Plant Archives Vol. 19 No. 2, 2019 pp. 4415-4418 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

EFFECT OF IRRIGATION LEVELS ON MAIZE YIELD PLANTED UNDER CLIMATIC CONDITIONS OF WASIT PROVINCE

Jamal Naser Abdel Rahman Alsadoon[1], Mustafa Iskander Zaid Al-Wardy[2] and Haidar Abd al Mahdi Kadim[3]

[1]Department of soil science and water resources, College of Agriculture, Wasit University, Iraq.
[2, 3] Wasit Agriculture Directorate , Wasit, Iraq.

Abstract

This study was carried out to determine the effects of different irrigation levels on yield and yield components of maize planted at basin irrigation method under climatic conditions of middle Iraq. Irrigation water was applied as I25%, 100%, 75% and 50% of evaporation from a Class A Pan (Ep). The experimental layout was distributed in randomized complete block design (RCBD) with three replicates. Irrigation levels significantly affected yield and yield contributing parameters at $P<0.05$ level. The highest grain yield and yield components were found at 125% and 100% Ep while the lowest were found at 50% Ep treatment. Irrigation levels had statistically significant effect on dry above ground biomass production of maize at $P<0.05$ level.

Key words: Irrigation levels, Ep%, yield and yield components of maize.

Introduction

Water is an important natural resource and its increasing scarcity has led to concerns for its efficient use, management, and sustainability (Brar *et al.,* 2016). Water shortage is one of the main constraints for economic development in arid and semi-arid areas. However, it is very important for these areas to promote public awareness as regards water-saving measures so as to develop the social sustainability and extension of new cultivated areas (El-Hendawy *et al.,* 2008).

Water is one of the most important factor affecting crop production and its movement through the soil-plant atmosphere (Hussain *et al.,* 2015). One of the most important factors that can limit crop production is the availability of water (Farsiani *et al.,* 2011).

Deficit irrigation provides means of reducing water consumption while minimizing adverse effects on yield (Abd el-wahed *et al.,* 2015). The irrigation studies have made great achievements on improving the efficiency of water and ensuring food security, but still has great potential for improving water use efficiency in many field crops (Al-Maeini *et al.,* 2018).

Due to the serious water shortages, the great challenge for the coming decades is the task of increasing food production with less water, particularly in countries with limited water, land resources. Therefore, techniques are needed to increase the water use efficiency (Tariq and Usman, 2009).

Water scarcity and drought are the major factors constraining agricultural crop production in arid and semi-arid zones of the world. Irrigation is today the primary consumer of fresh water on earth (Yazar *et al.,* 2009).

Kuscu *et al.,* (2013) indicated that there was linear relationship between grain yield of maize and seasonal irrigation water amount. Maize (*Zea mays* L.) is the third most important cereal crop in the world after wheat and rice (Al-Maeini and Kadim, 2018).

The objectives of this study were to evaluate the effects of four irrigation levels on yield and it is components of maize planted in middle Iraq.

Materials and methods

Experimental site

The research was conducted in the central Kut nursery, Wasit Agriculture Directorate during the season 2018 under ecological and climatical conditions of Kut district, Wasit Province, Iraq. Soil samples were taken from depths of 0 – 40 cm prior to sowing of crop and

analyzed to determine the physical and chemical properties which are shown in Table 1 by using methods of soil analysis (Page *et al.,* 1982).

Table 1: Some chemical and physical properties of soil field experiment (depth 0 - 40 cm) for the season 2018.

Measured Character	Value	measuring unit
pH	7.8	
Electrical conductivity (EC)	4.4	dS m^{-1}
Available Nitrogen	15	mg kg^{-1}
Available Phosphorus	53	mg kg^{-1}
Available Potassium	189	mg kg^{-1}
Soil texture	clay	

Experimental design and treatments

The experiments were conducted using a randomized complete block design with three replications, the area of each plot was 6 m^2. The irrigation treatments considered in the study were basin irrigation equivalent to different level of 50% (I_1), 75% (I_2), 100% (I_3) and 125% (I_4) of evaporation from a Class A Pan.

Planting and fertilization

Hybrid maize (Kalimeras) was used and the seeds were sown at 5 August 2018, at a spacing of 25 cm × 75 cm. All treatments plots received the same amount of fertilizer application at rates of 300 kg ha^{-1} DAP (Di Amino Phosphate, 18:46:0), and applied uniformly before planting, 320 kg ha^{-1} of urea (46% N), was applied in banding along the rows on two doses, first it was applied at six leaves appears and second after 30 days of applying them.

