DETERMINING IRRIGATION SCHEDULING AND DIFFERENT MANURE SOURCES OF YIELD AND NUTRITION CONTENT ON MAIZE (*ZEA MAYS* L.) CULTIVATION

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Abstract. The aim of this study was to determine the most suitable irrigation schedules and sources of manure for maize under Mardin ecological conditions. For this purpose, four sources of fertilizer and three irrigation schedules were applied in hybrid maize cultivar to find out their effects on the yield and yield factors in the years of 2014 and 2015. The study used a randomized complete block with split block design with 3 replications. In the study, significant differences were determined on traits at the level of 1% and 5%. The plant height, first cob height, cob length, number of seeds per cob, cob yield, 1000 seed weight, seed yield per unit, hectoliter, protein and oil ratio in seed, Mg, K, Fe, Ni, Cu, Zn, Mn, Na, Ca content of seeds were significantly influenced by irrigation schedules and sources of fertilizer for two years. The highest values were obtained from chicken manure with 9646 kg ha^{-1} in the first year and 11019 kg ha^{-1} in the second year, whereas the lowest values were obtained from control with 6363 and 6662 kg ha^{-1} for the first year and the second, respectively. But the difference between 180-80 kg N-P_2O_5-ha^{-1} and chicken manure was not statistically significant in the second year. According to the irrigation schedules, the grain yield ranged between 6386-10678 kg/ha in the first year and 7575-12133 kg ha^{-1} in the second year. The lowest grain yield per area was from the four-irrigation application, whereas the highest values were obtained from the six-irrigation application. The results of the study showed that grain yield and nutrient level of corn seeds increased, depending on irrigation time and number.
Keywords: *Zea mays, water application, organic and inorganic fertilizer, macro and micro element, yield*

Introduction

Maize is a widely cultivated grain cereal for food consumption on the global scale with 183 million hectares and 1.031 million tons of worldwide production. The area sown in Turkey is 6.390.000 hectares and it produces 5.900.000 tons. Average global yield per year is 563 kg ha^{-1}, 9230 kg ha^{-1} for Turkey (FAO, 2017). Maize is a major crop for both direct and indirect human consumption as it forms a major energy feed for livestock. It is a cheap source of raw material for various agricultural industries and extensively used for preparation of corn starch.

Appropriate development and growth of maize need favorable moisture in root zone. The amount of moisture in the soil decreases in time during dry seasons. Limited water supply during the growing season results in soil and plant water deficits, causing a decrease in maize yields (Gordon et al., 1995; Patel et al., 2006). Timing and supplemental irrigation is important in irrigation scheduling for the most effective use of available water in optimizing maize production. Water deficit affects timing of emergence, number of leaves per plant but delays tasseling initiation and silking,

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reduces plant height and vegetation growth of maize (Abrecht and Carberry, 1993; Singh et al., 2007).

The constant use of chemical fertilizers leads to hazards concerning health and environment (Pimentel et al., 1996). The importance of the use of organic manures under low input agricultural systems has been the subject of many studies. Majority of these studies aim at improving the quality and fertility of soil (DeJager et al., 2001; Palm et al., 2001). Manure can serve as a source of significant nutrient element which includes P and N (Gilley and Eghball, 2002). The application of manure to land give rise to similar results to those obtained when inorganic fertilizers are applied (Eghball and Power, 1999). The amount of organic matter in manure can significantly increase soil aggregation, structure and water holding capacity, infiltration, microbial activity, and can reduce erosion and soil compaction (Haynes and Naidu, 1998; Gilley and Risse, 2000). Poultry manure is relatively a cheap source of macro and micro nutrients (N, P, K, Ca, Mg, S, Cu, Fe, Mn, B). It has the potential to increase soil carbon and N content, soil porosity and enhance microbial activity. The hazards of chemical fertilizers, which occurred in heavy and unbalanced ways, led to the use of organic manures in intensively growing areas for sustainable production system. Therefore, in order to sustain the land and achieve potential crop production, careful use of organic manures has become important scientifically. It must be stressed that the importance of farm yard manure, vermicompost, chicken manure and green leaf manure in soil improvement depends on their nutrient content. It helps the improvement of soil structure and water holding capacity (Kale and Bano, 1986; Srivastava, 1998).

The aim of this research is to determine the effects of irrigation scheduling and different manure sources on yield and nutrition content in maize cultivation.

