The Andhra Agric. J 66 (2): 269-271, 2019

Productivity of *Rabi* Maize (*Zea mays* L.) as Influenced by Water Management Practices

N Ramya, N V Lakshmi, K Chandrasekhar, K L Narasimha Rao and S Prathibha Sree
Department of Agronomy (Water Management), APGC, Lam, Guntur.

ABSTRACT

A field experiment was conducted on sandy loam soils of Agricultural College Farm, Bapatla during *rabi*, 2017-18 to study the effect of deficit irrigation practices on growth and yield of maize. Results of the experiment revealed that growth parameters, yield attributes and yield were significantly influenced by irrigation practices and depth of irrigation. Irrigation through alternate furrows recorded higher plant height (323.9 cm), dry matter accumulation (13308 kg ha^{-1}), kernel weight cob^{-1} (94.5 g), number of kernels per cob (337.5), kernel (6251 kg ha^{-1}) and stover (6038 kg ha^{-1}) yields. Irrigation at a depth of 60 mm recorded significantly higher plant height (336.0 cm), dry matter accumulation (13243 kg ha^{-1}), kernel weight per cob (100 g), kernel yield (6455 kg ha^{-1}) and stover yield (6015 kg ha^{-1}).Interaction between irrigation practices and depth of irrigation recorded the highest kernel yield under irrigation through alternate furrows at 60 mm depth.

Key words: *Depth of irrigation, Irrigation practices, Maize.*

The increasing shortages of water and costs of irrigation are leading to an emphasis on developing methods of irrigation that minimize water use and maximize the water use efficiency.Maize is the principle cereal crop after rice in Andhra Pradesh. Though it is mainly grown as rainfed crop during *kharif* season, it is also being cultivated as a irrigated crop during *rabi*season. By applying exact amount of water needed to replenish soil moisture to desired level, saves water and energy and could lead to increased yields and greater profit for farmers, significant water savings and improved sustainability of irrigated agriculture. Due to serious water shortages, the great challenge for the coming decades is the task of increasing food production with less water, particularly where water is a limited resource. Deficit irrigation is one way of maximizing water use efficiency for higher yields per unit of water applied. The water stress may reduce the crop yield to some extent but it will remain economically feasible as long as the marginal benefit from reduced cost of water is equal or greater than marginal cost of reduced yield. (Aulakh *et. al.* 2012).

MATERIAL AND METHODS

A field trial to study the effect of deficit irrigation practices on growth and yield of maize was conducted at Agricultural College Farm, Bapatla during *rabi* season, 2017-18. The experiment was laid out in split-plot design with three irrigation practices as main plots and three depths of irrigation as sub plots with a total of nine treatments and replicated thrice. Three irrigation practices *i.e.*, alternate furrow irrigation (AFI), fixed alternate furrow irrigation (FAFI) and conventional furrow irrigation (CFI) are consisted as main plots and three depths of irrigation *i.e.*, 60 mm, 45 mm and 30 mm as subplots. The crop was sown on November 4th 2017.The volume of water to be given for each treatment is calculated by multiplying the area with depth and the measured quantity of water was given to different treatments by using Parshall flume. Five plants were tagged in each net plot area for recording observations that did not involve destructive sampling. All the observations were recorded on these plants at 30, 60, 90 DAS and at harvest. Five plants in the second row from the border row in each plot were cut at each time for recording dry matter accumulation. The data recorded on various parameters of crop was subjected to statistical scrutiny by the method of analysis of variance.

