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Influence of organic manures alone or in combination with inorganic fertilizer on productivity of winter drilled fennel (*Foeniculum vulgare*)

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ABSTRACT

Effect of organic manures [castor cake, mustard cake and farmyard manure (FYM)] alone or in combination with inorganic fertilizers was studied during 1997–98 to 1999–2000 on yield, quality and economics of winter fennel (*Foeniculum vulgare* Mill.) at Main Spices Research Station, Jagudan. Maximum seed yield and its attributes were obtained when recommended fertilizer dose applied through inorganic fertilizer. Different organic manures (castor cake, mustard cake and FYM) were equally effective and gave significantly lower seed yield than that with inorganic fertilizer. Application of different organic manures alone or mix with inorganic fertilizers significantly improved the oil content of fennel (1.56 to 1.64%). The highest net profit (Rs/ha 70,139) and benefit : cost ratio (4.13) were obtained when recommended dose of fertilizer applied in the form of chemical fertilizers. However, on the basis of premium price of organic product, recommended fertilizer dose applied through FYM alone recorded the maximum net realization 90,393 (Rs/ha) and benefit : cost ratio (1 : 5.14).

Key words : Fennel, Castor cake, Mustard cake, FYM

Fennel is an important seed spice crop grown as rainy-season, transplanted or winter drilled crop under North Gujarat and Rajasthan conditions where light-textured soils are poor in fertility. Green seeds with uniform size and free from chemical residues, bioagents or physical impurities are preferred by customer and have high demand in national as well as international market with premium price. Among the various factors contributing towards the attainment of potential yield with good quality, fertilizer management has considerable practical importance. Unjudicious use of chemical fertilizers not only harms the soil health but also increases the cost of production. In view of the escalating prices and high demand-supply gap of chemical fertilizers, there is a strong need to adopt integrated nutrient supply system to improve soil health and quality production. Therefore present study was taken to develop a suitable nutrient-management practice for fennel crop based on organic farming.

MATERIALS AND METHODS

The field experiment was conducted at Main Spices Research Station, Jagudan, during winter season of 1997–98 to 1999–2000 in randomized block design, having 4 replications. There were 8 treatments (Table 1), comprising 3 organic sources [castor cake, mustard cake and farmyard manure (FYM)] alone or in conjunction with inorganic fertilizer and inorganic fertility only. The soil was sandy loam with slightly alkaline in soil reaction (8.1 pH), low in organic carbon (0.23%), medium in available P_2O_5 (35 kg/ha) and rich in available potassium (415 kg/ha). The recommended fertilizer dose, i.e. 90 + 45 kg N+P/ha applied as per treatments except F_8 where only nitrogen applied through chemical fertilizer. 'Gujarat Fennel 1' was sown during the fourth week of October, keeping 45 cm inter-row spacing with uniform seed rate of 5 kg/ha, while crop was harvested at the end of March. Intra-row spacing of 15 cm was maintained by thinning operation. Recommended cultural practices were also adopted as per need of crop.

RESULTS AND DISCUSSION

Yield-attributing characters

Most of yield-attributing characters of the fennel, viz. branches/plant, umbellates/umbel as well as seeds/umbellates and test weight, were equally effective when recommended fertilizer dose applied in form of various organic sources (caster cake, mustard cake and FYM) alone or in combination with inorganic fertilizer at the ratio of 1:1 (Table 1). Application of organic manures with inorganic fertilizers and inorganic fertilizer (only nitrogen) were statistically most similar but recorded significantly higher umbels/plant compared to organic sources alone. Crop fertilized with nitrogen and phosphorus fertilizers (F_7) recorded the maximum yield attributes and signifi-

cantly superior to rest of the treatments. Similar trend was observed for plant height, but the effect was non-significant. Quick and easy availability of primary nutrients in chemical fertilizers resulted in profuse vegetative growth. The results support the findings of Bhati *et al.* (1989) and Ashok Kumar *et al.* (2000).

Quality

Oil content of fennel seeds were significantly influenced by various treatments (Table 1). Application of rec-

Table 1. Yield-attributing characters and oil content of winter fennel as influenced by organic and inorganic fertilizers (pooled data of 3 years)

	Treatment	Plant height (cm)	Branches/ plant	Umbels/ plant	Umbellates/ umbel	Seeds/ umbellate	Test weight (g)	Volatile oil (%)
F_1,	R.D. of N in form of castor cake	124.35	5.75	14.78	23.08	24.37	6.49	1.64
F_2,	R.D. of N in form of mustard cake	120.30	5.95	14.98	23.92	23.68	6.42	1.62
F_3,	R.D. of N in form of FYM	117.38	5.83	15.58	23.07	23.73	6.54	1.58
F_4,	R.D. of N in form of CC + inorganic fertilizer at the ratio of 1:1	120.55	6.23	17.85	25.52	25.05	6.58	1.61
F_5,	R.D. of N in form of MC + inorganic fertilizer at the ratio of 1:1	120.03	6.07	17.17	24.15	24.62	6.53	1.61
F_6,	R.D. of N in form of FYM + inorganic fertilizer at the ratio of 1:1	121.98	5.98	17.73	26.09	25.53	6.56	1.56
F_7,	R.D. of N as inorganic fertilizer (N and P)	124.18	7.11	20.98	27.93	28.12	7.37	1.54
F_8,	R.D. of inorganic fertilizer (N only)	119.77	6.27	18.70	25.77	26.20	6.92	1.49
	CD (P=0.05)	NS	0.57	1.51	1.71	1.81	0.32	0.07
	CV (%)	5.17	11.58	10.31	8.92	9.22	5.56	11.85

