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Impact of Water Stress and Nitrogen Fertilizer on Yield, Yield Components and Quality of Maize Hybrids (*zea mays* l.).

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Abstract:

Two field experiment were carried out during the two successive seasons of 2008 and 2009 in the Agricultural Experiment Station Farm of the Faculty of Agriculture, Assiut University., to study the effect of three irrigation intervals (15, 25 and 35days), three nitrogen fertilizer rates (40, 80,120 kg N/fed.) and two maize hybrids (Single cross Watania 4 and Three way cross 310) and their interaction on yield, yield components and quality of maize (*Zea Mays* L.).

The obtained results can be summarized as follows:

1- Water stress by extending irrigation intervals to 35 days caused highly significant reduction in yield and other studied characters, as well as grain protein percentage but increased number of days to 50 % tasseling.

2- Increasing nitrogen application level up to 120 kg N/fed. caused highly significant increase in grain yield and its components, protein percentage in grains and number of days to 50 % tasseling.

3- Single cross Watania 4 significantly surpassed three way cross 310 in the mean values of ear length, grains weight/ear, 100-grain weight and grain yield /fed. in the second season only, except number of days to 50 % tasseling and protein percentage no significant difference in both seasons.

4- The interaction between irrigation intervals every 15 days and nitrogen fertilizer rate 120 kg N/fed. gave the highest grain yield (ardab/fed) by planting single crossWatania 4.

Key words: Maize hybrids, Water stress, Irrigation intervals, Yield, Nitrogen fertilization.

Introduction:

Increasing pressing grain yield of cereal crops is an important national target in Egypt in order to face the pressing needs of the fast growing Egyptian population.

Maize (*Zea Mays* L.) is one of the most important cereal crops growing principally during the summer season in Egypt and Yemen. The growing area of maize during 2008 and 2009 seasons was 820274 and 835000 ha.in Egypt but reached 43467 and 37402 ha. in Yemen, respectively. giving an average production of 7977 and 8143 kg/ha. in Egypt and 1514 and1499 kg/ha

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in Yemen, (F.A.O, 2008 and 2009).

The optimum supply of irrigation water and N fertilizer rates are two main factors directly affecting growth and productivity of corn hybrids. Water is considered the limiting factor for agricultural expansion and increasing productivity of field crops. In corn at the prepollination stage, treatments such as water deficit inhibit stigma (silk) elongation and floret development that leads to decrease in kernel set. EL-Sayed (1998) reported that water stress delayed flowering in maize plants. Also, El-morshidy *et al.* (2002) found that days to 50 % silking was 63.46 and 64.14 days with a rang from 57.0 to 68.5 days and no silking to 88 days for white corn S1 lines under favorable and water stress environments, respectively. On the contrary, Ibrahem (2002) and Sharaan *et al.* (2002) recorded that increasing irrigation interval significantly decreased number of days to 50 % tasseling.

Water stress affects almost all plant processes, including photosynthesis, respiration, stomatal conductivity. However, water stress response depends on the intensity, rate and duration of exposure to stress and their stage of crop growth Wajid *et al.* (2004).

Also water stress could be affect photosynthesis via stomata closure, enzyme activity reduction or hormonal aspects of this phenomenon, with changing of photosynthesis, affects plant respiration which become low (Ibrahim and Hala (2007)).

Nitrogen fertilizer is essential to the growth and yield of maize plants. Nitrogen plays a vital role in nutrition and physiological status of plants and promotes changes in mineral composition of plants Mengel and kirkby (1982).Therefore, nitrogen is considerably influenced by the quantity of available nitrogen. Many researchers reported that increasing nitrogen level up to 120 or 150 kg N / fed. led to a significant increase in grain yield and its components, protein percentage in grains and number of days to 50 % tasseling.Similar trend was shown by Badr *et al.* (2003); EL-Nagar (2003); Saleh and Nawar (2003); EL-Rewainy and Galal (2004); EL-Sayed (2006); Ibrahim and Hala (2007); Ahmed (2009); Mansour (2009) and Mansour and abdEL-Maksoud (2009). Using new improved maize hybrids in order to increase the Egyptian maize productivity requires determination of the most appropriate irrigation interval and level of nitrogen fertilizer. Evidently, some workers recorded significant cultivar differences in yield and its components, among them EL-Aref *et al.* (2004); Ahmed and Mekki (2005); Seif *et al.* (2005); Osman (2006) Ahmed (2009) and Mansour and abdEL-Maksoud (2009).

Therefore, the aim of this study was to investigate the effect of three irrigation intervals and three nitrogen levels on yield and its components, as well as

grains quality of two maize hybrids.

Materials and Methods

Two field experiments were carried out at the Agricultural Experimental Station Faculty of Agriculture, Assiut University., Egypt, during the two successive growing seasons of 2008 and 2009 to study the effect of different irrigation intervals and nitrogen fertilizer rates on yield, yield components and quality of two maize hybrids.

A. Irrigation intervals:

I_1-Irrigation every 15 days (No. of irrigations7). I_2-Irrigation every 25 days (No.of irrigations 4). I_3 -Irrigation every 35 days (No. of irrigations 3).