RESULTS AND DISCUSSION

Effect of water management practiceson growth parameters of maize

Irrigation practices did not affect the plant height significantly at different stages of crop growth. However, taller plants (323.9 cm) were recorded under alternate furrow irrigation practice. Significantly higher dry matter accumulation (13308 kg ha^{-1}) at harvest was found under alternate furrow irrigation compared to fixed alternate furrow irrigation (11047 kg ha^{-1}) and conventional furrow irrigation (12152 kg ha^{-1}) (Table 1). Significantly higher plant height (336.0 cm) and dry matter accumulation (13308 kg ha^{-1}) were recorded under irrigation at 60 mm depth compared to 45 mm and 30 mm depths. Significantly less number of days to 50 % tasseling and silking (58.7 and 66.3

Table 1. Growth parameters of *rabi* maize as influenced by different water management practices

Treatments	Plant height (cm)	Dry matter (kg ha^{-1})	Days to 50% tasseling	Days to 50% silking
Irrigation practices (I)				
I_1: AFI	323.9	13308.0	58.7	66.3
I_2: FAFI	305.1	11047.0	61.4	68.6
I_3: CFI	313.9	12152.0	60.1	66.9
SEm ±	5.0	158.0	0.4	0.2
CD (p=0.05)	NS	618.0	1.4	0.9
CV (%)	4.8	3.9	1.8	1.0
Depth of irrigation (D)				
D_1 : 60 mm	336.0	13243.0	58.9	66.0
D_2 : 45 mm	316.0	12130.0	60.0	67.1
D_3 : 30 mm	290.8	11133.0	61.3	68.7
SEm ±	3.0	119.0	0.3	0.9
CD (p=0.05)	9.4	368.0	0.8	1.0
CV (%)	2.9	2.9	1.3	1.5
Interaction (I X D)	NS	NS	NS	NS

Table 2. Yield parameters and yield of maize as influenced by different water management practices

Treatments	No. of cobs per plant	Cob length (cm)	No. of kernels per cob	Kernel weight per cob (g)	Test weight (g)	Kernel yield (kg ha^{-1})	Stover yield (kg ha^{-1})	Shelling percentage (%)
Irrigation practices (I)								
I_1: AFI	1	13.90	337.50	94.50	26.10	6251.00	6038.00	74.70
I_2: FAFI	1	12.60	280.20	72.80	22.70	4714.00	5278.00	69.00
I_3: CFI	1	13.60	300.00	85.50	24.40	5503.00	5764.00	73.60
SEm ±	NS	0.33	4.30	2.48	0.36	121.00	156.00	2.20
CD (p=0.05)	NS	1.20	16.90	9.70	1.40	475.00	611.00	8.70
CV (%)	NS	7.40	4.20	8.80	4.40	6.60	8.20	9.20
Depth of irrigation (D)								
D_1 : 60 mm	1	14.20	347.10	100.00	25.40	6455.00	6015.00	75.70
D_2 : 45 mm	1	13.40	304.80	81.30	24.30	5348.00	5579.00	72.60
D_3 : 30 mm	1	12.60	266.00	71.40	23.30	4665.00	5486.00	68.90
SEm ±	NS	0.16	5.58	2.03	0.30	141.00	186.00	2.46
CD (p=0.05)	NS	0.50	17.20	6.30	0.90	436.00	NS	7.60
CV (%)	NS	3.60	5.50	7.20	3.70	7.70	9.80	10.20
Interaction (I X D)	NS	NS	NS	10.9	1.9	755	NS	NS

days, respectively) was observed over with fixed alternate furrow irrigation (61.4 and 67.1 days, respectively), but found at par with conventional furrow irrigation (60.1 and 66.9 days, respectively). Among the depths, less number of days to 50 % tasseling and silking (58.9 and 67.1 days, respectively) were recorded under irrigation at 60 mm depth, which was significantly superior over 45 mm (60.0 and 67.1 days, respectively) and 30 mm (61.3 and 68.7 days, respectively).

