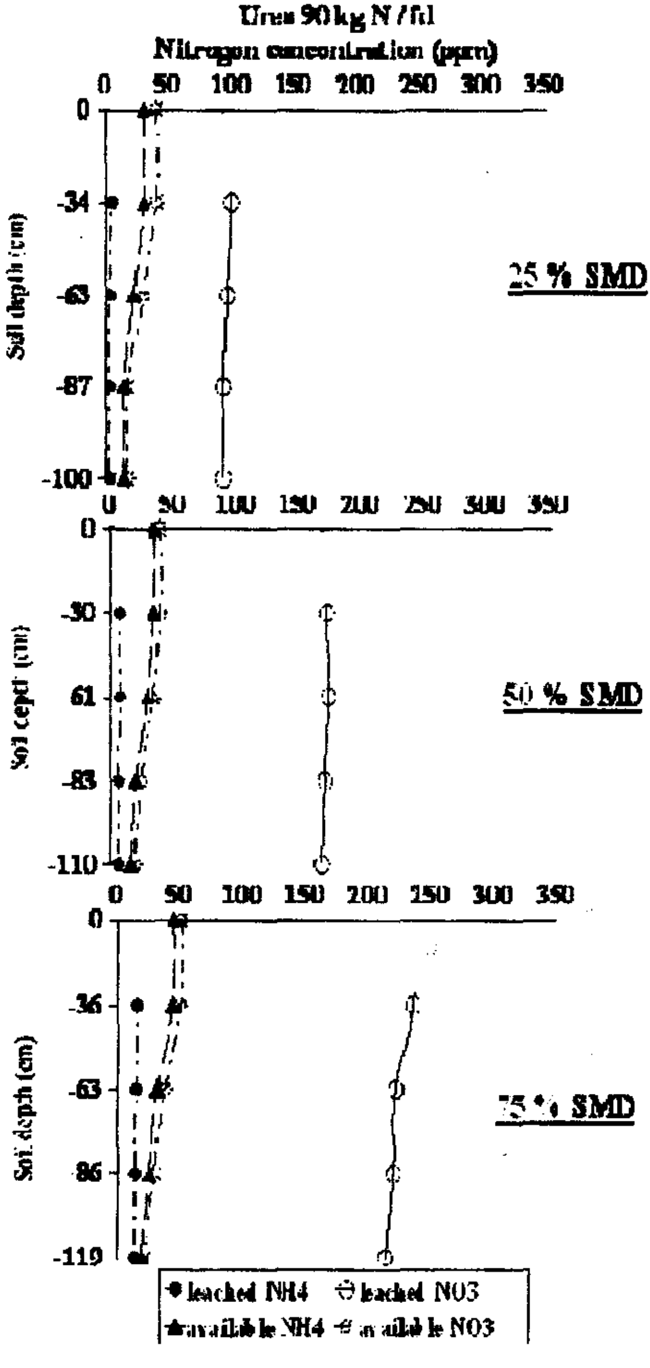

Fig. (3). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 90 kg N/ fd of Urea.