Irrigation interval treatments were practiced after the planting irrigation.

B. Maize hybrids:

H_1-Single cross Watania 4.

H_2-Three way cross 310.

The two hybrids of maize were obtained from Agriculture Research Center, Ministry of Agriculture and Land reclamation.

C. Nitrogen fertilizer rates:

N_1- 40 kg N / feddan. N_2- 80 kg N / feddan.N_3- 120 kg N / feddan Nitrogen fertilizer rates were applied before the first irrigation in one dose in the form of ammonium nitrate (33.5% N).

Physical and chemical analysis of the experimental soil according to Klute (1986) is shown in Table (1).Also, meteorological data of the two growing seasons (2008 and 2009) at Assiut condition Table (2).

The experiments were established in randomized complete block design with split plot distribution, combined over irrigation using four replication. The main plots were devoted the two maize hybrids, while the sub plots were included by N fertilizer rates. The experimental plot area was 10.5 m^2 (3 x 3.5 m) consisting of 5 ridges each of 70 cm. width and 3m length 30 cm was between hills of the rate 15 kg/fed. Before planting all plots received 100 kg super phosphates/fed (15.5 % P_2O_5).In addition100 kg potassium sulphat/fed. (48 % K_2O) was added before the first irrigation for all plots.

Table(1):Physical and chemical properties of experimental sites.

Properties	2008	2009
Mechanical analysis:		
Sand %	26.20	26.60
Silt %	24.20	23.00
Clay %	49.60	50.40
Soil type	Clay	Clay
Chemical analysis:		
PH	7.73	7.80
Organic matter%	1.74	1.62
Total Nitrogen %	0.08	0.07
Total CaCo3%	1.17	1.20

Sowing date was on 4th and 2nd June, 2008 and 2009 seasons, respectively. Maize plants were thinned to secure one healthy plant/hill prior before the first irrigation, which gave a population of 20.000 plants/ fed. The plots were hand hoed once for controlling weeds before first irrigation. Irrigation intervals treatments were practiced from the first irrigation. All recommended cultural operations were carried out as usual in both seasons.

The studied characters:

At harvest time after 120 days from planting, the inner three rows were taken from each sub-plot in which grain yield was determined on the basis of 15.5 % moisture. Also, five guarded plants were taken randomly and labeled to study growth measurements at 80 days from planting in both seasons.

Data recorded:

1- Tasseling date: number of days from planting to 50 % tasseling appearance on sub-plot basis.
2- Ear length (cm).
3- Grain weight / ear (g).
4- 100-grain weight (g).
5-Grain yield (ardab/ fed).
6- Protein percentage in grains. It was determined using the technique of micro-kjeldahle apparatus according to A.O.A.C. (1990).

All obtained data for the experiment of each season were subjected to the statistical analysis of two factors in Randomized Complete Block Design in Split Plot arrangement, then combined analysis over irrigation treatments was done. Statistical analysis of the collected data was carried out using the computer program Mstat-C. L.S.D.test at 0.05% and 0.01 % level was used to compare between treatment combinations means according to Gomez and Gomez (1984).

Table (2): Average maximum (Max) and minimum (Min) of monthly temperature and relative humidity, at the experimental farm during the two growing seasons*.

Season	Day	2008				2009			
		Temperature		Relative humidity %		Temperature		Relative humidity %	
month		Max	Min	Max	Min	Max	Min	Max	Min
June	1-10	41.1	23.4	47.9	13.3	40.6	22.2	46.3	13.8
	11-20	38.9	22.2	54.0	16.4	38.7	22.5	53.8	17.8
	21-30	40.4	23.0	47.5	14.7	41.9	23.9	51.0	13.4
	Average	40.1	22.9	49.8	14.8	40.4	22.9	50.4	15.0
July	1-10	39.2	23.9	59.4	20.0	40.2	25.0	61.5	25.9
	11-20	38.7	24.2	58.9	20.7	39.7	25.0	68.4	26.9
	21-31	37.9	22.5	63.7	24.5	40.0	23.8	68.3	26.7
	Average	38.6	23.5	60.7	21.7	39.9	24.6	66.1	26.5
August	1-10	38.8	22.4	60.1	23.2	38.6	22.8	61.5	25.9
	11-20	38.8	22.6	64.3	24.5	36.7	22.7	68.4	26.9
	21-31	39.4	23.1	60.5	28.1	37.5	21.9	68.3	26.7
	Average	39.0	22.7	61.6	25.3	37.6	22.5	66.1	26.5
September	1-10	36.6	22.5	69.8	31.4	36.5	20.9	70.4	29.4
	11-20	37.9	21.0	62.7	24.9	37.0	22.0	64.4	26.5
	21-30	37.6	21.1	63.7	23.9	36.7	20.5	66.0	24.8
	Average	37.4	21.5	65.4	26.7	36.7	21.1	67.0	27.0
October	1-10	37.0	20.6	62.3	20.8	31.5	16.7	67.7	28.6
	11-20	31.2	16.6	70.7	29.0	32.7	17.6	61.6	22.9
	21-31	28.9	14.7	75.0	32.9	33.4	17.8	67.5	28.8
	Average	32.3	17.3	69.3	27.6	32.5	17.4	65.7	26.8

