The Examination of the Effect of Irrigation Interval and Nitrogen Amount on the Yield and Yield Components of Maize (Zea mays L. CV. Single cross 704) in Mazandaran Provience

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Abstract

In order to evaluation the effect of irrigation interval and different amount of nitrogen fertilizer on agronomic characteristics of maize, single cross 704, the experiment was carried out as split plot in randomized complet blocks design with 3 replictions at 2009 in mazandaran provience. Irrigation interval was chosen as main plot at 4 levels which are 75, 100, 125 and 150mm evaporation pot of A class, nitrogen amount was also chosen as sub-plot at 3 replictions which are 0, 96 and 184 kg/ha at the rate of 0, 200 and 400 kg/ha urea fertilizer, respectively. The results showed that the grain yield in creased using of 184 kg/ha nitrogen fertilizer due to in creasing, ear length and thick, inceasing the graing and the row number per ear, and increasing the grain number per row of ear and the weight of 100 grains. The maximum grain tield was obtained by 75 and 125mm evaporation of class A pot, at the rate of 12490 and 13000 kg/ha, respectively. The graing yield components were not influenced by irrigation interval, statistically. Interaction between irrigation interval and nitrogen amount was significant on biological yield at the level of 1%, probability. The maximum grain yield was obtained by interaction of 125mm, evaporation of A class pot and using 184 kg/ha nitrogen fertilizer.

Keywords: Grain Maize, Irrigation Interval, Nitrogen amount, Grain Yield

1. Introduction

Maize with scientific name of (Zea mays L.) and English name of maize is one of the major sources of humon and animal food supply and industrial purposes considering 140 milion hectar global cultures, more than 600 milion ton production in year and 4296 kilogram yield in hectar (Anonymous, 2005; Nourmohammadi et al., 1997). This valuable product is in the third rank for its culture are after wheat an rice conside ring its short growth and having more yield than others with climate factors while the domestic consumption of grain corn is 3 milion maize, at the present we have around 2 milion ton maize from culture area of around 30000 hectar. Three is still problems reaching to self- sufficiency and having no need to external imports (Anonymous, 2005). One of the major measures in irrigation management is having accurate programming. In irrigation projects which are a part of water design, the calculation of farm crops irrigation interval is necessary. To estimate the appropriate irrigation interval, we have to estimate the water needed for farm crops, considering the water cost and irrigation systems management. One of the appropriate ways for cstimation of the farm crops water is straight- forward measuring with class A pan evaporation. In dry and semi- dry areas, water is the main confinement and dryness is one of the nost important factors of tension in farm crops. Such a tension has effect on product and often causes scourge (Sloan et al., 1990; Stanhill, 1986). Oktem et al., (2003) has done the irrigation interval in 2, 4, 6 and 8 days interval and set the needed water according to 70, 80, 90 and 100 percent evaporation of class a pan. They got the most and least wet weight of ear in irrigation treatments in 2 and 8 days intervals respectively. They also showed that the most efficiency of water was in four days interval treatment and water needed for 90 percent pan evaporation. Zhang et al., (2004) showed that the water tension causes the sever falling of grain yield, evaporation and perspiration. Emam and Ranjber (2000) examined the effect of low irrigation on the single cross hybrid grain corn features. The treatment of low irrigation in 3 areas inciuding normal irrigation (no stress), 75 (moderate stress) and 150 (high stress) percent crop water need and was based on the eraporation of class A pan. The results showed that the dry stress causes the implicit falling of axis height, ear height from soil area, the number of levels and the branch. Mosavat et al., (2002) could gain new ear hybrids with the help of moisture stress of 60% crop water need which decreases the grain yield noisture stress and its relevant features except for the area, the number of levels and the corncob percentage. Westgate (1994) mode reports about the sensitivity of the blooming and pollination stage in ear to the watwr lack. Yet the researchers indicated on enough water supply in culture growth and before pollination the shortage in culture growth stage has an empact on levels spread and axis development and severly decreases the material gathering in these organs. Nesmith and Ritchie (1992) as a result, in dry stress the generative growth is more dependant on the resources on axis and leat, so the grain deformation could be because of non- sufficienty of photosynthesis in pollination, grain molt and before that according (Zinselmeier et al., 1995). Osborn et al., (2002) the dry stress before blooming, during blooming and after blooming decreased the corn yield 50, 25 and 20 percent respectively compared to control crops. One of the most important factors, effecting on yield is nitrogen fertilizer. The efficiency of consumption is dependent on the soil moisture position, as in dryness reduces the crop nitrogen rare (Rossate et al., 2001). The high nitrogen values in this crop production reveals the non- suitabity of the use and the danger of nitrogen missing (Setter, 1990). The falling of nitrogen absorption in stress- based crops follows by the crop growth falling which influnces the crop will for nitrogen absorption (Xu et al., 2006). Girardin et al. (1987) beliere that beside water lack the needed nitrogen lack could hare more falling results on crop yield and growth. The change in araible nitrogen values, severly shakes the crop yield. The avaible nitrogen values is useful on photosynthesis distribution between generative and culture organs. Some of the phonological stages of culture postpones be cause of nitrogen lack. Norwood (2000) to experts, the irrigation and nitrogen non- management are major factors of crop yield falling. There are several reports on nitrogen positive effect on grain ear, grain weight and maize yield rising (Osborn et al., 2002). Osborn et al. (2002) in water lack of soil, which the materials absorption, specically nitrogen is influnced, it is necessary to make a balance between wanted nitrogen and the moisture availability in soil. When no sufficient water, the good condition management doesnot work and follows by the product resourcers specially water and nitrogen and decreases the water and nitrogen water consumption yield. Osborn et al. (2002) in sereral studies has reported the positive effect of nitrogen on grain rising in ear and in different hybrids. So considering the importance of the irrigation water amount and the nitrogen values, the present study is done for determing of wanted nitrogen and good irrigation interval in mazandaran.