Materials and Methods

This trial was conducted to determine the most suitable irrigation schedules and sources of manure in a well-adapted maize (*Zea mays* L.) Farw. cultivar Limagrain Helen, in 2014 and 2015 in the fields of Kiziltepe Vocational High School of Mardin Artuklu University (longitude 40º57´59.01"E, latitude 37º07´34.74"N, and altitude 494.0 m) (*Figure 1*). Cultivar Limagrain Helen is intensively grown as a kind of grain maize in the region.

Figure 1. *The research was conducted in Kiziltepe/Mardin of Turkey*

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In 2014 and 2015, precipitation throughout the season was 158.6 mm and 133.6 mm respectively, and the average over the long-term for the same period was 111.1 mm (*Table 1*).

Table 1. *Meteorological data for the growing seasons of 2014, 2015 and long-term averages in Mardin, Turkey (TSMS, 2016)*

	Precipitation (mm)			**Average temperature (°C)**				**Relative humidity (%)**	
Months	**2014**	**2015**	**LTA***	**2014**	**2015**	**LTA***	**2014**	**2015**	**LTA***
June	1.4	2.9	4.1	25.9	25.9	25.7	22.5	29.0	32.3
July	1.0	0.2	1.1	30.4	31.6	29.9	20.0	19.6	27.7
August	7.0	0.4	0.5	31.3	30.5	29.6	17.1	25.8	28.4
September	10.8	9.9	1.9	24.3	28.4	25.1	31.2	23.0	32.6
October	42.8	58.2	32.6	18.1	19.5	18.4	47.2	49.6	45.1
November	95.6	62.0	70.9	10.2	11.7	10.9	53.1	50.3	57.0
Total	158.6	133.6	111.1						
Average				23.4	24.6	23.3	31.9	32.9	37.2

*LTA = Long-term average (1960-2015)

Average temperature was 23.54°C in 2014 and 24.6°C in 2015. There was an increase in average temperature when it is compared to long term average of 23.3°C. Average relative humidity was 31.9% in the first and 32.9% in the second vegetation periods (TSMS, 2016) and 37.2% for the long term. The soil, in which this study carried out, is classified as entisols according to soil taxonomy (Soil Survey Staff, 1999). The results of calcareous soil analysis are as follows: sandy loam texture, very low organic matter and moderate in available phosphorus (*Table 2*).

The experiment was laid out in a randomized complete block design (RCBD) with split-plot arrangement keeping the irrigation schedules in main plots and integrated manure sources in sub plots. The experiment was replicated three times. The net plot size was 5m x 2.8m.

Table 2. *Some properties of the <2 mm fraction of the top 30 cm of soil used for site*

Soil properties	**Site**
Texture	sandy loam
pH[A]	7.59
Clay (%)[B]	29.6
$CaCO_3$ (%)[C]	18.9
Olsen soil test P (ppm)[D]	57.8
Total Salt (%)[E]	0.059
Organic matter (%)[F]	1.59

[A]1:2.5 soil:water, [B]Bouyoucos (1951), [C]lime by calcimetric methods, [D]Olsen et al. (1954), [E]Richard (1954), [F]Jackson (1962)

The treatments were three irrigation schedules i.e. I1: four irrigations (1st at three leaf stage, 2nd at ninth-leaf stage, 3rd at tasseling stage, 4th at milking stage), I2: five irrigations (1st at fourth leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at milking stage, 5th at dough stage) and I3: six irrigations (1st at third leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at blister stage, 5th at milking stage, 6th at dough stage) and four manure (M0: control, M1: 180-80 kg N-P_2O_5- ha^{-1}, M2: Chicken manure 15 t ha^{-1} and M3: Farmyard manure 15 t ha^{-1}). Manure and irrigation were applied

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according to the treatments. All other agronomic practices were kept normal and uniform for all treatments. Observations on growth and yield parameters were recorded using standard procedures. All fertilization and irrigation applications were conducted as (Sharif et al., 2004; Hussaini et al., 2008; Rezvantalab et al., 2008). The concentrations of Zn, Fe, Mn and Cu in the digested solutions were determined by inductively coupled plasma atomic emission spectroscopy (ICP-AES, OPTIMA 3300 DV, Perkin-Elmer, USA). IPE556 grain and IPE883 straw (Wageningen University, The Netherlands) were used as reference materials (Hussaini et al., 2008).