*Source: Station of Agriculture Meteorology, Assiut University, Assiut

Results and Discussion

The combined analysis of variance for irrigation intervals presented in (Table 3) indicated that number of days to 50 % tasseling, ear length, grains weight/ear, 100-grain weight, grain yield /fed. and protein percentage in grains was significantly affected by irrigation intervals and nitrogen fertilizer rates. Furthermore, maize hybrids significantly differed for the studied characters in the second season only, except number of days to 50 % tasseling and protein percentage were insignificant in both seasons, all interactions were insignificant except the interactions between irrigation intervals and N levels were significant for grains weight/ear and 100-grain weight in the second season, also grain yield/fed in the first season, but protein percentage in grains for the two season.

1- Number of days to 50 % tasseling:

Table (4) revealed that increasing irrigation intervals from 15 or 25 to 35 days significantly increased number of days to 50 % tasseling in both seasons. The irrigation every 15 days decreased number of days to 50 % tasseling. These results are in agreement with EL-Sayed (1998); El-murshedy (2002) and Ibrahem (2002), who reported that water stress during flowering stage or increasing irrigation intervals delayed tasselling dates in the second season only. Nitrogen fertilizer significantly affected number of days to 50 % tasseling, N3 (120 kgN/ fed) delayed tasselling dates in two seasons. It could be attributed to the physiological role of nitrogen in plants, as well as nitrogen increased the period of vegetative growth. These results confirmed with those detected by Shafshak *et al.* (1994). Hybrids of maize were insignificantly different for number of days to 50 % tasseling in both seasons. Similar findings were reported by Osman (2006).These results may be attributed to genetic characters, such as Soliman, Mona (2002).

All interactions were insignificant except (HxN) interaction in the first season only. The H_1 (single cross Watania 4) x N_1 (40 kg N/fed) gave the early maize plants for 50 % tasseling.

2- Ear length (cm):

Result in Table (5) showed that ear length was significantly affected by irrigation intervals, as well as nitrogen fertilizer in the two seasons, but hybrids were significantly affected in the second season only.

Irrigation every 15 days gave the highest of ear length. These results are in agreement with those obtained by Ibrahem (2002); Soliman, Mona (2002); EL-Nagar (2003); EL-Gizawy (2005); and Ibrahim and Hala (2007),who reported that increasing irrigation intervals up to 35 days decreased ear length. It is may be attributed to the physiological role of water in plants. N_3 (120 kg N/fed.) gave the highest ear length.

Table (3): Mean squares of irrigation intervals, maize hybrids and nitrogen levels on number of days to 50 % tasseling, ear length (cm), grains weight /ear (gm),100-grain weight (gm),grain yield (ardab/fed) and protein percentage in grains in 2008 , 2009 seasons.

		Mean squares											
		Number of days to 50 % tasseling		Ear length (cm)		Grains weight ear (g)		100-grain weight (g)		grain yield (ardab/fed)		Protein percentage in grains	
S.O.V	df	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009	2008	2009
Irrigation (I)	2	1223.181**	872.542**	40.911**	107.221**	52598.722**	62857.764**	496.208**	276.931**	1053.066**	1345.160**	7.202**	23.994**
Rep. / I	9	39.954	32.218	2.099	3.809	460.778	1609.958	12.922	5.509	26.639	74.321	0.125	0.745
Hybrids (H)	1	84.500	48.347	15.680	15.494**	138.889	2556.125**	23.256	9.389*	1.150	52.925*	0.044	0.034
I×H	2	4.625	18.514	3.952	0.367	37.722	81.542	17.469	0.681	7.151	3.526	0.087	0.229
Error(a)	9	16.769	27.644	3.566	0.501	201.815	52.921	11.617	1.435	19.107	6.766	0.250	0.545
Nitrogen (N)	2	46.764**	65.375**	39.549**	49.467**	9826.722**	8645.056**	44.584**	46.931**	60.406**	167.167**	1.575**	3.581**
I×N	4	1.368	8.417	1.671	1.132	350.389	666.910**	3.498	4.618*	3.205*	4.541	0.149**	0.277*
H×N	2	2.542*	3.431	0.027	0.457	184.722	32.167	2.772	1.931	1.358	2.415	0.021	0.020
I× H×N	4	4.104	3.222	0.496	0.081	117.556	148.271	4.456	0.410	1.170	0.176	0.085	0.018
Error(b)	36	1.931	4.792	0.964	1.058	157.963	64.079	2.489	1.264	1.095	2.507	0.038	0.108

Table (4): Means number of days to 50 % tasseling of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 seasons.