2. Materlals

This study was done in Agricultural Research stand of biokola (Neca), the subset of Mazadaran natural resources and Agricultural Research Center in 2009. The mention stand is located in 36 and 41 second weidth, 53 and 36 second length and 4 meters height from sea level. The average falling and temperature in culture time is 610 mm and 18 centigrad respectively. To examine the physical and chemical feauers of soil, the table (1 and 2) showes the ssaples of these features. The experiment was done in split plot design and in accidental block based design. The irrigation treatment was applied as main plots including (75, 100, 125 and 150mm evaporation of class A pan. The side treatments was peroformed in 3 areas of nitrogen fertilizer including (0, 96 and 184 with equal appliance of 0, 200 and 400 kg nitrogen from urea sources.

The wanted water amount to gain the soil moisture up to farm capacity was measured by 2 inches bulky counter and was applied in treatments. To determine the irrigation exact time in each experiment, 48 hours affer irrigation time, from the root development farm soil, a sample case was done by agar, daily and non- stoppely to et the percentage of weight moister of soil. Affer getting to a percentage of soil moisture as appointed one for applying treatment, the volume of consuming water for each treatment was calculated by following relation (Alizade, 1995).

$$d = \frac{(Fc - \theta)}{100} \times D$$

d: The depth of irrigation water (mm)

FC: The moisture of farm capacity (percent)

θ: The soil moisture during sampling (percent)

D: The depth of crop root in growth stage (cm)

Therefore the volume of wanted water in each irrigation phase in each plot determined and based on the efficiency of 90 degree water destrihution, divided with the help of pump and counter. The tested farm mensuration was 20 in 50 m2 and dimension of 5 in 3/5 for eacd plot. Each tested unit included 5 furrows, 7 dools with 3.5 meter length and with 70 centimeter distance. 50% of wanted nitrogen of each treatment was consumed as the base and the other 50% was consumed as side dress in two stages of 6-8 leaves and 10-12 leaves, so that the seeds planted in 5 centimeter depth and with drying procedure. In order to sate germination and having perfect bushes, 2 seeds was allocted in each pile. But after greening up in 5 to 7 leaves stage, they sparsed to gain plant density. The fight with fucultutive weed was also done during growth stage manually. During attention stage, for following features, each plot was sampled accidentally:

(1). The ear length and diameter for based on centimenter and millimeter respectively and by measuring of 10 bushes.