Three different irrigation methods were applied in the research, and the irrigation was the same in the both seasons of 2015 and 2016. Details of irrigation applications are given below (*Table 3*).

Table 3. *Details of different irrigation application have been shown*

Years	1.st irrigation application		2nd irrigation application		3rd irrigation application	
2015* 2016	1st at three leaf stage	125 mm	1st at three leaf stage	125 mm	1st at three leaf stage	125 mm
	2nd at ninth-leaf stage	125 mm	2nd at ninth-leaf stage	125 mm	2nd at ninth-leaf stage	125 mm
	3rd at tasseling stage	125 mm	3rd at tasseling stage	125 mm	3rd at tasseling stage	125 mm
	4th at milking stage	125 mm	4th at milking stage	125 mm	4th at milking stage	125 mm
			5th at dough stage	125 mm	5th at dough stage	125 mm
					6th at dough stage	125 mm
Total	500 mm		625 mm		750 mm	

* Irrıgation was used the same for both (2015 and 2016) seasons

The sowing was made 5 cm depth, the eight seeds counted for per square meter and the separate of between two rows calculated 70 cm and between two plant on bed 20 cm. The first-year sowing was down on 15th of June 2014 with trial plantation and harvest was made on 5 November 2014. The second-year sowing was made on 13 June 2015; the harvest was made on 10 November 2015. On the other hand, chemical application and hoeing were made against weeds during the growing season in the trial plots. Any chemical drugs were not used during these two years, because there was no shown disease in the trials.

Observations and measurements in each plot were calculated by taking the mean of 10 randomly selected plants. Observations and measurements were obtained as suggested by Turgut (2003).

The effect of treatments (Irrigation schedules and sources of manure) on maize were analyzed using the analysis of variance procedures for a randomized complete block design with the SAS (1998) statistical package. When the F-value of the ANOVA was significant at the $P<0.05$ level of probability. The means related with nutrient content, yield and yield components in maize were evaluated with Duncan's Multiple Range Test statistical analysis.

Results

Regarding maize grown under different fertilizer and irrigation treatments, results in *Table 4* indicated that all the studied characteristics were significantly affected by irrigation treatments over the two growing seasons.

The highest plant height, according to the sources of manure, were obtained from M1 with 226.9 cm and 215.7 cm for 2014 and 2015, respectively. But the difference with

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M2 (chicken manure) was not statistically significant in both years. The lowest plant heights were obtained from control plots with 205.4 cm and 200.3 cm in 2014 and 2015, respectively. According to the irrigation schedules, the plant height ranged between 199.4 and 239.7 cm in the first year, and 190.5 and 239.9 cm in the second.

In terms of first cob height, the highest values were obtained from M1 with 89.7 cm and 91.8 cm for both years, whereas the lowest first cob height was obtained control plots (M0). On the other hand, the difference among M, M2 and M3 was found to be statistically insignificant in the first year. According to the irrigation schedules the first cob height ranged between 83.2 and 90.7 cm in 2014, and 80.2 and 90.4 cm in 2015. The lowest first cob heights were observed in the I1 application, whereas the highest values were obtained from the I3 application (*Table 4*).

Table 4. *Effect of irrigation schedules and sources of manure on yield and yield components of maize and Duncan groups (2014-2015)*