Years		2008				2009			
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	60.500	61.500	62.000	61.333	61.250	61.500	63.250	62.000
	H 2	61.000	64.000	65.000	63.333	63.500	65.000	66.250	64.917
Mean		60.750	62.750	63.500	62.333	62.375	63.250	64.750	63.458
I_2	H 1	64.500	64.750	66.250	65.167	65.250	66.750	71.250	67.750
	H 2	66.250	66.250	67.250	66.583	66.750	67.000	68.750	67.500
Mean		65.375	65.500	66.750	65.875	66.000	66.875	70.000	67.625
I_3	H 1	71.500	71.750	72.250	71.833	73.000	75.500	76.500	75.000
	H 2	72.750	74.500	76.250	74.500	73.000	76.250	77.250	75.500
Mean		72.125	73.125	74.250	73.167	73.000	75.875	76.875	75.250
Mean over all I	H 1	65.500	66.000	66.833	66.111	66.500	67.917	70.333	68.250
	H 2	66.667	68.250	69.500	68.139	67.750	69.417	70.750	69.306
Mean of N		66.083	67.125	68.167	67.125	67.125	68.667	70.542	68.778

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	4.193	6.030	3.263	4.692
Hybrids (H)	N.S.	N.S.	N.S.	N.S.
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	0.622	0.833	1.187	1.590
I x N	N.S.	N.S.	N.S.	N.S.
H X N	0.879	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

Table (5):Means of ear length (cm) of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 season.

Years		2008			2009				
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	18.600	19.900	20.500	19.667	22.250	23.450	24.750	23.483
	H 2	20.000	20.400	21.650	20.683	21.800	22.400	24.100	22.767
Mean		19.300	20.150	21.075	20.175	22.025	22.925	24.425	23.125
I_2	H 1	18.600	19.650	20.600	19.617	20.400	21.450	22.850	21.567
	H 2	18.100	20.100	20.900	19.700	19.500	20.250	22.350	20.700
Mean		18.350	19.875	20.750	19.658	19.950	20.850	22.600	21.133
I_3	H 1	14.850	17.200	18.500	16.850	17.700	19.800	21.000	19.500
	H 2	16.750	18.850	20.050	18.550	16.350	18.400	20.150	18.300
Mean		15.800	18.025	19.275	17.700	17.025	19.100	20.575	18.900
Mean over all I	H 1	17.350	18.917	19.867	18.711	20.117	21.567	22.867	21.517
	H 2	18.283	19.783	20.867	19.644	19.217	20.350	22.200	20.589
Mean of N		17.817	19.350	20.367	19.178	19.667	20.958	22.533	21.053

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	0.945	1.359	1.273	1.831
Hybrids (H)	N.S.	N.S.	0.377	0.542
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	0.575	0.771	0.603	0.807
I x N	N.S.	N.S.	N.S.	N.S.
H X N	N.S.	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

These results confirmed with those detected by Badr *et al.* (2003); EL-Nagar (2003); EL-Rewainy and Galal (2004); Nofal *et al.* (2005) and EL-Sayed (2006) who found that increasing nitrogen fertilizer increased ear length. It is could be attributed to the physiological effect of nitrogen on growth which in turn increased ear length. The hybrid 1 (single cross Watania 4) was higher for ear length in the second season only. Similar information were reported by others EL-Aref *et al.* (2004); Ahmed and Mekki (2005): Seif *et al.* (2005); Osman (2006) and Ahmed (2009).

3- Grains weight / ear (g):

Results presented in Table (6) revealed that grains weight/ear was significantly affected by irrigation intervals, as well as nitrogen fertilizer in the two seasons, but hybrids were significantly affected in the second season only. Irrigation every 15 days gave the highest of grains weight/ear. The results are in accordance with those obtained by Ibrahem (2002); Soliman, Mona (2002) and Abdo (2007) who indicated that increasing irrigation intervals were decreased grains weight/ear. These results may be attributed to the effect of soil moisture deficit during heading stage on flowering, pollination and fertilization. N_3 (120 kg N/fed) gave the maximum grains weight / ear. Similar results were obtained by Saleh and Nawar (2003); Attia *et al.* (2008) and Leilah *et al.* (2009).who found that increasing nitrogen fertilizer increased grains weight/ear. The hybrid 1 (single cross Watania 4) gave highest grains weight/ear than three way cross 310 in the second season only. All interactions were insignificant for grains weight/ear except (IxN) interaction in the second season. The I_1 (irrigation every 15 days) x N_3 (120 kg N/fed) gave the maximum grains weight/ear.

4- 100-grain weight (g):

Data in Table (7) reported that irrigation intervals significantly affected 100-grain weight, the highest value was obtained at irrigation every 15 days in both seasons. Such findings may be attributed to the effect of prolonged irrigation intervals, which decreased the available soil moisture in the root zone during the gowning season and this in turn reduced plant growth, dry matter accumulation, translocation of metabolites and nutrients to grain during grain filling stage. These results are consistent with those reported by Ibrahem (2002); Soliman, Mona (2002); EL-Nagar (2003); EL-Gizawy (2005); and Abdo (2007).Hybrids of maize were significant in the second season only. H_1 (single cross Watania 4) gave the highest value of 100-grain weight. These results are in agreement with those reported by EL-Aref *et al.* (2004); Ahmed and Mekki (2005); Seif *et al.* (2005);

Table (6): Means of grains weight/ear (g) of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 seasons.

