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Response of Chickpea (*Cicer arietinum* L.) Productivity under Different Irrigation Frequencies and Mulching

D. Komal[1*], S.R. Bhakar[1], S.S. Lakhawat[2], B.G. Chhipa[2] and Manjeet Singh[1]

[1]Department of Soil and Water Engineering, C.T.A.E, MPUAT, Udaipur-313001, Rajasthan, India
[2]Department of horticulture, RCA, MPUAT, Udaipur-313001, Rajasthan, India

**Corresponding author*

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A B S T R A C T

A field experiment entitled "Response of chickpea (*Cicer arietinum* L.) productivity under different irrigation frequencies and mulching" was conducted during rabi season from 13th October, 2017 to 19th February, 2018 At plasticulture farm of CTAE, Udaipur. (Rajasthan). The experiment consist of nine treatment combination; Irrigation based on field capability at three irrigation frequencies of I_1-single irrigation (at pre sowing only), I_2-double irrigation (at pre sowing + flowering stage) and I_3-triple irrigation (at pre sowing + flowering stage + pod filling stage) irrigation frequencies along with; M_0-Black plastic mulch (BPM), M_1-Polypropylene woven mulch (PPWM) and M_2-No mulch (NM) were laid out with three replications in factorial randomized block design (FRBD). Mulching and irrigation frequencies significantly influenced the growth and yield attributes at harvest maximum plant height (77.67 cm), number of primary branches per plant (28.50), number of pod/plant (37.33), seed weight/pod (0.21 gm), and yield/hectare (20.29 q) higher in treatment combination of M_1-PPWM and I_2-double irrigation i.e. treatment (T_5).

Introduction

Chickpea (*Cicer arietinum* L.) is most important rabi pulse crop of India. Pulses are an important commodity group of crops that provide high quality protein. Pulses are mostly cultivated rainfed condition that's why shortage of soil moisture in the rainfed agriculture areas occurs during the most sensitive growth stage (flowering and pod filling stages) of rabi crops.

The modern technology of drip irrigation is successfully practiced in many countries for orchards, vegetables, ornamental crops and as well as high value field crops. It is gaining momentum and its prospects in the years to come are expected to be very bright. Though India has the largest irrigation network, the irrigation efficiency does not exceed 40%. Due to water scarcity, the available water resources should be very effectively utilized through water saving irrigation technologies. Hence, further expansion of irrigation may depend upon the adoption of new systems such as pressurized irrigation methods with the limited water resources (Kumar *et al.*, 2016).

Mulching reduces the deterioration of soil, minimizes the weed infestation and checks the water evaporation. Thus, it facilitates more retention of soil moisture and helps in control of temperature fluctuations, improves physical, chemical and biological properties of soil. As it adds nutrients to the soil and ultimately enhances the growth and yield of crops. Inorganic mulch includes plastic mulch and accounts for the greatest volume of mulch use in commercial crop production. The plastic materials used as mulch are polyvinyl chloride or polyethylene films.

Materials and Methods

Study area

Field experiment was conducted for chickpea crop during rabi season from 13th October, 2017 to 19th February, 2018, at plasticulture farm, College of Technology and Engineering, MPUAT Udaipur (Rajasthan). Geographically, Udaipur is located at 24° 35 N latitude and 73° 44 E longitudes.

The altitude of the site is 582.17 m above mean sea level. The area has a sub-humid climate. The average annual rainfall in the region is 662.5 mm and more than 80% of this amount is received as a part of south-west monsoon during the period of 16th June to 15th September.

Experimental details

Experiment was laid out in factorial Randomized block design (FRBD) with three replications. Plot size was 15×1 m^2 and plant spacing was 30×10 cm^2. Nine treatment combination; Irrigation based on field capability at three irrigation frequencies of I_1-single irrigation (at presowing only), I_2-double irrigation (at pre sowing + flowering stage) and I_3-triple irrigation (at presowing + flowering stage + pod filling stage) irrigation frequencies along with; M_0-Black plastic mulch (BPM), M_1- Polypropylene woven mulch (PPWM) and M_2-No mulch (NM).

Plant height, number of primary branches per plant, number of pods per plant, seed weight per pod (gm), yield per hectare (q), 5% level of significance was considered in ANOVA to test the influence of mulching and irrigation frequencies on growth and yield attributes of chickpea.

Results and Discussion

The effect of mulching, irrigation frequencies and their interaction on growth and yield attributes are presented in Table 1 and interaction effect of mulching and irrigation frequencies on growth and yield attributes depicted in Figure 1 to 5.