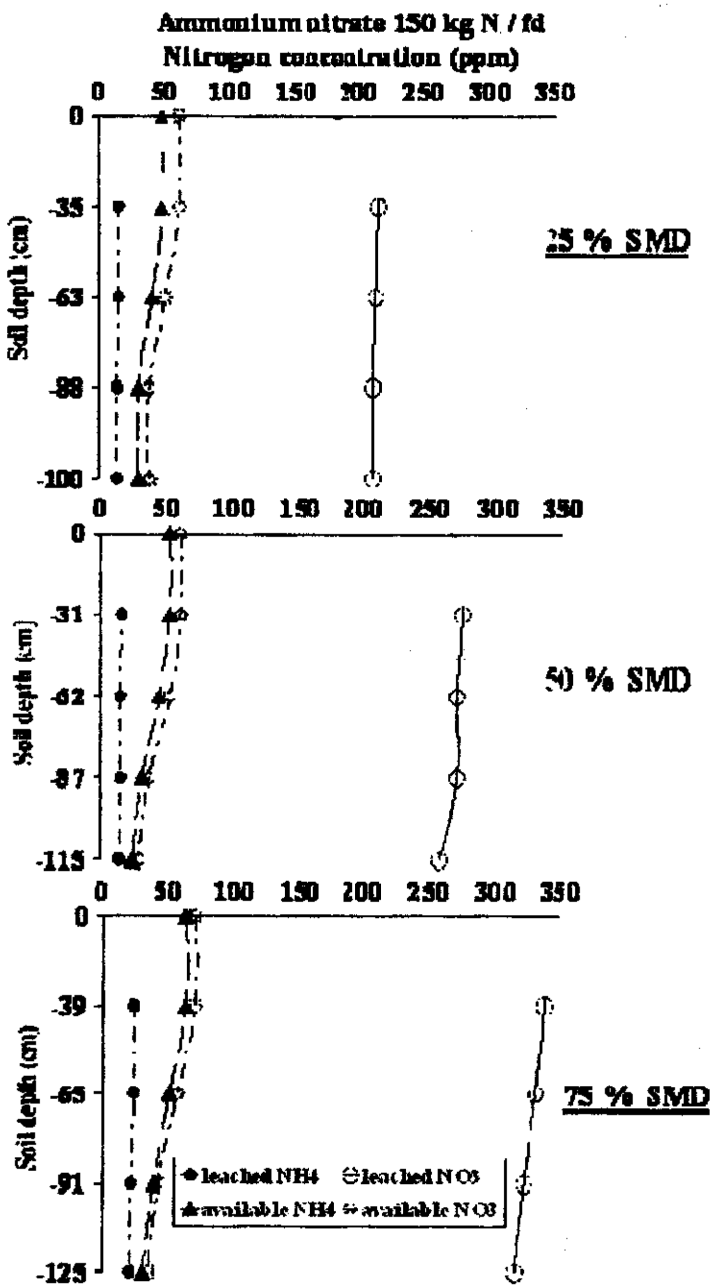

Fig. (4). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 150 kg N/ fd of Ammonium nitrate.

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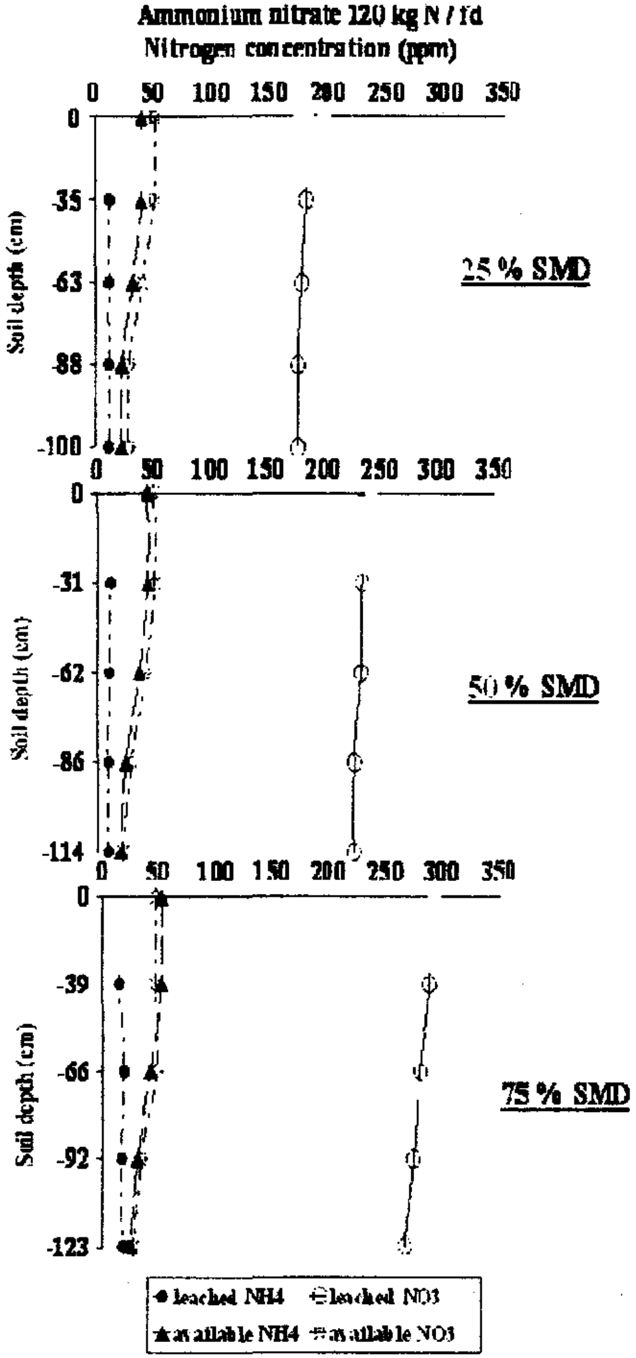

Fig. (5). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 120 kg N/ fd of Ammonium nitrate.