Pest control weed was carried out as needed. Five plants in the middle rows in each experimental unit were harvested at physiological maturity at 20 November in 2018. Some biological properties were study and the plants were dried, at 65^0C until constant weight. The number of row per ear, number of grains per row, number of grains per ear, 500-grain weight, grain yield, biological yield and harvest index was investigated.

Statistical analysis:

All collected data in this study were analyzed using analysis of variance (ANOVA). Mean separation of treatment effects in this study was accomplished using least significant difference (LSD) test at probability levels of 0.05.

Results and Discussion

Effect of irrigation levels on some biological parameter were shown in Table 2. The results showed that the number of rows per ear of maize was not affected by irrigation levels. On the other hand the irrigation levels significant effect on the number of grains per row (Table 2). The highest average of the no. of grains per row (35.83) was the I_4 level, while the lowest average (29.33) was found at the I_1 level. These results were in agreement with (Karasu *et al.,* 2015), who stated that the water stress decreased the number of grain per row at silking stage.

The results in Table 2 showed that irrigation levels affected the number of grains per ear significantly. Maximum no. of grains per ear (514.2) was obtained when irrigation was applied at 125% Ep. While minimum no. of grains per ear (387.5) at 50 % Ep. These results were in agreement with (Bozkurt *et al.,* 2011) and (Karasu *et al.,* 2015). Number of grains per ear decreased with increasing deficiency in irrigation water, and number of grains is closely associated with yield of maize and the number of grains per ear is a yield component that varies markedly with stress water (Tabatabaei and Dadashi, 2013).

The results in Table 2 showed the effect of irrigation levels under basin irrigation method on 500-grain weight of maize crop. The results indicated that the highest 500 grain weight value was (188.8g) observed using 125% Ep. While, the lowest value was (156g) obtained with 50% Ep. Similar results were reported by (Bozkurt *et al.,* 2011) and (Xiukang *et al.,* 2014). Because, when the amount of water decreased, the 500-grain weight were decreased (Karasu *et al.,* 2015).

The effect of irrigation levels on average grain yield, biological yield and harvest index of maize crops were shown in Table 3. The results indicated that the grain yield was affected significantly by various irrigation levels. Maximum grain yield (9.603 t ha^{-1}) was obtained when irrigation levels was applied at 125% Ep. While minimum grain yield (6.437 t ha^{-1}) at 50% Ep. Xiukang *et al.,* (2014) reported that a linear relationship existed between seasonal water use and grain yield, also the declines in dry matter and grain yields could be attributed to an increased soil water deficit. These results are in line with, (Bozkurt *et al.,* 2011) and (Karasu *et al.,* 2015).

Biological yield affected significantly by irrigation levels. Maximum biological yield (25.80 t ha^{-1}) was obtained when irrigation levels treatments applied at 125% Ep (Table 2). Minimum biological yield (20.29 t ha^{-1}) was observed at I_1 level. (Tabatabaei and Dadashi, 2013) indicated that the effect of irrigation levels on biological yield was significant, that water deficiency in seed filling stage results in dry matter accumulation decrease and simultaneously shorten seed improvement period. These results are in agreement with those of (Bozkurt *et al.,*

Table 2: Effect of irrigation levels on the average No. of rows per ear, No. of grains per row, No. of grains per ear and 500 grain weight of maize during the season 2018.

Treatments	No. of rows per ear	No. of grain per row	No. of grain per ear	500 grain weight (gm)
I1	13.20	29.33	387.5	156.0
I2	13.83	31.67	437.3	172.7
I3	14.37	34.50	500.3	182.2
I4	14.40	35.83	514.2	188.8
LSD(0.05)	N.S	4.492	58.73	15.06

2011) and (Xiukang *et al.,* 2014).

Data in Table 3 indicated that the highest harvest index value (37.58) was obtained under basin irrigation method using 125% Ep, the lowest value was (32.13) with 50% Ep. This result are consistent with findings of (Bozkurt *et al.,* 2011), who reported that the irrigation treatments had significant effect ($P<0.01$) on harvest index.

Table 3: Effect of irrigation levels, on the average grain yield, biological yield and harvest index of maize during the season 2018.

Treatments	Grain yield (t. ha^{-1})	Biological yield (t. ha^{-1})	Harvest index
I1	6.437	20.29	32.13
I2	8.068	22.72	36.07
I3	9.417	24.76	38.23
I4	9.603	25.80	37.58
LSD(0.05)	1.061	2.316	3.321

Conclusion

From the above mentioned presentation, it can be concluded that:

1- The effects of irrigation levels on yield and yield components of maize plant were significant in this study, the highest grain yield was obtained from 125% and 100% Epan treatment as about (9.603 and 9.417 t ha^{-1}) while the lowest ones were observed in irrigation treatment 50% Epan as about (6.437 t ha^{-1}).