Characters	Years	Sources of manure				Irrigation schedules		
		M0	**M1**	**M2**	**M3**	**I1**	**I2**	**I3**
Plant height (cm)	2014	205.1 c	226.9 a	225.7 a	219.6 b	199.4 c	218.9 b	239.7 a
	2015	200.3 c	215.7 a	214.2 a	209.8 b	190.5 c	199. 5 b	239.9 a
First cob height (cm)	2014	83.4 b	89.7 a	88.9 a	88.3 a	83.2 c	87.7 b	90.7 a
	2015	84.9 c	91.8 a	87.9 bc	90.4 ab	80.2 b	85.7 a	90.4 a
Cob height (cm)	2014	17.7 d	19.1 c	20.9 a	20.3 b	17.2 c	19.3 b	22.1 a
	2015	18.1 c	19.5 b	21.3 a	19.9 b	17.8 c	18.8 b	22.6 a
No. of grains/cob (number)	2014	323.3 c	394.1 b	419.6 ab	431.3 a	289.3 c	347.6 b	546.1 a
	2015	375.3 c	390.2 c	468.7 a	448.1 b	371.7 c	399.8 b	490.2 a
Grain yield of cob (g)	2014	24.4 d	28.3 c	36.1 a	33.0 b	24.5 c	27.1 b	39.7 a
	2015	31.8 b	38.7 a	38.2 a	37.6 a	29.4 c	36.5 b	43.7 a
1000-seed weight (g)	2014	121.1 b	124.0 b	134.8 a	132.9 a	118.9 c	126.9 b	138.7 a
	2015	135.7 b	137.9 ab	143.7 ab	145.1 a	135.5 b	139.4 ab	148.9 a
Grain yield (kg ha^{-1})	2014	6362 d	7833 c	9646 a	8841 b	6386 c	7448 b	10678 a
	2015	Çö	11243 a	11019 a	9429 b	7575 b	9056 b	12133 a
Hectoliter (kg)	2014	69.8 c	71.1 b	73.9 a	72.1 b	69.4 b	73.1 a	72.6 a
	2015	69.9 d	71.4 c	72.8 a	72.1 b	70.4 c	71.7 b	72.7 a
Seed oil content (%)	2014	3.50 c	4.05 a	3.89 ab	3.84 b	3.60 b	3.73 b	4.13 a
	2015	3.57 d	4.32 a	3.94 b	3.72 c	3.58 c	3.91 b	4.17 a
Seed protein ratio (%)	2014	8.9 c	10.4 b	10.9 a	10.3 b	9.6 b	9.9 b	10.8 a
	2015	9.01 b	9.50 b	10.6 a	9.91 ab	9.30 b	9.46 b	10.51 a

I1: Four irrigations (1st at three leaf stage, 2nd at ninth-leaf stage, 3rd at tasseling stage, 4th at milking stage), **I2:** Five irrigations (1st at fourth leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at milking stage, 5th at dough stage) and **I3:**Six irrigations (1st at third leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at blister stage, 5th at milking stage, 6th at dough stage) and four manure (**M0:**control, **M1:** 180-80 kg N-P_2O_5- ha^{-1}, **M2**: Chicken manure 15 t ha^{-1} and **M3:** Farmyard manure 15 t ha^{-1})

The highest cob lengths according to the sources of manure were obtained from M2 with 20.9 cm and 21.3 cm for the first and second years, respectively. The lowest cob lengths were obtained from control plots (M0) with 17.7 and 18.1 cm for 2014 and 2015, respectively. The highest cob lengths for irrigation were obtained from I3 with 22.1 and 22.6 cm in the first year and the second, respectively, while the lowest values were obtained from I1 for both years.

The highest number of grains/cob, according to the sources of manure, was obtained from M3 with 431.3 grains/cob in 2015. The highest number of grains/cob was obtained from M2 with 468.7 grains/cob in 2015. The lowest grains/cob were obtained from

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control plots in both years but the difference between M0 and M1 was not statistically significant in the second year. In terms of irrigation schedule, the number of grains/cob ranged between 289.3 and 546.1 grains/cob in the first year, and 371.7 and 490.2 grains/cob in the second year.

In terms of grain yield of cob, while the highest value was collected from M2 with 36.1g, the lowest value was obtained from 24.4 g for the first year. Whereas, the highest value was obtained from M1 with 38.7 g but the difference among M1, M2 and M3 was found to be statistically insignificant in the second year. According to the irrigation schedules, grain yield of cob ranged between 24.5 and 39.7 g in 2014, and 29.4 and 43.7 g in 2015. The lowest values were collected from the I1 application, whereas the highest values were obtained from the I3 application (*Table 4*).

Significant results of both factors under study during both years of experimentation were found. According to the source of manure, the highest 1000 seed weight was obtained from M2 with 134.8 g in the first year, while the highest 1000 seed weight was collected M3 with 145.1 g in the second year. The lowest values were obtained from control plots in both years. In terms of irrigation schedule, the highest 1000 seed weights were obtained from I3 with 138.7 and 148.9 g for years, whereas the lowest values were obtained from the I1 application with 118.9 and 135.5 g for the first year and the second, respectively.

In terms of grain yield, the highest values were obtained from M2 with 9646 and 11019 kg ha^{-1} for 2014 and 2015, while the lowest values were obtained from M0 with 6363 and 6662 kg ha^{-1} for both years, respectively. But the difference between M1 and M2 was not statistically significant in the second year. These finding are also supported by (Seker and Ersoy, 2005). According to the irrigation schedules, the grain yield ranged from 6386 to 10678 hg/ha in the first year, and from 7575 to 12133 kg ha^{-1} in 2015. The lowest seed yield was collected from the I1 application, whereas the highest values were obtained from the I3 application (*Table 3*).