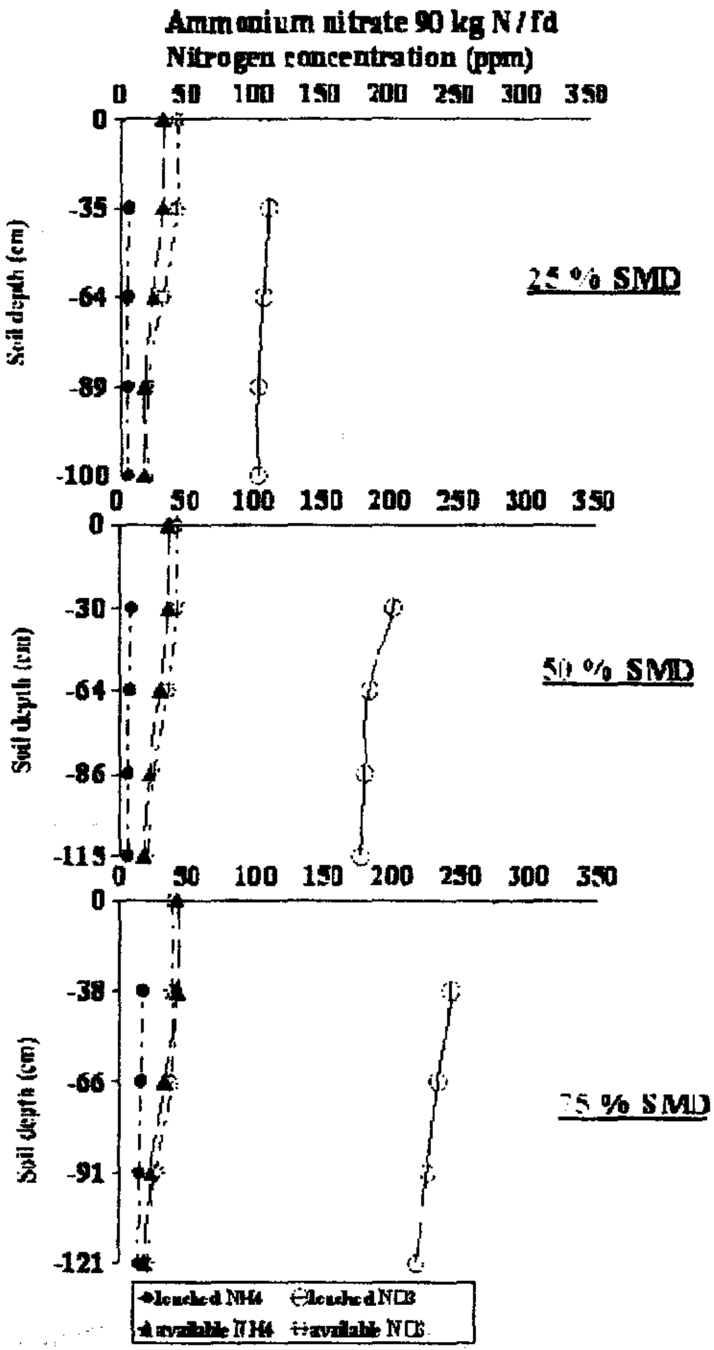

Fig. (6). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 90 kg N/ fd of Ammonium nitrate.