R.D., Recommended dose; CC, castor cake; M.C., mustard cake

Table 2. Fennel seed yield and economics as influenced by different treatments

Treatment	Yield (kg/ha)			Yield (kg/ha)	Gross realization (R/ha)		Total cost of production (Rs/ha)	Net realization (Rs/ha)		More return over inorganic fertilizer	Net cost : benefit ratio	
	1997–98	1998–99	1999–2000		Normal price	1.5 times more price		Normal price	1.5 times more price		Normal price	1.5 time more price
F_1, RD of N in form of castor cake	1,677	2,391	1,919	1,996	69,860	104,790	17,960	51,900	86,830	16.691	1:2.89	1:4.83
F_2, RD of N in form of mustard cake	1,775	2,068	1,902	1,915	67,025	100,538	20,480	46,545	80,058	9.919	1:2.27	1:3.97
F_3, R.D. of N in form of FYM	1,869	2,687	1,615	2,057	71,995	107,993	17,600	54,395	90,393	20,254	1:3.09	1:5.14
F_4, R.D. of N in form of C.C.+inorganic fertilizer at the ratio of 1:1	2,083	2,676	2,033	2,264	79,240		16,463	62,827			1:3.83	
F_5, R.D. of N in form of MC+inorganic fertilizer at the ratio of 1:1	1,984	2,619	1,795	2,133	74,655		17,673	56,980			1:3.22	
F_6, R.D. of N in form of FYM + inorganic fertilizer at the ratio of 1:1	1,912	2,469	2,327	2,236	78,260		16,233	62,027			1:3.82	
F_7, R.D. of inorganic fertilizer (N and P)	2,176	2,825	2,365	2,456	85,960		15,821	70,139			1:4.43	
F_8, R.D. of N as inorganic fertilizer (N only)	1,984	2,449	2,140	2,191	76,685		14,955	61,730			1:4.13	
CD (P=0.05)	214	328	262	304								
C.V.(%)	7.53	8.85	8.85	8.58								

Purchase price (Rs/tonne): Caster cake, 2,200; mustard cake, 3,600; FYM, 200; nitrogen, 8.42 Rs/kg; phosphorus, 19.25 Rs/kg
Selling price, Rs 35/kg

ommended fertilizer dose through castor cake alone (F_1) recorded maximum oil content and was at par with treatments F_2, F_3, F_4 and F_5 but significantly superior to rest of the treatments, supporting the findings of Randhava *et al.* (1981) and Ahmed *et al.* (1988). The lowest oil content was recorded when only nitrogen was applied in form of chemical fertilizer (F_8).

Seed yield

Seed yield of fennel was significantly influenced by various treatments during individual year and also in pooled data (Table 2). During 1997–98, the maximum seed yield was obtained with application of recommended fertilizer dose through inorganic fertilizers (F_7) and was at par with treatments F_4, F_5 and F_8, but significantly superior to rest of the treatments. During the second year, crop fertilized with recommended dose in form of inorganic fertilizers F_7 gave maximum seed yield and was statistically similar with treatment F_3, F_4 and F_5 but higher than the rest of the treatments. In 1999–2000, treatment F_7 recorded maximum yield and did not differ significantly with treatments F_6 and F_8 but gave yield remarkably higher than the rest of the treatments. In pooled data, application of N and P fertilizers alone (F_7) gave maximum seed yield and was at par with treatments F_4, F_6 and F_8 but significantly higher yield than the rest of the treatments. The higher yield was recorded under inorganic fertilizers alone or in combination with organic manures might be owing to quick availability of primary nutrients, which accelerate the photosynthesis rate. Similar findings were also obtained by Sharma and Gill (1985) and Ashok Kumar *et al.* (2000). All the organic sources, i.e. castor cake, mustard cake and FYM (F_1, F_2 and F_3), were equally effective and resulted in lower seed yield. This might be due to slow availability of primary and secondary nutrients which resulted in poor growth.

Economics

Application of recommended fertilizer dose through inorganic fertilizers (F_7) recorded maximum net realization and benefit : cost ratio followed by treatment F_8, i.e. only nitrogen applied in the form of chemical fertilizer. However, considering the price of organic product, i.e. 1.5 times more, the highest net realization and benefit : cost ratio were registered when crop was manured with FYM alone (F_3). The lowest values of net realization and benefit : cost ratio were accrued with application of mustard cake because of high price of cake (Table 2).

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