(2). The number of rows and grains in each ear by counting 12 bushes in each plot.

(3). The weight of 100 grains with counting and distribution of 100 grains of 12% moisture.

(4). The grain yield and biology with bushes harvest from 2 middle rows of each plot with omission of side effects coming from 12% moisture.

(5). The harvest index was calculated by the rate of grain yield to biology.

The measured data was done by stastic software, MSTATC, analysis of variance and the comparison of averages with Danken multi-range test in probability level of 5% and the coordination with SPSS softwer.

3. Results and Discussion

3.1 Ear length

The results of analysis of variance showed that the ear langth was just affected by nitrogen in probability area of 1% statistically (table 3). So that the most ear length gained by 184 kg nitrogen in hectar and the least by no-nitrogen case which were 20.62 and 17.86 respectively. The ear length didn,t show a major difference, being affected by irrigation interval.

3.2 Ear thick

The ear thick showed the major discrepence probability level of 5% just being affected by nitrogen values (table 3). The most ear thick for fertilizer treatment with 184 kg nitrogen in hectar was (44.33mm) and was (43.04) and (43.48mm) for no-nitrogen treatment with 96kg nitrogen in hectar (table 4). Based on kim and Chung (1998) and Vipawen and Anthai (1995) indicated that with rising contest between grains for reciering food the tiny grains would be see on ear that decreases the ear thick.

3.3 Number of rows in ear

The results of analysis of variance showed that the number of rows in ear was just affected by nitrogen values in probability area of 1% statisitically (Table 3). So that the most rows with 184kg nitrogen in hectar was (14.35) rows and the least was (13.73) with no-nitrogen (Table 4).

3.4 Number of grains in each row

Between the changes resources, just nitrogen values in probability erea of 1% has major effect on the grain numbers in row (Table 3). The most number of grain in row for treatment of 184kg nitrogen was (39.73) grain and the least was (34.39) grains in treatment with no-nitrogen (Table 4). Mcpherson and Boyer (1977) and Hall et al., (1981) the main reason of grain number falling is the falling of ear thick as a result of dry stress. Alizade et al., (2007) reported that the effects of dry stress and diffirent values of nitrogen on rows number in each 1% probability area was meaning ful, but the effects of these 2 factors and their mutual effect on rows number in each ear was meaning ful.

3.5 Grain number per row of ear

The results of analysis of variance showed that the meaning ful discrepence revealed just by nitrogen values in 1% probability area (Table 3). The most and the least grain number in ear under nitrogen fertilizer values was (555.6 grain) for treatments of 184 kg nitrogen in hectar and it was (477.8 grain) in no-nitrogen condition. The consumptson of 96 kg nitrogen equaled with (522.1 grain) of ear in hectar (Table 4). Ghasemi pirbalouti (2002) reported that the availability of food elements specially nitrogen in critic perod of grain shaping one or two weeks before to 3 weeks after silk-given has on effect on grain number by crop speed rising and this positions made a strong coordination between grain number in ear in silk-given stage. Osborn et al., (2002) in severl studies, the positive effect of nitrogen consumption on grain number rising in ear has been reported. Schjoerring et al., (1995) indicated that the falling of grain numbers may come from the silk delay or miscarry because of hydro ear bates lack. The study showed that the main reason for falling of grain yield in dry stress treatments, were the falling of grain in ear and in ear weight, so that the moisture stress and nitrogen lack made the grain number and the grain weight decrease.

3.6 Weight of 100 grains

The 100 grain wight was just affected by nitrogen values of 1% probability erea, statistically (Table 1). The most and the least weight with 184kg nitrogen in hectar were (45.21 gr and with no-nitrogen we had 42.26gr). With 96kg nitrogen in hectar we had 43.85 (Table 4). Osborn et al.,(2002), Uhart and Anderade (1995) has had several studies showing the grain yield, grain number and grain wight rising as a result of more nitrogen.