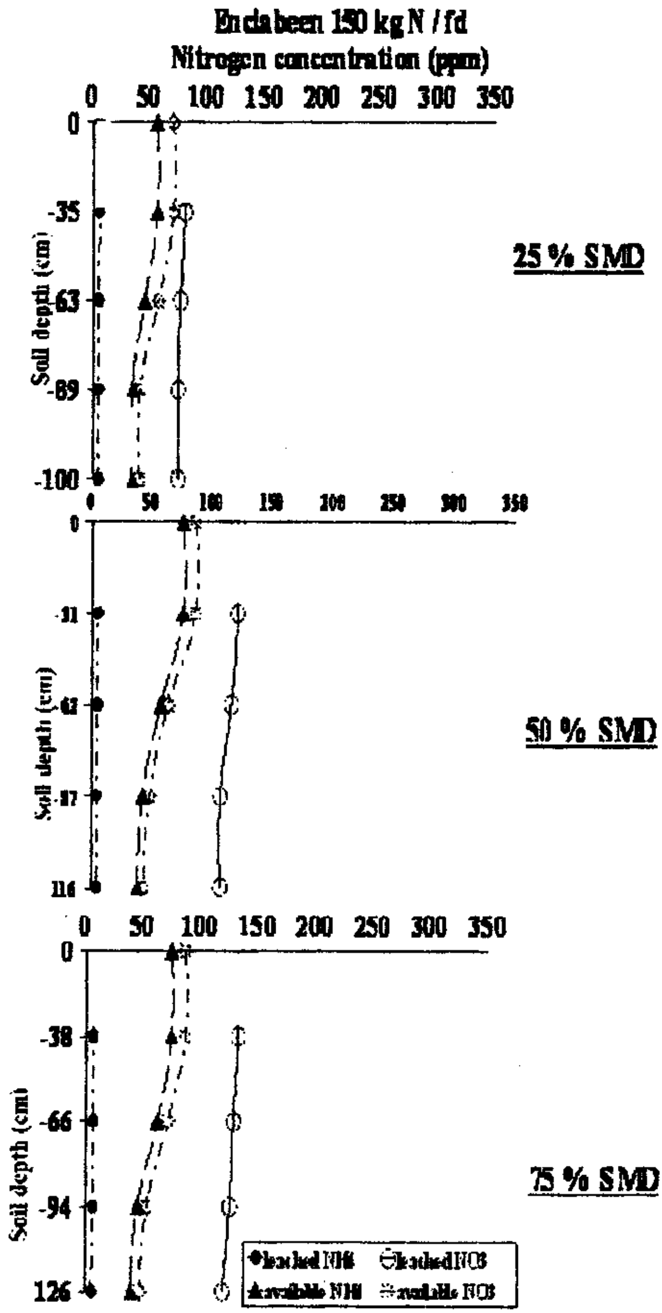

Fig. (7). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 150 kg N/ fd of Enciabeen

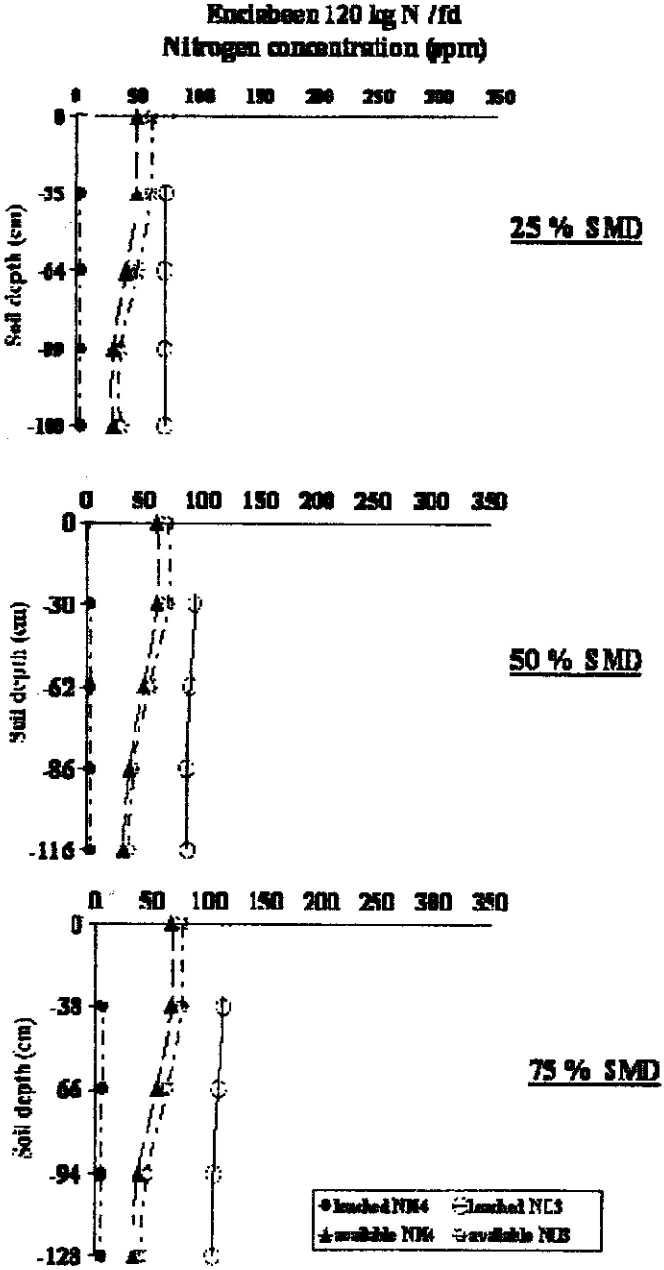

Fig. (8). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 120 kg N/ fd of Encisbeen.