Net water requirement of chickpea was found to be single irrigation 70 mm presowing only, double irrigation 144 mm at presowing and flowering stage and triple irrigation 216 mm at presowing, flowering stage and pod filling stage. At harvest maximum plant height (77.67 cm), number of primary branches per plant (28.50), number of pods per plant (37.33), seed weight per pod (0.21 gm) and yield per hectare (20.29 q).

The result showed the maximum growth and yield attributes was recorded in treatment combination of M_1 (PPWM) and irrigation frequencies I_2 (at pre sowing + flowering stage) i.e. treatment (T_5) then the minimum growth and yield attributes was recorded in treatment combination of M_0 (NM) and irrigation frequencies I_1 (at pre sowing) i.e. treatment (T_1). Similar results were reported mulching treatments crop mulched with PPWM and BPM showed superiority over no mulch. Awal *et al.*, (2016) reports that mulching treatment increase plant height and number primary branches per plant.

Table.1 Effect of mulching, irrigation frequencies and their interaction on growth and yield attributes of chickpea

Treatments	Yield parameters				
	Plant height (cm)	Number of primary branches/plant	Number of pods/plant	Seed weight/pod (gm)	Yield/ hectare (q)
Mulch (M)					
M_0 (NM)	60.89	22.67	26.78	0.142	12.9
M_1(PPWM)	73.22	26.92	35	0.192	18.98
M_2 (BPM)	70.01	25.51	32.78	0.179	17.77
S.Em±	**1.4**	**0.52**	**0.57**	**0.003**	**0.28**
C.D.5%	**4.21**	**1.57**	**1.71**	**0.009**	**0.85**
Irrigation (I)					
I_1	64.56	23.82	29.78	0.155	14.79
I_2	70.23	26.12	32.56	0.18	17.58
I_3	69.33	25.16	32.22	0.178	17.28
S.Em±	**1.4**	**0.52**	**0.57**	**0.003**	**0.28**
C.D.5%	**4.21**	**1.57**	**1.71**	**0.009**	**0.85**
Interaction (M×I)					
M_0I_1 (T_1)	58.00	22.00	25.67	0.13	10.22
M_0I_2 (T_2)	60.00	22.90	26.33	0.14	13.89
M_0I_3 (T_3)	64.67	23.10	28.33	0.15	14.58
M_1I_1 (T_4)	68.00	25.10	32.33	0.17	17.87
M_1I_2 (T_5)	77.67	28.50	37.33	0.21	20.29
M_1I_3 (T_6)	74.00	27.17	35.33	0.20	18.78
M_2I_1 (T_7)	67.67	24.37	31.33	0.16	16.27
M_2I_2 (T_8)	73.03	26.97	34.00	0.19	18.55
M_2I_3 (T_9)	69.33	25.20	33.00	0.18	18.49
S.Em±	**2.43**	**0.91**	**0.99**	**0.01**	**0.49**
C.D.5%	**7.29**	**2.73**	**2.96**	**0.02**	**1.48**

