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Feasibility of drip irrigation in fennel (*Foeniculum vulgare* Miller)

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ABSTRACT

Different nine fertigation treatments and surface method of irrigation were tested under RBD with four replications during 2005-06 to 2007-08 at Centre for Research on Seed Spices, SDAU, Jagudan to study the "Feasibility of drip irrigation in fennel". Effect of different fertigation treatments on growth and yield attributes as well as yield of fennel was significant during course of investigation and in pooled results where as, oil content was not influenced significantly. Crop irrigated at 0.8 ADPEF with 80% RDN recorded maximum umbels per plant, seeds per umbellate and test weight, whereas, no. of branches per plant was the highest when crop receive irrigation at 1.0 ADPEF with 80% RDN. The tallest plants were observed under 0.8 ADPEF with 100% RDN. Application of 80 kg N ha^{-1} through drip at 0.8 ADPEF ratio (T5) recorded maximum seed yield during the period of experimentation and in pooled data also and was statistically near to equal with 1.0 ADPEF + 80 kg N ha^{-1} (T8). Water use efficiency increased with increased in application of nitrogen levels from 60 to 80% of RDN then it was reduced drastically with further increase in nitrogen *i.e.*, 100% of RDN, which was the minimum. Maximum gross and net realizations were obtained when crop was irrigated at 0.8 ADPEF + 80% of RDN (80 kg N ha^{-1}). It was closely followed by 1.0 ADPEF + 80% of RDN. However, the highest BCR was recorded under surface method of irrigation with RDF (100 + 60 kg NP ha^{-1}).

Key words : Fertigation, fennel, feasibility, irrigation

Spices crops play an important role in Indian economy. Demand of spices increase at 10-12% per annum in world market due to change in food habit and established as ayurvedic medicines. Arid to semi arid regions of Gujarat are well know in India and abroad for their quality production. Soils of these regions are poor in fertility and water retentive capacity. Irrigation water and fertilizer are costly and scare inputs for crop production. Adoption of fertigation through drip irrigation is only alternative for economic use of water and fertilizer, which reduced consumption of costly inputs and increased yields. Fennel is well remunerative spice crop of north Gujarat which grown during *kharif* and *rabi* seasons. Scientific information regarding application of water and fertilizer through drip irrigation system is scanty. Hence the present experiment was planned.

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MATERIALS AND METHODS

The experiment was conducted for three consecutive years from 2005-06 to 2007-08 at Centre for Research on Seed Spices, SDAU, Jagudan (Gujarat). The soil was loamy sand in texture, neutral in soil reaction, with low in organic carbon, medium in available Phosphorus and Potash. An experiment comprising a set of nine fertigation treatments and surface method of irrigation (Table 1) were laid out in randomized block design with four replications. The crop was transplanted at 90 x 60 cm spacing by using seedling of cv. Gujarat fennel 2. The drip irrigation system was laid out at lateral spacing of 90 cm with dripper spacing of 60 cm and operated at pressure of 1.2 kg cm^{-2} with 4 LPH discharge rate. The scheduling of irrigation was done with 0.6, 0.8 and 1.0 ADPEF and 100, 80 and 60% RDN was applied as per treatment At the time of transplanting 60 kg P and 20% N ha^{-1} were applied as basal dose, whereas, remaining 80% N was applied in four equal splits at one month interval through drip system starting 30 days after transplanting. In surface

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method of irrigation fertilizer dose applied in *i.e.*, 40 + 60 kg NP ha^{-1} as basal dose and remaining nitrogen applied in two equal splits at 30 and 60 days after transplanting. All the recommended package of practices was followed during the crop period as per need of the crop.

RESULTS AND DISCUSSION

Effect on growth and yield attributes

Effect of different fertigation treatments on growth and yield attributes of fennel was significant in pooled results. Crop irrigated at 0.8 ADPEF with 80% RDN recorded maximum umbels per plant, seeds per umbellate and test weight, whereas, no. of branches per plant was the highest when crop receive irrigation at 1.0 ADPEF with 80% RDN. The tallest plants were observed under 0.8 ADPEF with 100% RDN. The minimum values of all the growth and yield attributes were recorded when crop was irrigated under surface irrigation method with 100% RDF (Table 1).

Effect on yield

Seed yield of fennel was significantly influenced by various fertigation treatments during the course of investigation and in pooled data (Table 2). Application of 80 kg N ha^{-1} through drip at 0.8 ADPEF ratio (T5) recorded maximum seed yield during the period of experimentation and in pooled data also and was statistically near to equal with 1.0 ADPEF + 80 kg N ha^{-1} (T8). These both the treatments (T5 and T8) recorded 25 & 19, 36 & 27, 29 & 27 as well as 30 & 24 per cent higher seed yield than control (surface method with 100+60 kg NP ha^{-1}) during 2005-06, 2006-07, 2007-08 and pooled data, respectively. Application of adequate amount of water and nitrogen in root zone as per need of crop during crop growth period might be increased yield and save 20 per cent nitrogen *i.e.* 20 kg per hectare and water. According to patel *et al.*, (2000), drip irrigation system in fennel save the water.

Effect on quality

Effect of different ADPEF ratios with various nitrogen levels under drip and surface irrigation method on volatile oil content was non-significant during course of investigation and in pooled data also. However, beneficial effect of fertigation was observed on quality (Table 1).