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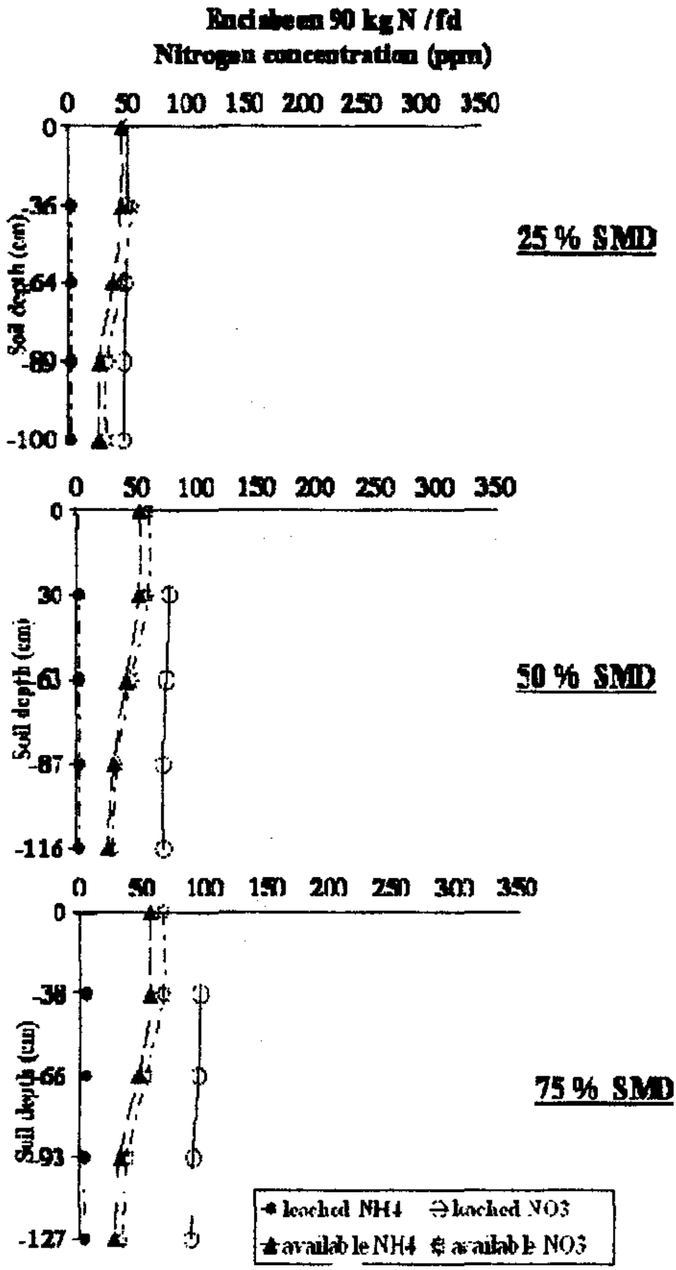

Fig. (9). Nitrogen concentration in soil and groundwater at different soil moisture depletion when fertilized by 90 kg N/ fd of Enciabeen.

4- Effect of irrigation regime, nitrogen source and its level on the soil available nitrogen

Average nitrogen concentrations of 0-130 cm soil layer for all treatments are shown in fig. 1-9. Ammonium (NH4-N) concentration values are 34, 41 and 43 ppm at SMD 25 or 50 and 75%, respectively. The available NH4-N increases with higher SMD by about 21%. NO3-N concentration values are 43, 39 and 47 ppm at SMD 25, 50 and 75%, respectively. Available NH4-N realizes a value of 32.7 ppm for the fast release fertilizers (urea or ammonium nitrate) and a value of 42.6 for the slow release fertilizer (enciabeen). Available NO3-N realizes a value of 39.3 and 49.7 ppm for the corresponding fertilizers. Enciabeen fertilization increases the soil content of NH_4 and NO_3 by 30 and 26%, respectively compared to the other fertilizer. Soil content of NH4-N values is 43.6, 34.5 and 29.8 ppm at nitrogen level of 150, 120 and 90 kg N/fd, respectively. Soil content of NO3-N values is 51.8, 40.8 and 35.7 ppm at the corresponding nitrogen level. Data clearly indicated that increasing the applied nitrogen level increases soil nitrogen content. It could be revealed that increasing SMD from 25 to 75% increased NO3-N concentrations in the soil solution. This may due to NO3 leaching was restricted by the amount of irrigation water, soil moisture.

Nitrogen dynamics associated with mineral N applications to maize fields are complex and dynamic, with huge year-to-year variability associated with climate, N management practices, and soil properties. Field studies are critical for documenting N dynamics and losses; however, large-scale, multi-year studies are expensive and may not fully capture the range of the processes involved.

5- Effect of water and fertilization management on corn yield and its component

It is known that nutrients uptake by plants is controlled by the external and internal ionic concentration, selectivity and plant energy levels as well as water absorption. Data presented in tables (2,3,4 and 5) show the effect of irrigation regime, nitrogen fertilizer sources and their levels on maize yield and its component. In general maize yield and its component were high significantly affected by irrigation regimes, nitrogen sources and their levels. Plant height decreases as the level of soil moisture decrease. The maximum plant height (269.25 cm) was recorded when 150 kg N/ fd of enciabeen was applied with 25 % of SMD irrigation level. While the minimum value (202 cm) was recorded when 150 kg N/ fed of enciabeen was applied with 75 % of SMD. The highest value of seed index (40.10 g/100seeds) was obtained with application of 150 kg N/ fed urea at 25% SMD.

