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Effect of irrigation and nitrogen on seed yield of cumin (*Cuminum cyminum*)

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ABSTRACT

A field study was undertaken during winter season of 1989–90 and 1990–91 at Mandor, to determine suitable irrigation schedule and optimum dose of N for cumin (*Cuminum cyminum* L.) on Alfisols. Application of 5 irrigations at sowing, 10, 30, 55 and 80 days after sowing increased the seed yield in both years compared with 4 irrigations. Higher irrigations frequencies (6) had no additional advantage. The crop responded only up to 20 kg N/ha and gave significantly more seed yield than the unfertilized crop. Seasonal consumptive use of water was 162 mm.

Cumin (*Cuminum cyminum* L.) is mainly grown in Rajasthan and Gujarat, mostly by lift irrigation from open wells and tube-wells. Irrigation water is not only scarce but also a costly commodity for the irrigation in these states.

The crop responds to variable irrigation frequencies (Patel *et al.*, 1992). Excessive watering may lead to disease invasion in cumin. A suitable irrigation schedule has remained one of the major constraints for this crop in realization of full yield potential. Benefits from nitrogen depends on the available soil nitrogen, which inturns, is dependent on water supply.

In the present investigation, an attempt was made to determine the effect of irrigation and N fertilization on yield of cumin grown in sandyloam soils of western Rajasthan.

MATERIALS AND METHODS

A field investigation was carried out during the winter seasons of 1989–90 and 1990–91 at Mandor. The treatment comprised 3 irrigation frequencies (4, 5 and 6) in main plots and 4 levels of nitrogen (0, 20, 40 and 60 kg/ha) in subplots, were replicated thrice in split-plot design.

The soil of the experimental field was sandy loam in texture and alkaline in reaction (8.1 pH). It was low in organic carbon (0.26%), medium in available P (20 kg/ha) and rich in available K (230 kg/ha). The field capacity and permanent wilting point in 0–45 cm soil layer were 7.92 and 2.82% respectively, with a bulk density of 1.50 g/cm. Cumin variety 'RZ 19' was seeded in rows at 30 cm apart on 25 November 1989 and 20 November 1990. A uniform basal dose of 20 kg P_2O_5/ha was applied at sowing. Nitrogen was applied in 2 equal splits, 50% at sowing and 50% at the time of third irrigation. Irrigation depth was kept 50 mm in all irrigation levels during both the years. Soil samples were collected from 3 succes-

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Table 1. Yield attributes and seed yield of cumin as influenced by irrigation and nitrogen

Treatment	Branches/plant		Umbels/plant		Umbelets/plant		Test weight (g)		Seed yield (kg/ha)		
	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Y_1	Y_2	Mean
Irrigation frequency											
4	5.4	6.1	29.3	19.5	101.1	88.4	5.09	4.03	825	470	647
5	5.6	6.4	33.4	22.5	130.5	99.6	5.36	4.45	965	564	764
6	6.0	6.9	35.4	21.8	132.4	99.6	5.44	4.11	920	593	756
CD (P = 0.05)	NS	NS	3.1	2.6	7.6	5.4	NS	NS	84	77	
N (kg/ha)											
0	4.4	5.9	29.1	16.6	97.5	78.7	5.42	4.12	732	450	591
20	6.3	7.0	35.8	23.0	128.5	102.6	5.30	4.19	945	587	766
40	5.9	6.2	33.2	23.0	128.8	102.2	5.18	4.19	965	544	754
60	6.1	6.6	34.1	22.6	130.4	100.0	5.20	4.28	972	588	780
CD (P = 0.05)	1.4	NS	3.9	3.2	8.5	5.1	NS	NS	76	89	

Y_1, 1989–90; Y_2, 1990–91

Four irrigations, at sowing, 10, 40 and 70 days after sowing (DAS); 5 irrigations, at sowing, 10, 30, 55 and 80 DAS; 6 irrigations, at sowing, 10, 30, 50, 70 and 90 DAS

sive soil layers (0–15, 15–30 and 30–45 cm depth) for determination of soil moisture content by gravimetric method at sowing, before each irrigation and 24 hr after of the irrigation and at harvest. Computation of the consumptive use of water was done as per procedure suggested by Dastane (1972). Water-use efficiency of different treatments was determined as defined by Viets (1962). Weed management, thinning and other operations was carried out as recommended for this crop.

RESULTS AND DISCUSSION

Irrigation schedule had a significant influence on seed yield and yield components (Table 1). Application of 5 irrigations at sowing, 10, 30, 55 and 80 days after sowing recorded significantly higher seed yield than 4 irrigations schedule during both the years. This might be attributed to enhancement in number of umbels and umbelets/plant. Mean seed yield of the 2 seasons revealed that schedule of 5 irrigations increased the seed yield by 18.1% over 4 irrigations (647 kg/ha). However, there was no significant difference in seed yield between 5 and 6 irrigation frequencies. Patel *et al.* (1992) also reported that 5 irrigations commencing immediately after sowing were sufficient for the optimum seed yield of cumin.

Nitrogen fertilization showed an overall increase in yield attributes and seed yield in both the seasons. The crop responded only up to 20 kg/ha and resulted in significant improvement in number of branches, umbels and umbelets/plant and seed yield over unfertilized plots. Application of 20 kg N/ha enhanced mean seed yield to 29.6% over the control (591 kg/ha). This crop responds to the nitrogen application and optimum dose varies from 30 kg at Jobner (Choudhary and Gupta. 1989) to 35 kg N/ha on sandy loam soils at Durgapura (Bhargave *et al.*, 1989). No beneficial effect of nitrogen beyond 20 kg/ha was observed. This probably might be due to its inherently low biomass production.

The successive increase in irrigation frequency from 4 to 6 progressively increased the seasonal consumptive use of water by cumin. The highest mean seasonal consumptive use of 162 mm was computed at 6 irrigations. The mean increase in

Table 2. Effect of levels of irrigation and nitrogen on consumptive use of water and water-use efficiency of cumin

Treatment	Consumptive use of water (mm)			Water-use efficiency (kg/ha-mm)		
	1989–90	1990–91	Mean	1989–90	1990–91	Mean
Irrigation frequency						
4	131	120	121	6.30	3.91	5.10
5	152	142	149	6.35	3.97	5.16
6	164	158	162	5.61	3.75	4.68
N (kg/ha)						
0	127	117	122	5.76	3.84	4.80
20	152	144	148	6.21	4.07	5.14
40	157	148	152	6.14	3.67	4.90
60	160	151	155	6.07	3.89	4.98

Details of irrigation given in Table 1

consumptive use was 13 and 41 mm over 5 and 4 irrigation frequencies respectively. The irrigation water-use efficiency (WUE) was marginally increased due to the application of 5 irrigations in both seasons over 4 and 6 irrigations. Increasing level of nitrogen from 0 to 60 kg/ha increased the seasonal consumptive use. However, there was not much variation amongst 20, 40 and 60 kg N/ha. Similar trend was also observed in water-use efficiency (WUE). The results confirm the findings of Patel *et al.* (1992).

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