Effect of water management practices on yield parameters of maize

Number of cobs per plant showed a non-significant influence by the irrigation practice and depth of irrigation. Higher cob length (13.9 cm) was recorded under alternate furrow irrigation but found at par with conventional furrow irrigation (13.6 cm) and lowest (12.6 cm) under fixed alternate furrow irrigation Table 2). Kernels per cob (337.5), kernel weight per cob (94.5 g) and test weight (26.1 g) were significantly higher under alternate furrow irrigation compared to conventional furrow irrigation and fixed alternate furrow irrigation. Irrigating the crop at 60 mm depth of irrigation recorded significantly higher cob length (14.2 cm), kernels per cob (347.1), kernel weight per cob (100.0 g) and test weight (25.4 g) which were significantly superior over 45 mm and 30 mm depths. This might be due to the fact that increasing available soil moisture during vegetative and reproductive growth of maize increased the yield attributes. Interaction between irrigation practices and depth of irrigation revealed that significantly higher kernel weight and test weight were recorded under alternate furrow irrigation at 60 mm depth over rest of the treatments (Parthasarathi and Vanitha, 2014).

Effect of water management practices on yield of maize

Irrigation given through alternate furrows recorded higher kernel yield (6251 kg ha^{-1}) which was significantly superior over irrigation through fixed alternate furrow irrigation (4714 kg ha^{-1}) and conventional furrow irrigation (5503 kg ha^{-1}). Irrigating the crop at 60 mm depth recorded significantly higher kernel yield (6455 kg ha^{-1}) over 45 mm and 30 mm depths. By reducing the amount of irrigation water by 25 and 50 per cent there is only 17 and 28 per cent reduction in kernel yield. Significantly higher kernel yield under sufficiently irrigated treatments can be attributed to the adequate turgidity which must have prevailed inside the plant and thereby helping in better growth and development of the crop. Interaction between irrigation practices and depth of irrigation revealed that higher kernel yield was recorded with irrigation through alternate furrows at 60 mm depth over rest of the treatments. Maximum stover yield (6038 kg ha^{-1}) was recorded under alternate furrow irrigation which was on a par with conventional furrow irrigation (5764 kg ha^{-1}). The lowest stover yield was registered by fixed alternate furrow irrigation (5278 kg ha^{-1}), among the three irrigation practices. The stover yield decreased with decrease in depth of irrigation, but not differed significantly. Maximum stover yield of 6015 kg ha^{-1} was recorded under 60 mm depth of irrigation followed by 45 mm (5579 kg ha^{-1}) and 30 mm depth (5486 kg ha^{-1}) of irrigation. This is in accordance with the findings of Ullah *et al*. (2013).

CONCLUSION

From the present study, it was concluded that irrigation applied through alternate furrow method resulted in significantly higher growth and yield attributing characters of maize leading to significant increase in kernel yield and stover yield compared to fixed alternate furrow practice and conventional furrow irrigation practice. Among different depths, irrigating the crop at 60 mm depth recorded significantly higher plant height, dry matter accumulation, grain yield and stover yield, over 45 mm and 30 mm depth. With decrease in depth of irrigation water from 60 mm to 30 mm, reduction in yield was significant under all the methods of irrigation. However, the kernel yield under conventional furrow irrigation at 60 mm depth of irrigation was comparable with that of alternate furrow method at 45 mm depth of irrigation.

LITERATURE CITED

Aulakh G S, Vashist K K, Sharma S and Mahal S S 2012 Productivity, quality and water expense efficiency of late kharif sown hybrid maize (*Zea mays* L.) under different irrigation regimes and nitrogen levels. *Journal of Crop and Weed*. 8 (2): 139-142.

Parthasarathi T and Vanitha K 2014 Physiological interaction of soil moisture deficit and plant population on yield and yield components relationships of maize (*Zea mays* L.). *International Journal of Water*. 8 (1): 101-110.

Ullah S M, Mojid M A, Tabriz, S S, Acharjee T K and Adham A K M 2013 Growth and yield of three hybrid maize varieties under different irrigation levels. *Journal of Agricultural Technology*. 9 (7): 1749-1758.

Received on 07.06.2018 and revised on 26.08.2019