The lowest of seed index (30.41 g/100seeds) was obtained from plot treated by 90 kg N/ fed at 75% SMD. The highest value of grain yield (4.70 ton/ fed) was achieved from plot treated by 150 kg N/ fed of enciabeen at 25 or 50% SMD. The lowest one (2.44 ton/ fed) was recorded from plot treated by 90 kg N/ fed of ammonium nitrate at 75% SMD.

Table(2).Effect of irrigation regime, fertilizer sources and rates on maize yield and yield components.

Parameter	Treatment	Urea			Ammonium Nitrate			Enciabein		
		150kgN	120kgN	90kgN	150kgN	120kgN	90kgN	150kgN	120kgN	90kgN
Plant height(cm)	25%SMD	262.25	246.75	236.25	256	240	230.75	269.25	256.25	241.5
	50%SMD	260.25	257	241.75	255.25	247	235.25	265.75	256.75	240.5
	75%SMD	252.25	241.25	232.75	245.5	234.8	217.88	202	241.75	237.75
	L.S.D 5%	A	0.75	AB	2.025	AC	2.155	ABC	3.733	
		B	1.169	C	1.244	BC	2.155			
Seed index(g)	25%SMD	40.1	38.37	35.45	36.22	35.92	30.95	39.8	36.67	36.72
	50%SMD	39.47	38.65	37.85	35.57	34.8	33.8	37.85	37.75	34
	75%SMD	37.85	32.97	34.35	35.9	32.39	30.41	35.74	36.2	34.17
	L.S.D 5%	A	1.01	AB	1.13	AC	0.97	ABC	1.68	
		B	0.65	C	0.56	BC	0.97			
Grain yield (ton/fd)	25%SMD	4.4	4.29	3.53	4.23	3.93	3.53	4.7	4.38	4.04
	50%SMD	4.49	4.19	3.78	4.35	3.91	3.45	4.69	4.26	3.79
	75%SMD	3.03	2.79	2.54	2.88	2.5	2.44	3.44	2.96	2.68
	L.S.D 5%	A	0.114	AB	n.s	AC	0.126	ABC	n.s	
		B	0.061	C	0.073	BC	n.s			
Straw yield (ton/fd)	25%SMD	5.8	4.82	4.51	5.67	4.48	4.22	6.27	5.47	4.95
	50%SMD	5.94	5.27	4.31	5.75	4.42	4.22	6.1	5.41	4.79
	75%SMD	5.01	4.28	3.44	4.77	3.9	3.43	5.15	4.56	3.77
	L.S.D 5%	A	0.075	AB	0.105	AC	0.115	ABC	0.198	
		B	0.061	C	0.066	BC	0.115			
Grain nitrogen%	25%SMD	1.54	1.49	1.42	1.55	1.45	1.37	1.68	1.62	1.51
	50%SMD	1.54	1.48	1.41	1.55	1.45	1.36	1.69	1.62	1.49
	75%SMD	1.52	1.44	1.3	1.42	1.41	1.38	1.62	1.56	1.43
	L.S.D 5%	A	0.022	AB	0.04	AC	0.036	ABC	0.063	
		B	0.023	C	0.021	BC	n.s			
Straw nitrogen%	25%SMD	0.77	0.75	0.71	0.78	0.73	0.69	0.85	0.81	0.77
	50%SMD	0.78	0.75	0.71	0.78	0.73	0.68	0.84	0.81	0.75
	75%SMD	0.77	0.73	0.65	0.71	0.72	0.69	0.81	0.79	0.72
	L.S.D 5%	A	0.01	AB	0.019	AC	n.s	ABC	0.028	
		B	0.011	C	0.01	BC	0.016			

Data is average of two seasons A= Irrigation regime B= fertilizer sources C= fertilizer rates

The greater value of straw yield (6.27 ton/ fed) was obtained from plots treated by 150 kg N/ fed of enciabeen at 25 or 50% SMD. The lowest one (3.44 ton/ fed) was recorded from plots treated by 90 kg N/ fed of urea at 75% SMD. The greater value of nitrogen% in grains (1.69 %) is achieved in plots treated by 150 kg N/ fed of enciabeen at 25 or 50% SMD. The lowest one (1.36 %) is recorded in plot treated by 90 kg N/ fed of ammonium nitrate at 50% SMD. The highest value of nitrogen% in straw (0.85 %) was achieved from plot treated by 150 kg N/ fed of enciabeen at 25% SMD. The lowest one (0.65 %) was reported from plots treated by 90 kg N/ fed of urea at 50% SMD.

