

Effect of irrigation regimes and fertilizer levels on productivity of drip irrigated cumin (*Cuminum cyminum* L.)

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Received: 09 July, 2018

Accepted: 10 August, 2018

ABSTRACT

Water stress, especially in arid and semi-arid regions, is a major limitation on crop production in many parts of the world (Flexas *et al.*, 2004) since it not only reduces plant water content but also diminishes cell turgor and growth. It is more important to use water resources wisely and to irrigate intelligently in agriculture, where rainfall is scanty or limited to shorter period (Jeelani *et al.*, 2017). In semi-arid areas bringing new irrigation projects and converting most of cultivated area under micro irrigation is very necessary and this can save and increase water use efficiency of crops (Singh *et al.*, 2015).

Key words: Irrigation, cumin, productivity

India is the world leader in seed spices production, consumption and export. In India cumin, fennel and coriander occupy major area and production among spices. Cumin (*Cuminum cyminum* L.) is a highly remunerative but risky seed spice crop with a short growing cycle, which demands little moisture and nutrient inputs. It is being cultivated in arid and semi arid regions of Gujarat and Rajasthan where soils are sandy in nature with poor water holding capacity, fertility status and remarked with very less rainfall. As a *Rabi* crop cumin needs assured irrigation to germinate and maturity of crop. Cumin is highly sensitive to water stagnation. Irrigating cumin crop either with drip irrigation or micro sprinkler irrigation gave better seed yield as compared to surface irrigation (Singh *et al.*, 2015). Earlier, the research on drip irrigation system to cumin was focused mainly on plant density, irrigation interval only (Alizadeh *et al.*, 2002; Yadav *et al.*, 2003; Akbarinia *et al.*, 2005). The drip irrigation is

beneficial only when the system is designed appropriately and irrigation schedules are adopted properly.

MATERIALS AND METHODS

The experiment was conducted to study "Effect of irrigation regimes and fertilizer levels on productivity of drip irrigated cumin (*Cuminum cyminum* L.)". The experiment was conducted on latest cumin (Gujarat cumin 4) variety. The soil of experimental field was loamy sand having good drainage capacity. It was low in organic carbon (0.27%) and available nitrogen (161 kg/ha), medium in available phosphorus (36.7 kg/ha), sulphur (10.51 ppm) but high in available potash (284 kg/ha).

The experiment was laid out in split plot design with irrigation regimes (0.4 PEF, 0.6 PEF, 0.8 PEF and 0.8 IW/CPE surface method 40 mm depth check) as main plot and fertilizer levels (50%, 75% and 100% RDN) as sub plots for cumin and replicated four times. Cumin variety Gujarat Cumin 4 was grown at the rate of 12 kg/ha on

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November 18, 2017. Seed treated with thiram @ 3.0 g/kg for better germination. The recommended dose of fertilizer is 40:15:00 (N:P:K). In basal dose 30% nitrogen and 100% phosphorus were applied and remaining nitrogen was applied in three equal splits at 30, 40 and 50 days after sowing through drip Irrigation system. The irrigation withholds after physiological maturity, considering base period about 70 day. Cumin crop is sensitive to wilt disease. Hence, to protect the cumin crop from the attack of pest, insect and fungus disease careful actions were taken during crop season. Scheduling of irrigation through drip system was maintained by considering the rate of evaporation as yardstick. The quantity of water delivered per dripper at different places were measured and average flow rate of drippers was utilized to calculate the quantity of water to be delivered and time of operation as per treatments at every alternate day for the drip system.

RESULTS AND DISCUSSION

Impact of irrigation regimes and fertigation levels were analyzed mainly using plant height, number of umbels and yield attributes of cumin. There was increase in plant height with decreased levels of irrigation (pan evaporation replenishment) of cumin (Table 1). During the experimental year 2017-18, irrigation scheduled at 0.4 PEF (Treatment I_1) registered significantly higher plant height at harvest (35.8 cm) than that of with 0.8 IW/CPE ratio but was at par with rest of the levels of irrigation. The application of fertilizer dose proved its non significant effect on the plant height at harvest.

Different levels of irrigation and nitrogen failed to contribute significantly on number of umbels of cumin though, the maximum number of umbels of 34.9 and 32.4 were recorded under treatment I_3 (0.8 PEF) and treatment N_2 (75% RDN) level of

fertigation, respectively. Application of irrigation water through surface method (treatment I_4) showed its inferiority by producing lowest number of umbels (27.6). It might be due to drip irrigation at optimum level improved soil moisture status around the root zone and increased the nutrients availability ultimately resulted in to higher growth and yield attributing characters of cumin. These findings are in accordance with those reported by Singh *et al.* 2015.

A perusal of data indicated that significantly higher seed yield of cumin (744.4 kg/ha) was obtained with drip irrigation scheduled treatment I_2 (0.6 PEF) as compared to treatment I_4 (surface method) but was at par with rest of the treatments. The increase in seed yield under treatment I_2 might be due to maintenance of adequate soil moisture status in the root zone which in turn helped plants to maintain better turgor pressure, thus utilized moisture as well as nutrients more efficiently from wetted area and ultimately enhanced vegetative as well as reproductive growth of the crop. Different levels of nitrogen fertigation failed to exert any significant effect on growth parameters and yield of cumin. However, numerically highest cumin yield (675 kg/ha) was recorded under application of 50% RDN (N_1). Data outlined in Tables 1 showed that combined effect of irrigation and fertigation failed to exert significant interaction effect on parameters studied.

The results of irrigation treatments and fertigation (nitrogen through drip) indicated that the crop responded well to irrigation regimes in terms of plant characters and yield attributes. Treatments I_2 produced highest yield (744.4 kg/ha) of cumin followed by the rest of the treatments. The fertigation treatments (N_1 : 50% RDN) recorded highest yield (675.0 kg/ha) of cumin. Interaction effect of irrigation and nitrogen fertigation was found not significant.

Table 1 Plant height at harvest, number of umbels and seed yield of cumin as influenced by different irrigation scheduling and nitrogen fertigation (2017-18)

Treatments	Plant height at harvest (cm)	Number of umbels	Seed yield (kg/ha)
Irrigation scheduling (I)			
I ₁ : 0.4 PEF	35.8	31.6	665
I ₂ : 0.6PEF	35.4	32.0	744
I ₃ :0.8 PEF	35.1	34.9	672
I ₄ : 0.8 IW/CPE (40 mm depth)	31.0	27.6	565
S.Em. r	0.69	2.11	35
C.D. (P= 0.05)	2.21	NS	110
C.V. %	6.97	23.15	18.08
Nitrogen fertigation (N)			
N ₁ : 50% RDN	33.8	30.3	675
N ₂ : 75% RDN	34.6	32.4	667
N ₃ : 100% RDN	34.7	32.0	643
S.Em. r	0.53	1.25	42
C.D. (P= 0.05)	NS	NS	NS
Interaction			
I × N	NS	NS	NS
C.V. %	6.18	15.83	25.43

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