The highest hectoliter weight was obtained from M2 with 73.9 and 72.8 kg for the first year and the second, whereas the lowest hectoliter weight were observed from control plots both years. In terms of irrigation schedule, the highest hectoliter weights were obtained from I2 with 73.1 kg in the first year, I3 with 72.7 kg in 2015, the lowest values were obtained from I1 application with 69.4 and 70.4 kg for the first year and the second, respectively. But the difference between I2 and I3 was statistically insignificant in 2014.

The highest grain oil contents were reached from M1 with 4.05-4.32%, the lowest values were obtained from M0 application with 3.50-3.57% for 2014 and 2015, respectively. According to the irrigation schedules the seed oil content ranged between 3.60 and 4.13% in 2014, and 3.58 and 4.17% in 2015. The lowest seed oil contents were obtained from the I1 application, whereas the highest values were obtained from the I3 application (*Table 5*). In terms of seed protein ratio, the highest values were obtained from M2 with 10.9 and 10.6% for the first and the second years, the lowest values were obtained from control plots with 8.9 and 9.01% for both years, respectively. The highest seed protein ratio for irrigation schedule were obtained from I3 with 10.8 and 10.51% in 2014 and 2015, respectively, while the lowest values were obtained from I1 but the difference between I1 and I2 was statistically insignificant for both of the years.

The results on the nutrient contents of maize, based on the application of different manures and irrigation schedules, are showed in *Table 4*. When the effect of irrigation schedules and sources of manure on nutrient contents of maize seed, the highest K

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values were obtained from the M2 application in both of the years but there among M1, M2 and M3 was not statistically significant in the first year. When potassium is examined in terms of irrigation schedule while the highest values obtained from I3, the lowest values obtained from I1, but the difference between I2 and I3 was statistically insignificant in the second year.

The highest Na, Mg and Ca values were obtained from M2 application, while the lowest values were obtained from M0 application in 2014 and 2015. According to the irrigation schedule, the I1application gave the lowest value while the I3 gave the highest value (*Table 5*).

Table 5. *Effect of irrigation schedules and sources of manure on nutrient contents of maize seed and Duncan groups (2014-2015)*

Characters	Years	Sources of manure				Irrigation schedules		
		M0	**M1**	**M2**	**M3**	**I1**	**I2**	**I3**
K (ppm)	2014	2468.7 b	2757.1 a	2926.5 a	2814.1 a	2121.2 c	2807.5 b	3296.0 a
	2015	2489.4 c	3018.3 b	3472.6 a	3084.5 b	2576.8 b	3136.7 a	3335.1 a
Na (ppm)	2014	18.31 c	27.72 b	33.74 a	27.85 b	13.30 c	27.18 b	40.23 a
	2015	27.02 c	32.86 b	36.46 a	32.40 b	24.70 c	30.80 b	41.06 a
Mg (ppm)	2014	667.7 b	675.5 b	717.7 a	663.2 b	664.0 c	686.3 b	712.2 a
	2015	713.8 c	740.1 b	763.1 a	742.3 b	725.6 b	734.5 b	759.3 a
Ca (ppm)	2014	47.55 b	56.68 ab	61.72 a	54.90 ab	46.10 b	56.64 ab	62.90 a
	2015	35.40 d	40.88 c	46.52 a	43.40 b	36.00 c	41.19 b	47.45 a
Fe (ppm)	2014	12.11 c	14.24 b	15.41 a	14.37 b	12.51 c	14.20 b	15.39 a
	2015	12.57 c	16.42 b	18.07 a	15.72 b	14.25 b	16.15 a	16.69 a
Cu (ppm)	2014	2.916 d	3.223 c	4.330 a	3.897 b	3.141 c	3.430 b	4.204 a
	2015	3.970 c	5.858 a	4.858 b	4.634 b	4.406 b	4.791 ab	5.293 a
Zn (ppm)	2014	13.45 d	14.70 c	17.37 a	16.05 b	14.80 b	15.07 b	16.30 a
	2015	14.11 b	14.88 b	16.72 a	14.50 b	13.10 c	15.37 b	16.83 a
Mn (ppm)	2014	5.484 c	5.755 b	6.258 a	6.191 b	5.524 c	5.74 b	6.369 a
	2015	2.955 c	3.455 b	4.123 a	3.615 b	3.383 b	3.426 b	3.802 a
Ni (ppm)	2014	0.316 b	0.394 ab	0.423 a	0.418 a	0.333ns	0.405ns	0.425ns
	2015	0.460 b	0.484 b	0.560 a	0.508 ab	0.511 a	0.466 b	0.531 a
Pb (ppm)	2014	0.367 ns	0.432 ns	0.350 ns	0.412 ns	0.319 b	0.372 b	0.480 a
	2015	0.405 c	0.577 b	0.638 a	0.546 b	0.430 c	0.571 b	0.657 a