Years		2008				2009			
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	146.500	162.000	188.000	165.500	211.500	220.000	249.500	227.000
	H 2	139.000	161.000	197.000	165.667	206.500	214.000	227.750	216.083
Mean		142.750	161.500	192.500	165.583	209.000	217.000	238.625	221.542
I_2	H 1	136.000	147.000	170.000	151.000	176.500	190.500	195.500	187.500
	H 2	128.000	157.000	183.500	156.167	158.250	183.500	194.250	178.667
Mean		132.000	152.000	176.750	153.583	167.375	187.000	194.875	183.083
I_3	H 1	62.000	79.500	91.500	77.667	98.500	131.250	154.750	128.167
	H 2	67.500	83.000	91.500	80.667	81.500	116.500	138.500	112.167
Mean		64.750	81.250	91.500	79.167	90.000	123.875	146.625	120.167
Mean over all I	H 1	114.833	129.500	149.833	131.389	162.167	180.583	199.917	180.889
	H 2	111.500	133.667	157.333	134.167	148.750	171.333	186.833	168.972
Mean of N		113.167	131.583	153.583	132.778	155.458	175.958	193.375	174.931

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	14.004	20.139	26.177	37.644
Hybrids (H)	N.S.	N.S.	3.875	5.573
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	7.365	9.869	4.691	6.285
I x N	N.S.	N.S.	8.125	10.887
H X N	N.S.	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

Table (7): Means 100-grain weight (g) of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 seasons.

Years		2008				2009			
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	40.558	42.852	43.163	42.191	48.500	50.000	51.250	49.917
	H 2	43.760	44.257	46.483	44.833	46.500	50.000	50.000	48.833
Mean		42.159	43.555	44.823	43.512	47.500	50.000	50.625	49.375
I_2	H 1	39.440	39.597	39.948	39.662	45.000	45.500	46.500	45.667
	H 2	37.795	38.408	40.632	38.945	44.000	45.500	45.500	45.000
Mean		38.618	39.003	40.290	39.303	44.500	45.500	46.000	45.333
I_3	H 1	30.485	34.552	36.015	33.684	41.250	42.250	45.000	42.833
	H 2	33.965	35.460	36.080	35.168	40.750	42.000	44.500	42.417
Mean		32.225	35.006	36.048	34.426	41.000	42.125	44.750	42.625
Mean over all I	H 1	36.828	39.001	39.708	38.512	44.917	45.917	47.583	46.139
	H 2	38.507	39.375	41.065	39.649	43.750	45.833	46.667	45.417
Mean of N		37.667	39.188	40.387	40.387	39.081	44.333	45.875	47.125

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	2.345	3.373	1.531	2.202
Hybrids (H)	N.S.	N.S.	0.638	N.S.
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	0.924	1.239	0.659	0.883
I x N	N.S.	N.S.	1.141	N.S.
H X N	N.S.	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

Osman (2006) and Ahmed (2009) and Mansour and AbdEL-Maksoud (2009).Nitrogen fertilizer had significant effect on 100-grain weight in the two seasons. N_3 (120 kg N/fed) gave the maximum value. This may be attribute to the physiological role of nitrogen in plants growth (i.e. photosynthetic, accumulation of dry matter in grains). These results are in agreement with those obtained by Badr *et al.* (2003); EL-Nagar (2003); EL-Sayed (2006); Attia *et al.* (2008) and Ahmed (2009) and Leilah *et al.* (2009).

All interactions were not significant except (IxN) interaction in the second season only. High value of 100-grain weight was obtained at I_1 (irrigation every 15 days) x N_3 (120 kg N/fed). The results are in agreement with those revealed by EL-Nagar (2003); EL-Sayed (2006) and Ibrahim and Hala (2007).

5-Grain yield (ardab / fed):

Mean squares in Table (3) indicated highly significant differences was found between irrigation intervals as well as nitrogen fertilizer rates on grain yield (ardab/fed) in both seasons. while maize hybrids had a significant effect in the second season only. The interaction between irrigation intervals and nitrogen fertilizer was significant on grain yield (ardab/fed) in the first season only. Results in Table (8) and fig.1 indicated that mean grain yield (ardab/fed) was affected by irrigation intervals in both seasons. Increasing irrigation intervals up to 35 days were decreased significantly grain yield than 25 and 15 days by 8.14, 13.12 and 7.60, 14.97 (ardab/fed) for 2008 and 2009, respectively. Meanwhile, the highest grain yield was obtained at irrigation every 15 days; 17.20 and 23.76 ardab/fed. for the 2008 and 2009 seasons, respectively. The reduction in growth and yield components (ear length, grains weight/ear and 100-grain weight) decreased grain yield by irrigation every 25 and 35 days. This may be attributed to the unbalanced soil water-air under these conditions, which led to reduction all photosynthetic pigments and photosynthesis activity as well as the adverse relations between hormones and biological processes in the whole plant organs. Similar results were obtained by Ibrahem (2002); Soliman, Mona (2002); Wajid *et al.* (2004), EL-Gizawy (2005); and Abdo (2007) and Ibrahim and Hala (2007).

Results presented in Table (8) and fig. 2 showed that increasing nitrogen fertilizer rates, significantly increased grain yield ardab/fed. in both seasons These increases in the second season were more pronounced than those obtained in the first season. The highest yields in 2008 and 2009 seasons were obtained by using 120 kg N/fed.; 12.75 and 19.03 ardab/fed., respectively. These results may be due to the increase photosynthetic surface, which in turn resulted in an

Table (8): Means grain yield (ardab/fed) of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 seasons.