3.7 Grain yield in hectar

The results of analysis of variance showed that the grain yield was affected by nitrogen values in 1% probability area and under irrigation interval in 5% probability area (Table 3). The most graining yield under irrigation interval were with tretments of 125mm evaporation from pan (13000 kg in hectar) and 75mm from pan 12490 kg in hectar (Figure 1), and the least were with 100mm eraporation from pan (11370 kg in hectar). The most grain yield with 184 kg nitrogen in hectar was 13570 and the least when no nitrogen was 10870 kg in hectar (Figure 2). Alavi et al., (2008) reporter that in irrigation treatment of 150mm eraporation (the most stress) we had 50mm evaporation (the least stress) compare to desirable irrigation treatment this made the average grain yield decrease to 26 percent. Liang et al., (1992) reporter that the most grain yield needs extra irrigation, extra fertilizer and overcoming with high hitting needs.

3.8 Biological yield in hectar

The biological yield showed the statisticall diference being affected by nitrogen values, mutual effect of irrigation interval and nitrogen values in 1% probanility area and under irrigation interval in 5% probability area ((Table 3). The most biological yield under irrigation interval with 75mm eraporation from pan was 32460 kg in hectar and the least with 150 evaporation from pan was 24930kg in hectar. Also the most and the least biological yield we had with 184kg nitrogen was 34810 and 22480 kg in hectar respectively (Table 4). The most biological yield being affected by mutual irrigation interval effects and nitrogen fertilizer for treatments with 75mm evaporation from pan and with 184kg nitrogen in hectar was 42950 kg and the least was 18670 with no-nitrogen and for treatment of 150mm evaporation from pan (Figure 3). Claasen and Shaw (1970) and Dwyer et al., (1992) showed in a study that both dry stess and different nitrogen values could has appositive effect on biological weight. They also indicated that the dry stress decreases the crop biological yield.

3.9 Harvest index

The results of analysis of variance showed that the harvest index was just affected by nitrogen values in 1% probability area (Table 1). The most and the least harvest index under treatments with no-nitrogen and with 184kg nitrogen in hectar were 51.31% and 42.25% respectively (Table 4). Alavi et al., (2007) indicated that harvest index of irrigation treatment of 50mm does not have any meaning ful discrepence with harvest index in treatment of 150mm eraporation. The treatment of 150mm, compared to grain yield, decrensed the biological yield more significantly. This leaded to harvest index rising irrigation interval falling had a very positive effect on grain yield and biological yield. The dry stress rising decreased the grain yield to 24%, the biological yield to 26% in treatment 50 and 150 respectively. In this condition, because of falling of biological yield in comparison with grain yield, we had the harvest index rising.

4. Correlation Coefficient

The correlation of yield with measured featuers showed that the yield has the most correlation with grain nuber in each row and the grain number in ear. So that their correlation coefficient is 0.90** and 0.87** respectively. We could say that these two parameters are the most use ful and important parts of yield organs which increase the grain yield. Also the correlation of harvest index with other parameters showed that it has negative correlation with other featuers (Table 5).

5. Conclusion

The results of this sudy showed that the most grain yield under irrigation interval got for treatments of 125 and 75mm evaporation from evaporation pan respectively. The most grain yield gained with 184 kg nitrogen in hectar that equals 400kg urea.

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Table 1. Soil chemical analysis

depth	ds/m Ec	pH	T.N.V	N %	O.M %	O.C %	Sand %	Silt %	Clay %	Class
0- 30	0.76	7.76	25	0.134	2.77	1.61	14	50	36	C-L

Table 2. Soil physical analysis

Depth of sampling (Cm)	The capacity of farm (%)	Permanent deficiency (%)	Facial special w eight (gr/cm3)
0- 30	28.7	14.1	1.31

Table 3. The analysis of performance variance and performance details of single cross(704) corn under the treatments of interval irrigation and the amounts of nitrogen