I1: Four irrigations (1st at three leaf stage, 2nd at ninth-leaf stage, 3rd at tasseling stage, 4th at milking stage), **I2:** Five irrigations (1st at fourth leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at milking stage, 5th at dough stage) and **I3:** Six irrigations (1st at third leaf stage, 2nd at ninth leaf stage, 3rd at tasseling, 4th at blister stage, 5th at milking stage, 6th at dough stage) and four manure (**M0:** control, **M1:**180-80 kg N-P_2O_5- ha^{-1}, **M2:**Chicken manure 15 t ha^{-1} and **M3:**Farmyard manure 15 t ha^{-1})

In terms of Fe contents, the highest values were obtained from M2 application, the lowest values were obtained from the M0 application in both of the years. When Fe is examined in terms of irrigation schedule, the highest values obtained from I3, while the lowest values obtained from I1, but the difference between I2 and I3 was statistically insignificant in the second year.

When evaluated in terms of copper contents, the highest Cu content was obtained from M2 in the first year, M1 in the second. The lowest values were obtained from M0 in both years. In addition, the I3 application has the highest Cu content, whereas the I1 application has the lowest content both years. But the difference between I1 and I2 in 2014 and among I1, I2 and I3 in 2015 was not statistically significant.

The highest Zn, Mn, and Ni contents were obtained from M2 application, whereas the lowest values were obtained from the M0 application in 2014 and 2015. But the

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difference between M2 and M3 was statistically insignificant for Ni content in the first year. According to the irrigation schedule the highest values were obtained from I3, the lowest values were obtained from I1 except Ni content both years. Ni content was found to be insignificant in 2014.

According to the source of manure, Pb content was found to be insignificant in the first year, while the highest value was obtained from M2, the lowest value was obtained from M0 in the second year. In terms of irrigation schedule the highest values were obtained from the I3 application, the lowest values were obtained from the I1 application. But the difference between I1 and I2 was not statistically significant.

There was a significant interaction between irrigation schedules and different manure sources during both years. In *Table 6* I3 M2 (the first year: six irrigations and chicken manure) and I3 M1 (the second year: six irrigations and farmyard manure) interaction produced maximum grain yield (1348 kg ha^{-1} in 2014 and 1495 kg ha^{-1} in 2015).

Table 6. *Interaction between irrigation schedules and different manure sources affecting grain yield (kg ha^{-1}) during 2014 and 2015*

	Irrigation schedules	Sources of manure			
		M0	**M1**	**M2**	**M3**
2014	**I1**	5665 i	6309 h	6833 fg	6736 fgh
	I2	6402 gh	6857 fg	8618 d	7913 e
	I3	7020 f	1033 c	1348 a	1187 b
2015	**I1**	5674 g	8192 ef	8772 de	7664 ef
	I2	6286 fg	1057 cd	1082 c	8538 e
	I3	8025 ef	1495 a	1346 ab	1208 bc

Discussion

Each year was separately evaluated since there were significant differences between both years, as found from combined analysis. Maize yield and its components tend to be higher in 2015 growing season, compared with 2014 growing season. This could be attributed to favorable climatic conditions that were prevailing during the 2015 growing season. The lowest plant heights were obtained from the I1 application, whereas the highest values were obtained from the I3 application (*Table 4*). These results are similar to the findings of Randhawa et al. (2012), and El-Gizawi and Nasser (2005), who found taller plants by increasing irrigation interval. While the minimum plant height was obtained in control treatment. These results are inline as the results of Qasim et al. (2001), who reported an increase in plant height with farmyard manure application due to more availability and uptake of nutrients. Increasing scarcity and greater competition for use of freshwater resources will force irrigated agriculture to be more efficient in use of available supplies. Significant difference was found among the irrigation treatments and different manure sources on the production of first cob height and cob length. The highest values were obtained for the I3 irrigation application and the M2 fertilization. Similar effects were observed by Abera et al. (2013) and Majid et al. (2017). Rezvantalab et al. (2008) also reported higher number of grains cob-1 with application of farmyard manure and mineral fertilizers. While the highest values were obtained from I3, the lowest values were obtained from I1. Confirmatory results regarding number of grains cob-1 were given by El-Tantawy et al. (2007), who reported significant differences among different irrigation schedules. According to the irrigation schedules, grain yield of cob ranged between 24.5 and 39.7 g in 2014, and 29.4 and 43.7