Years		2008				2009			
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	15.630	18.205	19.570	17.802	22.372	22.938	27.505	24.272
	H 2	14.273	16.352	19.163	16.596	21.492	22.565	25.670	23.242
Mean		14.951	17.279	19.366	17.199	21.932	22.751	26.587	23.757
I_2	H 1	10.860	11.287	13.085	11.744	14.515	17.725	20.730	17.657
	H 2	10.477	12.920	14.650	12.682	11.703	15.722	17.917	15.114
Mean		10.669	12.104	13.867	12.213	13.109	16.724	19.324	16.385
I_3	H 1	3.362	4.313	5.290	4.322	6.938	9.375	12.400	9.571
	H 2	2.885	3.840	4.767	3.831	5.553	8.475	9.967	7.998
Mean		3.124	4.076	5.029	4.076	6.245	8.925	11.184	8.785
Mean over all I	H 1	9.951	11.268	12.648	11.289	14.608	16.679	20.212	17.166
	H 2	9.212	11.038	12.860	11.036	12.916	15.587	17.852	15.452
Mean of N		9.581	11.153	12.754	11.163	13.762	16.133	19.032	16.309

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	3.369	4.844	5.624	8.088
Hybrids (H)	N.S.	N.S.	1.386	N.S.
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	0.613	0.822	0.928	1.243
I x N	1.062	N.S.	N.S.	N.S.
H X N	N.S.	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

Fig.1: Effect of irrigation intervals on grain yield (ardab / feddan) of two maize hybrids in two years 2008 and 2009.

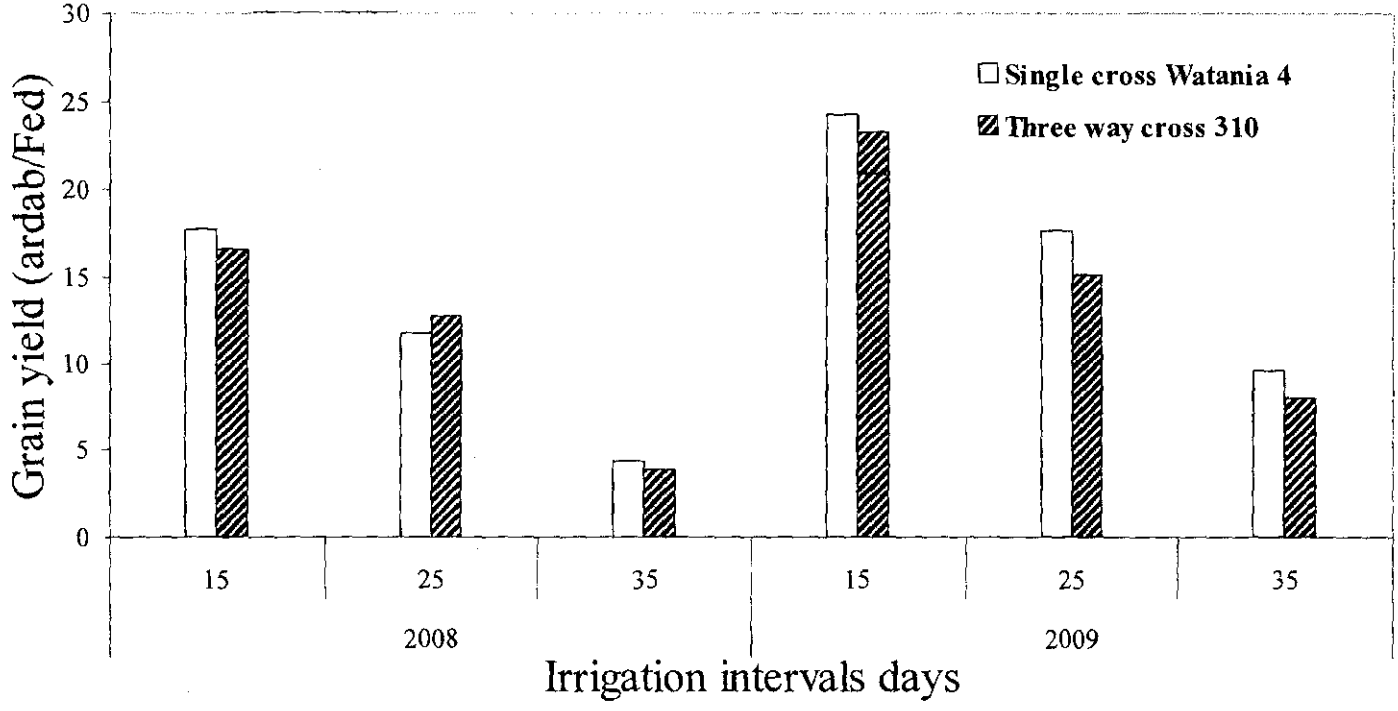
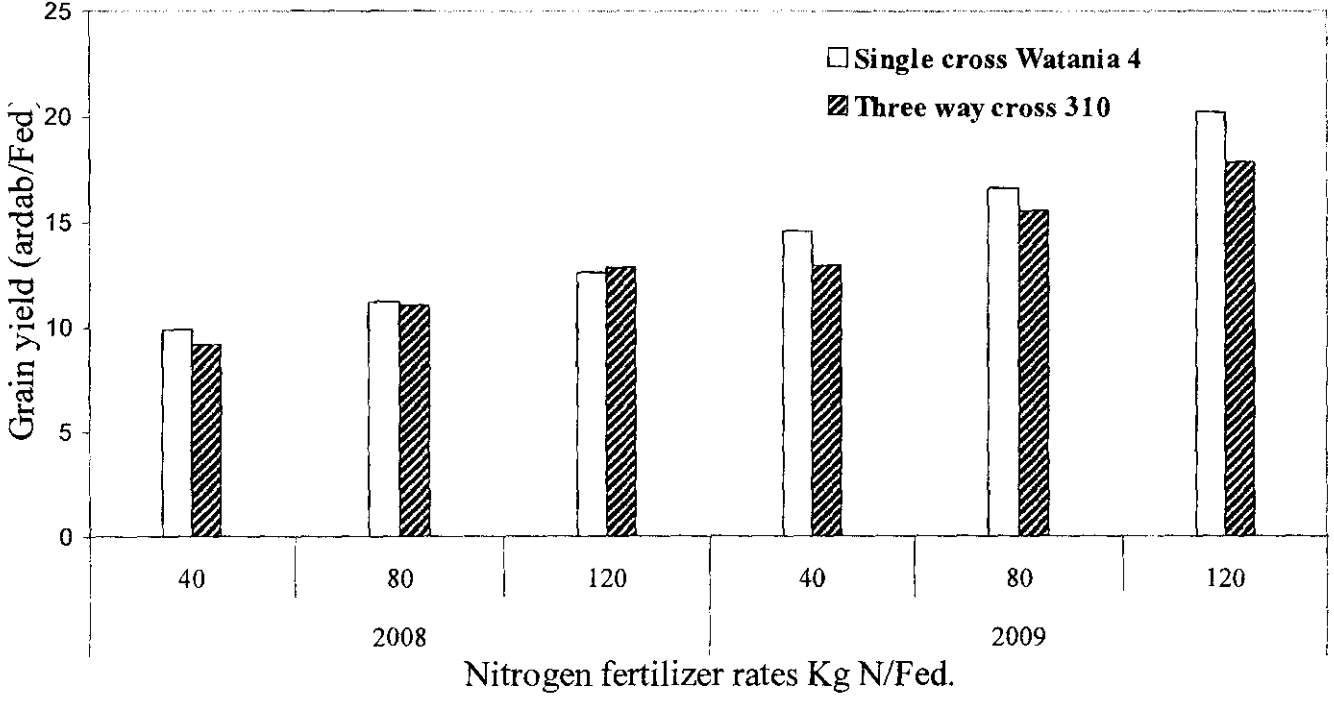