Fig.1 Interaction effect of mulching and irrigation frequencies on plant height

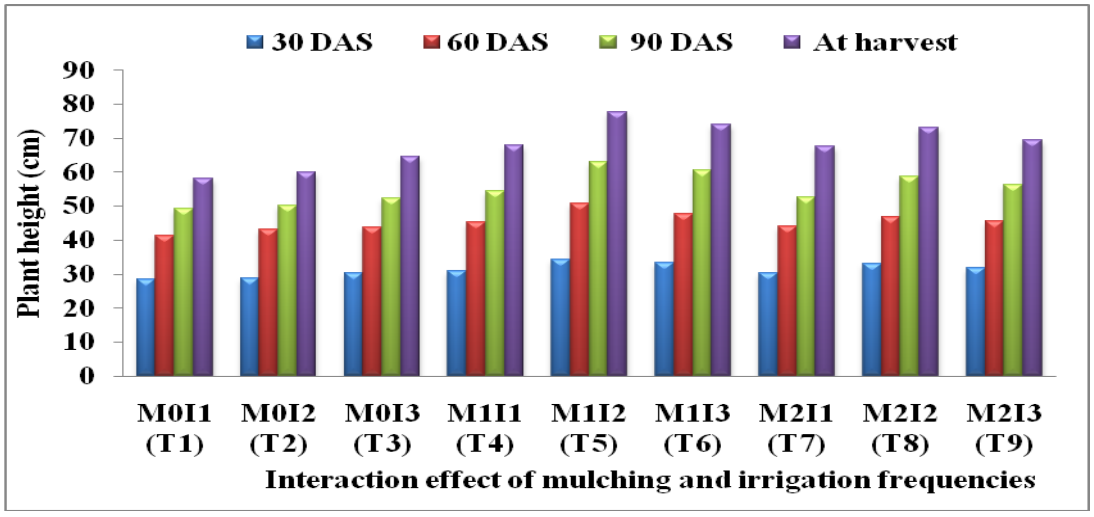


Fig.2 Interaction effect of mulching and irrigation frequencies number of Primary branches per plant

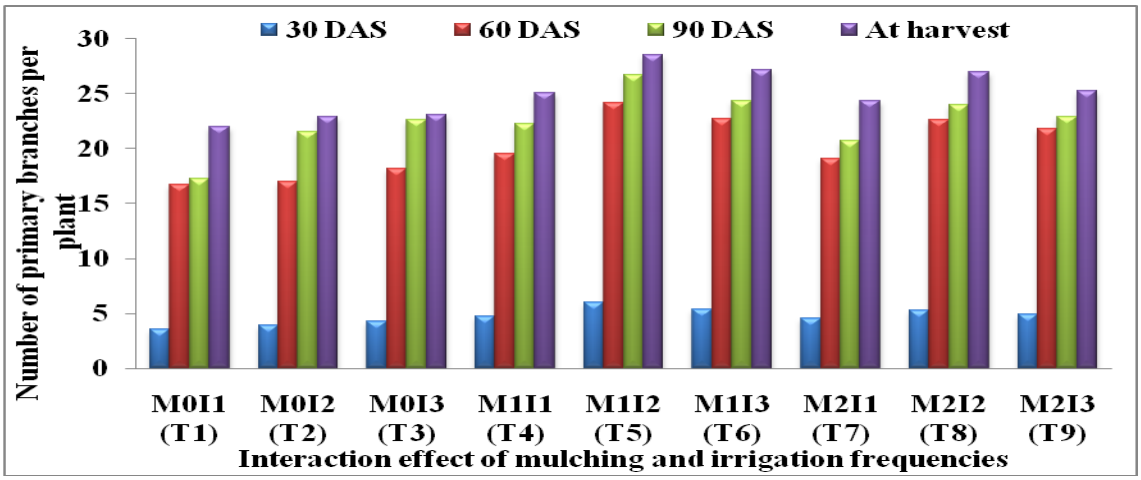


Fig.3 Interaction effect of mulching and irrigation frequencies on number of pods per plant

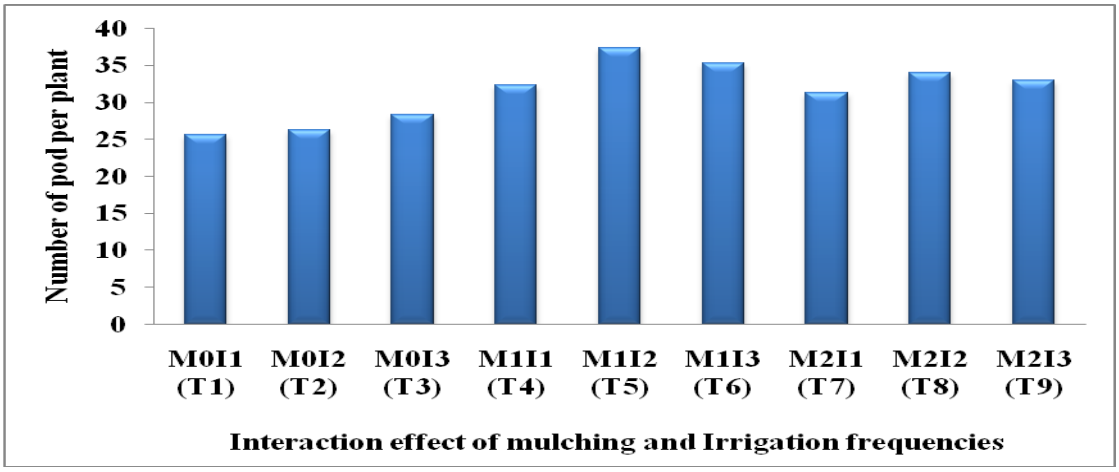


Fig.4 Interaction effect of mulching and irrigation frequencies on seed weight per pod (gm)