In conclusion the suggested best agriculture management is to use enciabeen fertilization at a rate of 150 kg N/ fed with 50 % SMD since this practice gave the highest maize production with a good quality as well as it minimized the hazardous effect from the environmental point of view.

Table(3). The effect of interaction between irrigation regime, fertilizer sources and rates on maize yield components.

Parameter	**Plant height(cm)**				**Seed index(g)**			
	Irrigation regime x fertilizer sources			mean	Irrigation regime x fertilizer sources			mean
Treatment	Urea	Ammonium Nitrate	Enciabeen		Urea	Ammonium Nitrate	Enciabeen	
25%SMD	248.4	242.3	255.7	248.8	38.0	34.4	37.7	36.7
50%SMD	253.0	245.8	254.3	251.1	38.6	34.7	36.5	36.6
75%SMD	242.1	232.7	227.2	234.0	35.1	32.9	35.4	34.4
mean	**247.8**	**240.3**	**245.7**	**244.6**	**37.2**	**34.0**	**36.5**	**35.9**
	Irrigation regime x fertilizer rates				Irrigation regime x fertilizer rates			
Treatment	150kgN	120kgN	90kgN	mean	150kgN	120kgN	90kgN	mean
25%SMD	262.5	247.7	236.2	248.8	38.7	37.0	34.4	36.7
50%SMD	260.4	253.6	239.2	251.1	37.6	37.1	35.2	36.6
75%SMD	233.3	239.3	229.5	234.0	36.5	33.9	33.0	34.4
mean	**252.1**	**246.8**	**234.9**	**244.6**	**37.6**	**36.0**	**34.2**	**35.9**
	fertilizer sources x fertilizer rates				fertilizer sources x fertilizer rates			
Treatment	Urea	Ammonium Nitrate	Enciabeen	mean	Urea	Ammonium Nitrate	Enciabeen	mean
150kgN	242.7	252.3	245.7	246.9	39.1	35.9	35.7	36.9
120kgN	243.1	240.6	251.6	245.1	36.7	34.4	36.2	35.7
90kgN	232.2	228.0	239.9	233.4	35.9	31.7	34.2	33.9
mean	**239.3**	**240.3**	**245.7**	**241.8**	**37.2**	**34.0**	**35.4**	**35.5**

Table(4). The effect of interaction between irrigation regime, fertilizer sources and rates on maize yield.

Parameter	Grain yield (ton/fd)				Straw yield (ton/fd)			
	Irrigation regime x fertilizer sources			mean	Irrigation regime x fertilizer sources			mean
Treatment	Urea	Ammonium Nitrate	Enciabeen		Urea	Ammonium Nitrate	Enciabeen	
25%SMD	4.1	3.5	4.4	4.0	5.0	4.8	5.6	5.1
50%SMD	4.2	3.5	4.2	4.0	5.2	4.8	5.4	5.1
75%SMD	2.8	2.4	3.0	2.8	4.2	4.0	4.5	4.3
mean	3.7	3.1	3.9	3.6	**4.8**	**4.5**	**5.2**	**4.8**
	Irrigation regime x fertilizer rates				Irrigation regime x fertilizer rates			
Treatment	150kgN	120kgN	90kgN	mean	150kgN	120kgN	90kgN	mean
25%SMD	4.4	4.2	3.7	4.1	5.9	4.9	4.6	5.1
50%SMD	4.5	4.1	3.7	4.1	5.9	5.0	4.4	5.1
75%SMD	3.1	2.8	2.6	2.8	5.0	4.2	3.5	4.3
mean	4.0	3.7	3.3	3.7	5.6	4.7	4.2	4.8
	fertilizer sources x fertilizer rates				fertilizer sources x fertilizer rates			
Treatment	Urea	Ammonium Nitrate	Enciabeen	mean	Urea	Ammonium Nitrate	Enciabeen	mean
150kgN	4.0	3.82	4.3	**4.0**	5.6	5.4	4.5	**5.2**
120kgN	3.8	3.4	3.9	**3.7**	4.79	4.3	5.8	**5.0**
90kgN	3.3	3.1	3.5	**3.3**	4.1	4.0	5.1	**4.4**
mean	3.7	3.5	3.9	**3.7**	4.8	4.5	5.2	**4.8**

These results prove clearly the prominent role of N element for increasing grain yield. The effect of nitrogen fertilizer on grain yield is the outcome of its positive effect on grain yield components and plant growth parameters. Also, results reveal that enciabeen has a significant effect on crops yield and their attributes especially, when enciabeen are applied at high rates. Enciabeen may be available regular source for nitrogen supply; also, its effect keeps up to two successive seasons.