Fig. 2: Effect of nitrogen fertilizer rates on grain yield (ardab / feddan) of two maize hybrids in two years 2008 and 2009.



increase in metabolic processes and building more grain yield. These results confirm with those by Mengel and kirkby (1982); Badr *et al.* (2003); EL-Nagar (2003); Saleh and Nawar (2003); EL-Rewainy and Galal (2004); Nofal *et al.* (2005); EL-Sayed (2006); Ibrahim and Hala (2007); Attia *et al.* (2008); Ahmed (2009); ALJobouri and Arowl (2009) and Leilah *et al.* (2009).

Data in Table (8) showed that the two maize hybrids differed significantly for grain yield (ardab/fed) in the second season only at 5% probability level. Single cross Watania 4 (H_1) surpassed three way cross 310 (H_2) in grain yield by 0.25 and 1.71 ardab/fed. in 2008 and 2009 seasons, respectively. Grain yield of maize hybrids was highest in the second season than in first one. These results may be due to high temperature and low relative humidity % in the first season than the second one as shown in (Table2).These results were similar with those found by Ibrahem (2002); EL-Aref *et al.* (2004); Ahmed and Mekki (2005); Seif *et al.* (2005); Osman (2006) Ahmed (2009) and Mansour and abdEL-Maksoud (2009).

All interactions were insignificant except the interaction between irrigation intervals and N fertilizer rates which was significant effect for grain yield (ardab/fed) in the first year only. Table (8) also showed that the highest grain yield (ardab / fed) was recorded with irrigation interval every 15 days and by application 120 kg N/fed.;19.37 and 26.59(ardab/fed) for the first and the second year, respectively. Also, the lowest grain yield (ardab/fed) was found by irrigation interval every 35 days and used 40 kg N/fed.;3.12 and 6.25(ardab/fed) for 2008 and 2009 years, respectively. The results are in agreement with those revealed by EL-Nagar (2003); EL-Sayed (2006) and Ibrahim and Hala (2007).