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g in 2015. The lowest values were collected from the I1 application, whereas the highest values were obtained from the I3 application (*Table 4*). These data confirm that of El-Tantawy et al. (2007) and Majid et al. (2017), who reported significant response of supplementary irrigation on grain weight cob-1. The highest 1000 grain weight was produced with the I3 irrigation treatment whereas the minimum weight of 1000-grain was produced by the control treatment. Significant results of both factors under the study during both years of experimentation were found. In case of plant nutrition treatments, the highest 1000-grain weight was noted in treatment chicken manure 15 t ha^{-1} (M2) as compared to all other integrated plant nutrition treatments in 2014. The same trend was observed during 2015. The increase in 1000-grain weight might be due to integrated use of farmyard manure and I3. Reports supporting the present results have appeared in the literature by Sharif et al. (2004) and Kashiani et al. (2011). The levels of irrigation and different manure sources remarkably influenced the grain yield in cultivar Limagrain Helen. Minimum grain yield counted from the treatment I1 M0, and it differed statistically from other treatments applications. The water stress (deficit water) remarkably influenced productivity and quality in maize (Barutcular et al., 2016; El Sabagh et al., 2017). However, water availability is usually the most important crop production factor limiting yield and yield traits of maize. These facts are comparable with the study of (Zhang et al., 2007) who obtained higher yield with the increase in number of irrigations. These results are similar to the findings of (Randhawa et al., 2012). The highest grain oil contents were reached from M1 with 4.05-4.32%, the lowest values were obtained from the M0 application with 3.50-3.57% for 2014 and 2015, respectively. According to the irrigation schedules, the seed oil content ranged between 3.60-4.13% in 2014 and 3.58-4.17% in the second year. The lowest seed oil contents were obtained from the I1 application, whereas the highest values were obtained from the I3 application. These results were in agreement with what was obtained by Yalçın et al. (2006). Grain analysis has been used to reveal the deficiency, adequacy or excessiveness status of various nutrient elements in a soil-plant system. Chicken manure application significantly increased the concentrations of K, Ca, Cu, Fe, Mn, Zn, Ni and Mg in maize seed. Application of chicken dunk organic fertilizer not only capable to increase sweet corn production, but also had positive impacts in term of improvement of soil physical, chemical and biological properties. Improvement of soil physical properties is achieved because organic matter (organic fertilizer) functions as adhesive of loose soil particles or aggregate stabilizer compound (Gonzales et al., 2002; Margaretha et al., 2014). The highest Na, Mg and Ca values were obtained from the M2 application. The lowest values were obtained from the M0 application in the first year and the second. According to the irrigation schedule, the I1 application gave the lowest value while I3 gave the highest. Similar effects were observed by Hussaini et al. (2008).

Conclusions

The effects on all the characteristics researched for different sources of manure and irrigation schedules were statistically significant for 2014 and 2015. The results of our work indicated that the highest plant yield for maize planted in both growing seasons of 2014 and 2015 was obtained when the plants were irrigated six times. On the basis of this two-year study, it is concluded that in order to obtain higher grain yield of hybrid maize under agro ecological conditions of Mardin/Turkey, the crop should be irrigated six times and fertilized with organic manures (15 t chicken manure ha^{-1}). While the

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highest grain yield per area was obtained from the third irrigation schedule and chicken manure in 2014, the highest value was obtained from the third irrigation schedule and standard fertilizer with 14959 kg ha^{-1} and the third irrigation schedule and chicken manure with 13463 kg ha^{-1} in 2015. Chicken manure application significantly increased the concentrations of K, Ca, Cu, Fe, Mn, Zn, Ni and Mg in maize seed. The results revealed that increase in soil moisture and mineral contents leads to increase in plant growth promotion and biomass production.

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