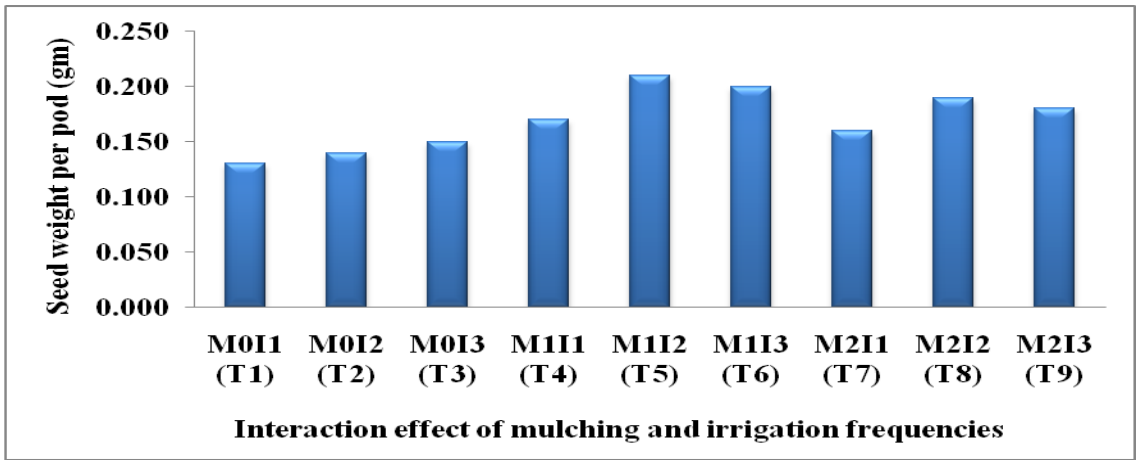
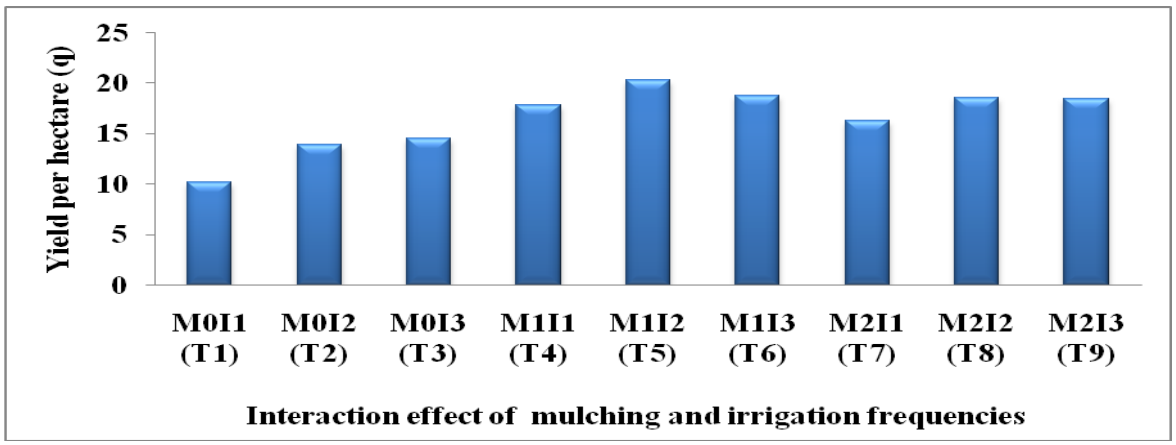


Fig.5 Interaction effect of mulching and irrigation frequencies on yield per hectare



Treatment combination of double irrigation and triple irrigation treatment recorded significantly higher plant height and number primary branches per plant than single irrigation. Krishnamurthy and Steeramula (2007) also observed similar results that highest grain yield (1968.65 kg/ha) was irrigated at flowering stage and pod formation stage. Birbal *et al.*, (2013) observed results interaction effect between drip irrigation and mulch increased growth and yield attributes.

From this study, growth and yield attributes such as plant height (77.67), number of primary branches per plant (28.50), number of pods per plant (37.33), seed weight per pod (0.21 gm) and yield per hectare (20.29 q). Higher in treatment combination M_1 (PPWM) and irrigation frequencies I_2 (at pre sowing + flowering stage) i.e. treatment (T_5) and BPM compare to treatment combination M_0 (NM) + I_1 (pre sowing) i.e. treatment (T_1).

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