6-Protein percentage in grains:

Results in Table (9) indicated that protein percentage in grains was significantly affected by irrigation intervals and nitrogen fertilizers in both seasons.Differences between the two hybrids were insignificant in both seasons. The highest value of protein percentage in grains was obtained at irrigation every 15 days. These results are in agreement with those reported by EL-Nagar (2003) and Ibrahim and Hala (2007). N_3 (120 kg N/fed) gave the high value of protein percentage in grains. These results are obtained with those reported by EL-Nagar (2003); Saleh and Nawar (2003); EL-Rewainy and Galal (2004) and EL-Sayed (2006).

All interactions were insignificant except I_1 (irrigation every 15 days) x N_3 (120 kg N/fed). in both seasons. Similar results were findings by EL-Nagar (2003) and Ibrahim and Hala (2007).

Conclusion

The highest maize grain yield per feddan under the condition Assiut governorate could be obtained by irrigation every 15 days and application of 120 kg N/feddan when Single cross Watania 4 was planted.

Table (9): Means protein percentage in grains of maize hybrids as affected by irrigation intervals and nitrogen levels in 2008 and 2009 seasons.

Years		2008				2009			
Treatment		N1	N2	N3	Mean	N1	N2	N3	Mean
I_1	H 1	10.697	10.865	11.162	10.908	10.858	11.387	11.800	11.348
	H 2	10.820	10.957	11.315	11.031	10.872	11.215	11.497	11.195
Mean		10.759	10.911	11.239	10.970	10.865	11.301	11.649	11.272
I_2	H 1	10.250	10.398	10.705	10.451	10.003	10.250	10.433	10.228
	H 2	10.473	10.553	10.673	10.566	10.205	10.523	10.670	10.466
Mean		10.361	10.475	10.689	10.508	10.104	10.386	10.551	10.347
I_3	H 1	9.648	10.013	10.110	9.923	8.588	9.537	9.628	9.251
	H 2	9.245	10.018	10.238	9.833	8.675	9.565	9.650	9.297
Mean		9.446	10.015	10.174	9.878	8.631	9.551	9.639	9.274
Mean over all I	H 1	10.198	10.425	10.659	10.428	9.816	10.392	10.620	10.276
	H 2	10.179	10.509	10.742	10.477	9.918	10.434	10.606	10.319
Mean of N		10.189	10.467	10.700	10.452	9.867	10.413	10.613	10.298

L.S.D	2008		2009	
	(0.05)	(0.01)	(0.05)	(0.01)
Irrigation(I)	0.231	0.332	0.563	0.810
Hybrids (H)	N.S.	N.S.	N.S.	N.S.
I X H	N.S.	N.S.	N.S.	N.S.
Nitrogen (N)	0.114	0.152	0.193	0.258
I x N	0.197	0.264	0.334	N.S.
H X N	N.S.	N.S.	N.S.	N.S.
I X H X N	N.S.	N.S.	N.S.	N.S.

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تأثير الإجهاد المائي والتسميد النيتروجيني على المحصول ومكوناته والجودة لهجن الذره الشامية

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يعتبر الماء من أهم العوامل التي تعوق التوسع الزراعي أفقياً ورأسياً وزيادة انتاجية معظم المحاصيل الحقلية. كذلك نجد أن التسميد الأزوتي من العوامل الهامة التي تؤثر على النمو والانتاجية والجودة لمحاصيل الحقل النجيلية، لذلك أجريت هذه الدراسة على بعض هجن الذرة الشامية خلال موسمي 2008،2009 بمحطة التجارب الزراعية بكلية الزراعة – جامعة أسيوط –، لدراسة تأثير ثلاث فترات ري (15، 25، 35يوم) وثلاثة مستويات تسميد نيتروجيني (40،80،120 كجم ن/فدان) على الحاصل ومكونات المحصول والجودة لهجينين من الذره الشامية (هجين فردي وطنية 4 وهجين ثلاثي 310).

ويمكن تلخيص النتائج على النحو التالي:

1- تسبب الإجهاد المائي الناتج عن زيادة الفترة بين الريات إلى 35 يوما انخفاضا معنويا في حاصل الحبوب وغيره من الصفات المدروسة، وكذلك نسبة البروتين في الحبوب ولكن أدى ذلك الى زيادة عدد ألايام من الزراعة حتى طرد 50% من النورات المذكرة.

2- أدت زيادة التسميد النيتروجيني حتى 120 كجم ن/فدان زيادة معنوية في حاصل الحبوب ومكوناته ونسبة البروتين في الحبوب وعدد ألايام من الزراعة حتى طرد 50% من النورات المذكرة.

3- تفوق هجين فردي وطنية4 معنويا على الهجين الثلاثي 310 في طول الكوز، وزن حبوب الكوز، وزن المائة حبة ومحصول الحبوب/فدان .في الموسم الثاني فقط ، باستثناء عدد ألايام من الزراعة حتى طرد 50% من النورات المذكرة وكذلك نسبة البروتين لا يوجد فرق معنوي بين الصنفين في كلا الموسمين.

4- أعطى الري كل 15يوم مع التسميد النيتروجيني بمعدل 120 كجم أزوت/فدان أعلى حاصل حبوب للفدان عند زراعة الهجين الفردي وطنية 4 (27.51 أردب/فدان).