Change sources	df	Ear length (cm)	Ear thich (mm)	Numbe rof rows in ear	Number of grains in each row	Grain number per row of ear	Weight of 100 grains(gr)	Grain yield in hectar (kg/ gr)	Biological yield in hectar (kg/ gr)	Harvest index
Replication	2	0.978 ns	0.022 ns	0.277 ns	6.892 ns	481.310 ns	2.291 ns	311457.208 ns	48219144.444 ns	139.972 ns
Irrigation interval	3	2.402 ns	1.262 ns	0.039 ns	15.469 ns	2961.921 ns	6.498 ns	426528.911 *	113367555.556*	207.416
Error	6	1.006	3.239	0.236	5.191	1026.873	5.107	601763.435	18568344.444	58.766
Nitrogen amounts	2	** 22.920	9.221*	1.178 **	86.227 **	18297.428**	26.114 **	21833631.361**	456370036.111**	245.993**
A×B	6	0.825 ns	1.917 ns	0.185 ns	2.005 ns	168.802 ns	0.708 ns	677768.435 ns	26572925**	38.922 ns
Error	16	1.589	2.057	0.088	5.324	1061.511	1.299	153538	6243473.611	20.231
C.v		6.57 %	3.28 %	2.12 %	6.25 %	6.28 %	2.60 %	10.13 %	8.75 %	9.61 %

**and*: In the order of significance in the probability area of 1 and 5 percent.

Table 4. the comparison of the average farming features of single cross (704) corn under irrigation interval an amounts of nitrogen

Treatments	Ear length (cm)	Ear thich (mm)	Numbe rof rows in ear	Number of grains in each row	Grain number per row of ear	Weight of 100 grains(gr)	Grain yield in hectar (kg/ gr)	Biological yield in hectar (kg/ gr)	Harvest index
Irrigation interval I1 75mm	19.65 a	43.88 a	13.98 a	38.14 a	532.6 a	42.74 a	12490 a	32460 a	43.49 b
I2 100mm	18.64 a	43.19 a	14.01 a	35.22 b	493.7 a	43.71 a	11370 b	26270 bc	47.28 ab
I3 125mm	19.61 a	43.98 a	14 ab	37.74 ab	531.6 a	43.83 a	13000 a	30610 ab	43.03 b
I4 150mm	18.86 a	43.95 a	14.11 ab	36.61 ab	516.1 a	44.82 a	1290 ab	24930 c	53.41 a
Nitrogen amounts N0	17.6 c	43.04 b	13.73 c	34.39 c	477.8 c	42.26 c	10870 c	22480 c	51.31 a
N96	19.09 b	43.48 b	14.07 b	36.67 b	522.1 b	43.85 b	12280 b	28410 b	46.84 b
N184	20.62 a	44.73 a	14.35 a	39.73 a	555.6 a	45.21 a	13570 a	34810 a	42.25 c

*in every column and in every group of treatment averages with shared Latin letters there is no shared significant difference on the probability area of 5% based on Dunken ultiple-aspect test.

Table 5. The matrix of simple correlation quotation among different features

Treatments	*Grain yield in hectar (kg/gr)*	*Biological yield in hectar (kg/gr)*	*Harvest index*	*Ear length (cm)*	*Ear thich (mm)*	*Numbe rof rows in ear*	*Number of grains in each row*	*Grain number per row of ear*	*Weight of 100 grains (gr)*
Grain yield in hectar (kg/gr)	1								
Biological yield in hectar (kg/gr)	.634*	1							
Harvest index	-.287 ns	-.816**	1						
Ear length (cm)	.739**	.547**	-.262 ns	1					
Ear thich (mm)	.622**	.337 ns	-.021 ns	.517**	1				
Numbe rof rows in ear	.397*	.441**	-.198 ns	.241 ns	.338*	1			
Number of grains in each row	.900**	.650**	-.287 ns	.710**	.421*	.288	1		
Grain number per row of ear	.871**	.680**	-.302 ns	.662**	.497**	.484**	.922**	1	
Weight of 100 grains	.446**	.211 ns	-.034 ns	.324 ns	.365*	.524 ns	.349*	.455**	1