Table(5). The effect of interaction between irrigation regime, fertilizer sources and rates on maize yield and yield components.

Parameter	Grain nitrogen %				Straw nitrogen %			
	Irrigation regime x fertilizer sources			mean	Irrigation regime x fertilizer sources			mean
Treatment	Urea	Ammonium Nitrate	Enciabeen		Urea	Ammonium Nitrate	Enciabeen	
25%SMD	1.5	1.5	1.6	1.5	0.7	0.7	0.8	0.8
50%SMD	1.5	1.5	1.6	1.5	0.7	0.7	0.8	0.8
75%SMD	1.4	1.4	1.5	1.5	0.7	0.7	0.8	0.7
mean	1.5	1.4	1.6	1.5	0.7	0.7	0.8	0.8
	Irrigation regime x fertilizer rates				Irrigation regime x fertilizer rates			
Treatment	150kgN	120kgN	90kgN	mean	150kgN	120kgN	90kgN	mean
25%SMD	1.6	1.5	1.4	1.5	0.8	0.8	0.7	0.8
50%SMD	1.6	1.5	1.4	1.5	0.8	0.8	0.7	0.8
75%SMD	1.5	1.5	1.4	1.5	0.8	0.7	0.7	0.7
mean	1.6	1.5	1.4	1.5	0.8	0.8	0.7	0.8
	fertilizer sources x fertilizer rates				fertilizer sources x fertilizer rates			
Treatment	Urea	Ammonium Nitrate	Enciabeen	mean	Urea	Ammonium Nitrate	Enciabeen	mean
150kgN	1.5	1.5	1.7	1.6	0.8	0.8	0.8	0.8
120kgN	1.5	1.5	1.6	1.5	0.7	0.7	0.8	0.8
90kgN	1.4	1.4	1.5	1.4	0.7	0.7	0.7	0.7
mean	1.5	1.5	1.6	1.5	0.7	0.7	0.8	0.8

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النظام الرطوبى والتسميد النيتروجينى لإنتاج الذرة الشامية وأثر ذلك على البيئة

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تم تنفيذ تجربة حقلية بالمزرعة التجريبية لكلية الزراعة جامعة الأزهر بأسيوط - مصر، بهدف تقليل فقد النيتروجين (ن) بالغسيل وحفظ البيئة من التلوث وأيضا الإجهاد المائي المناسب لتحديد أفضل مصدر ومستوى للنيتروجين يحقق أعلى إنتاجية بأقل اثر بيئي ضار.خلال الموسم الصيفي لعام 2010,2009 تمت زراعة محصول الذرة الشامية هجين ثلاث تحت إجهاد مائى (75,50,25% استنفاذ من الماء الميسر) والتسميد بمصادر نيتروجين مختلفة سريعة الذوبان (يوريا46.5% ن، نترات الأمونيوم33.5%ن) وبطيئة الذوبان (انسيابين40%ن) بثلاث مستويات(150,120,90 كجم ن/ فدان).

تشير النتائج المتحصل عليها ان زيادة كمية ماء الرى أدت الى زيادة تركيز النترات والامونيوم فى الماء الأرضى وكان التلوث أكثر بالنترات. كمية النترات والامونيوم المغسولة تزداد عند رى الأرض المعرضة لإجهاد رطوبى أعلى (75% استنفاذ من الرطوبة الميسرة). خلال الريات الأولى يزداد تركيز النترات والامونيوم فى الماء الأرضى ثم يتناقص تدريجيا بتوالي الريات. استخدام سماد الأنسيابين (بطئ الذوبان) بالمقارنة بمصادر النيتروجين الأخرى(سريعة الذوبان) أعطى اقل كمية من النترات والامونيوم المفقودة الى الماء الأرضى وكان أكثر حماية للبيئة. كما اتضح ان اضافة المعدلات المرتفعة من النيتروجين تؤدى الى زيادة الكمية المفقودة من النترات والامونيوم الى الماء الأرضى. وأظهرت النتائج ان هناك تأثير معنوي بين المعاملات المختلفة على محصول الذرة الشامية ومكوناته. وقد أعطت التربة المضاف إليها 150كجم ن/فدان سماد انسيابين (بطئ الذوبان) عند 50% استنفاذ من الرطوبة الميسرة أعلى محصول حيث وصل الى 4.7 طن/فدان من الحبوب و6.1 طن/فدان من القش وذو نوعية جيدة (أعلى نسبة بروتين فى الحبوب والقش) وأقل أثر بيئي ضار .