Water Use Efficiency

Water use efficiency increased with increased in application of nitrogen levels from 60 to 80% of RDN

Table 1 Growth and yield attributes of fennel as influenced by different treatments of fertigation (Pooled data of 2005-06, 2006-07 and 2007-08)

Treatments	Plant height (cm)	No. of branches per plant	No. of umbels per plant	No. of umblt. per umbel	No. of seeds per umbrella.	1000 Seed weight (g)	Volatile oil (%)	Water applied (mm)	WUE (kg ha-mm^{-1})
T1 0.6 ADPEF + 100% RDN	178.85	9.71	26.77	39.68	37.98	7.96	1.22	366	5.30
T2 0.6 ADPEF + 80% RDN	182.88	9.73	27.57	41.85	37.90	7.84	1.18	366	5.47
T3 0.6 ADPEF + 60% RDN	181.13	9.49	25.30	39.80	34.63	7.45	1.17	366	4.99
T4 0.8 ADPEF + 100% RDN	185.83	10.43	27.22	41.82	40.37	7.78	1.17	487	4.46
T5 0.8 ADPEF + 80% RDN	183.63	10.14	28.75	45.58	38.85	8.23	1.43	487	4.99
T6 0.8 ADPEF + 60% RDN	180.97	10.22	26.39	43.62	38.75	7.49	1.22	487	4.14
T7 1.0 ADPEF + 100% RDN	184.77	10.05	27.37	42.93	37.78	7.90	1.28	610	3.46
T8 1.0 ADPEF + 80% RDN	185.52	10.67	28.37	44.40	40.68	7.85	1.36	610	3.78
T9 1.0 ADPEF + 60% RDN	182.18	10.15	26.40	41.38	37.33	7.70	1.27	610	3.20
T10 Control (0.8 IW/CPE ratio 50mm depth) + RDF 100 + 60 kg NP ha-1	174.58	8.92	23.93	36.48	35.00	7.47	1.07	533	3.66
S.Em.±	1.83	0.314	0.690	1.034	0.905	0.127	0.074	-	-
C.D. at 5 %	5.13	0.88	1.94	2.91	2.54	0.36	NS	-	-
C.V.%	3.30	10.98	9.15	8.52	8.08	5.78	14.99	-	-
Y X T	NS	NS	NS	NS	NS	NS	0.26	-	-

Table 2 Seed yield, net return, net BCR and ICBR (kg/ha) of fennel as influenced by different treatments of fertigation

Treatments	Seed Yield(kg ha^{-1})				Gross Income (₹ ha^{-1})	Gross Expen-diture (₹ ha^{-1})	Net Return (₹ ha^{-1})	Net BCR	ICBR
	2005-06	2006-07	2007-08	Pooled					
T1 0.6 ADPEF + 100% RDN	1575	2225	1999	1933	96650	38250	58400	1.52	1:0.39
T2 0.6 ADPEF + 80% RDN	1764	2212	2014	1997	99850	37987	61863	1.63	1:0.78
T3 0.6 ADPEF + 60% RDN	1549	2101	1820	1823	91150	37725	53425	1.42	-
T4 0.8 ADPEF + 100% RDN	1789	2548	2179	2172	108600	39832	68768	1.73	1:1.48
T5 0.8 ADPEF + 80% RDN	2088	2762	2435	2428	121400	39568	81832	2.07	1:2.77
T6 0.8 ADPEF + 60% RDN	1672	2277	2093	2014	100700	39305	61395	1.56	1:0.76
T7 1.0 ADPEF + 100% RDN	1744	2475	2112	2110	105500	41439	64061	1.55	1:1.02
T8 1.0 ADPEF + 80% RDN	1976	2591	2352	2307	115350	41175	74175	1.80	1:1.88
T9 1.0 ADPEF + 60% RDN	1585	2289	1989	1954	97700	40913	56787	1.39	1:0.39
T10 Control (0.8 IW/CPE ratio 50mm depth) + RDF 100 + 60 kg NP ha-1	1664	2034	1889	1863	93150	29368	63782	2.17	-
S.Em.±	78	127	109	58					
C.D. at 5 %	225	368	317	163					
C.V. %	8.90	10.78	10.45	10.33					
Y X T	-	-	-	NS					

then it was reduced drastically with further increase in nitrogen i.e. 100% of RDN, which was the minimum. Crop receives irrigation water at 0.6 ADPEF recorded maximum WUE. Where as, it was the lowest under 1.0 ADPEF. Higher water use efficiency was recorded under drip irrigation system then surface method of irrigation and fertilized with 100% RDF (Table 1). As compared to surface method of irrigation with 100% RDF, fertigation treatments with 0.6 and 0.8 ADPEF increased yield, WUE and save water considerably. Similar results were reported by Annonymus (2009) in chilly.

Economics

Maximum gross and net realizations were obtained when crop was irrigated at 0.8 ADPEF + 80% of RDN (80 kg N ha-1). It was closely followed by 1.0 ADPEF+ 80% of RDN (Table 2). However, the highest BCR was recorded under surface method of irrigation with RDF due to minimum cost of cultivation. The lowest net realizations was recorded with 0.6 ADPEF + 60% of RDN (60 kg N ha^{-1}). Crop was irrigated at 0.8 ADPEF + 80% of RDN (80 kg N ha^{-1}) recorded 28 percent higher yield than surface method of irrigation with 100% RDF. This treatment also saves the water up to 10 per cent. Thus, saved 10% water can irrigate additional 0.10 ha land under drip method, which will give an additional net profit of ₹ 7365/ha.

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