2- Applied irrigation water was linearly and positively related to the duration of reproductive phase and to the grain yield. Higher dry matter accumulation and longer reproductive phase under well irrigation levels led to significantly higher grain yield.

3- The grain yield and biological yield were significantly and positively affected by irrigation levels .The highest GY and BY values were obtained from plants irrigated with the 125% and 100% Epan. Meanwhile, the lowest values were recorded when plants were irrigated with 50% Epan treatment under ecological conditions of middle region, Iraq.

References

Abd el-wahed, M.H., A. EL Sabagh, A. Zayed, S. Ahmed, H. Saneoka and C. Barutçular (2015). Improving yield and water productivity of maize grown under deficit-irrigated in dry area conditions. *Azarian J. of Agri.,* **(2)5:** 123-132.

Al-Maeini, A.H.A., J.N.A.A. Alsadoon and H.A.A. Kadim (2018b). Estimation of evapotranspiration of maize under climatic conditions of Wasit governorate Iraq. *BIO. RES.,* **15(4):** 4362-4373.

Al-Maeini, A.H.A. and H.A.A. Kadim (2018a). Effect of irrigation methods, soil mulching and polymer on water consumption and water use efficiency of maize (*Zea mays* L.). *Journal Tikrit Univ. For Agri. Sci.,* Vol. (18) special No. of The 7th Scientific and 1st International Conference of Agricultural Researches, 10-11 April 2018 ISSN-1813-1646.

Bozkurt, S., A. Yazar and G.S. Mansuro (2011). Effects of different drip irrigation levels on yield and some agronomic characteristics of raised bed planted corn. *African J. of Agri. Res.,* **6(23):** 5291-5300.

Brar, H.S., K.K. Vashist and S. Bedi (2016). Phenology and Yield of Spring Maize (*Zea mays* L.) under Different Drip Irrigation Regimes and Planting Methods. *J. Agr. Sci. Tech.,* **18:** 831-843.

El-Hendawy, S.E., E.M. Hokam and U. Schmidhalter (2008). Drip Irrigation Frequency: The Effects and Their Interaction with Nitrogen Fertilization on Sandy Soil Water Distribution, Maize Yield and Water Use Efficiency under Egyptian Conditions. *J. Agr. and Crop. Sci.,* 180-192.

Farsiani, A., M.E. Ghobadi and S.J. Honarmand (2011). The effect of water deficit and sowing date on yield components and seed sugar contents of sweet corn (*Zea mays* L.). *Afr. J. Agric. Res.,* **6(26):** 5769-5774.

Hussain, S., M. Iqbal, M. Iqbal, O. Aziz, G. murtaza, S. Iqbal, S. Mehmood and T. Rasool (2015). Effect of different irrigation practices and plastic mulch on water use efficiency, growth and yield of spring maize. *Basic Res. J. Agri. Sci.,* **4(11):** 314-320.

Karasu, A. H. Kuscu M. Oz and G. Bayram (2015). The Effect of Different Irrigation Water Levels on Grain Yield, Yield Components and Some Quality Parameters of Silage Maize (Zea mays indentata Sturt.) in Marmara Region of Turkey. *Not Bot Horti Agrobo,* **43(1):** 138-145.

Kuscu, H., A. Karasu, M. OZ, A.O. Demir and I. Turgut (2013). Effect of irrigation amounts applied with drip irrigation on maize evapotranspiration, yield, water use efficiency, and net return in a sub–humid climate. *Tur. J. of Field Crops.,* **18(1):** 13-19.

Page, A.L., R.H. Miller and D.R. Keeney (1982). Methods of Soil Analysis. Part 2. Chemical and Microbiological properties, 2nd. ed. Am. Soc. Agron. Inc. publisher,

Madison, Wisconsin, USA.

Tabatabaei, S.M. and M. Dadashi (2013). Effect of different water levels on the yield of Corn with trickle irrigation method (t-tape) in Moghan. *Int. J. of Sci. and Eng. Res.,* **4(10):** 1275- 1281.

Tariq, J.A. and K. Usman (2009). Regulated deficit irrigation scheduling of maize crop. *Sarhad J. Agric.,* **25(3):** 441-450.

Xiukang, W., L. Zhanbin and X. Yingying (2014). Effect of dripper discharge and irrigation frequency on growth and yield of maize in loess plateau of northwest chine. *Pak. J. Bot.,* **46(3):** 1019-1025.

Yazar, A., F. Gökçel and M.S. Sezen (2009). Corn yield response to partial rootzone drying and deficit irrigation strategies applied with drip system. *Plant soil environ.,* **55(11):** 494–503.