**and*in the order of meaningfulness in the probability area of 1 and 5 percent.

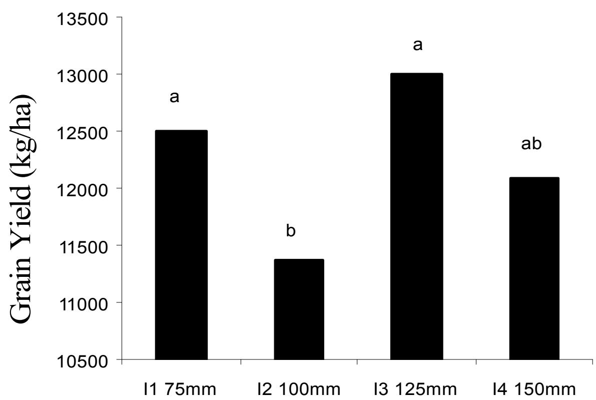

Figure 1. Effect irrigation interval on grain yield of maize

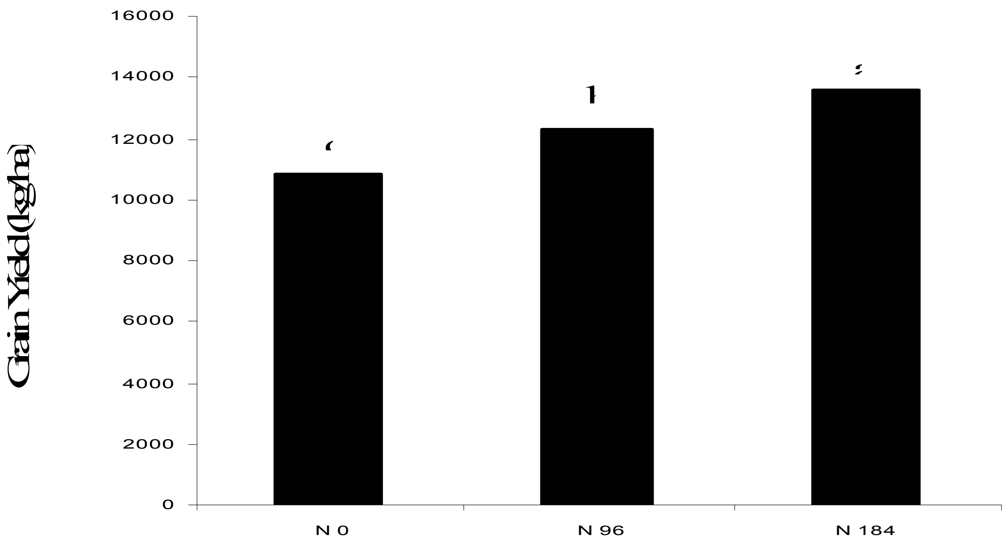

Figure 2. Effect nitrogen fertilizer on grain yield of maize

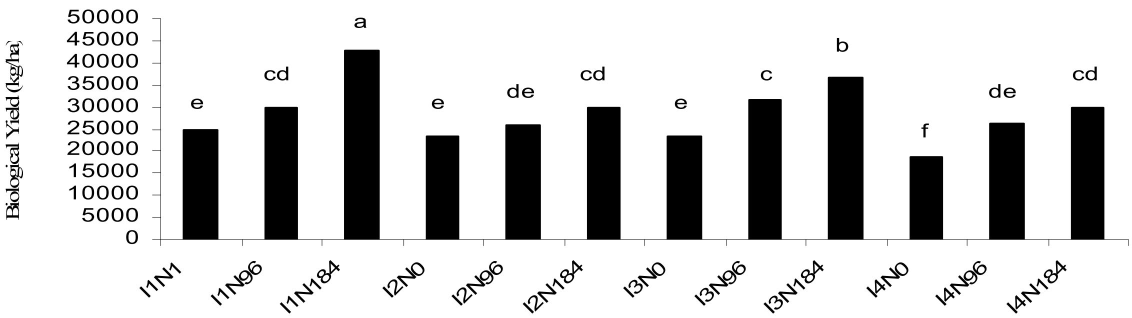

Figure 3. The mean comparisons of interaction effect of different irrigation interval and nitrogen levels on the biological yield of maize