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Effect of different sources of organic manures with and without bio fertilizers in Cumin (*Cuminum cyminum* L.)

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Abstract

A field experiment was conducted at Centre for Research on Seed Spices, Sardarkrushinagar Dantiwada Agricultural University, Jagudan, Dist.: Mehsana (Gujarat) during *rabi* 2005-2006 to 2009-2010 to study the feasibility of organic farming in cumin.Effect of different organic farming treatments on growth and yield attributes of cumin were observed significant except plant height, numbers of seeds per umbellate and oil content. Seed yield of cumin was the maximum under recommended dose of fertilizer (T_{13}).After fourth year, the maximum yield was obtained under treatment T_5 and was at par with treatments T_1, T_2, T_{11} ,T_{12} and T_{13}. However, in pooled data, organic manure with bio-fertilizers was significantly superior over organic manure alone. Both the organic sources (FYM and vermicompost) were statistically at per, but FYM was slightly more effective than vermi compost. The maximum removal of nitrogen, phosphorus and potash by seed was recorded when crop received RDF through fertilizer (T_{13}).Application of recommended nitrogen through vermicompost with biofertilizers recorded maximum organic carbon and available potash. Application of 100 percent of RDN through FYM with biofertilizers (*Azatobacter* and PSB) can fulfill the nutrient requirement of cumin under organic farming condition.

Key words : Cumin, recommended dose of fertilizers (RDF), farm yard manures (FYM), cost benefit ratio (CBR), net realization

Introduction

India occupies supreme position in terms of production, productivity, consumption and export of seed spices, therefore it is known as home of spices. Seed spices are low volume but high value crop and constitute an export oriented agricultural commodities. Cumin is an important seed spice and cash crop of semiarid regions of Gujarat and Rajasthan due to requirement of fewer inputs. However, it is risky crop due to incidence of diseases i.e. blight and wilt. Ever increasing price and shortage of chemical fertilizers with deterioration of soil health by unbalanced and injudicious use of chemical fertilizer necessitate the use of available renewable sources of plant nutrients. Awareness in the pollution free environment, soil health and quality production that is free from chemical residues has been increasing recently, Products obtained under organic farming condition are qualitative and fetches higher market price. Thus, adoptions of organic farming in cumin not only sustain the productivity and fertility of soil but also increase the income of farmers. Information available on cultivation of cumin under organic farming is scanty and therefore, an experiment was planned.

Materials and methods

A field experiment was conducted at Centre for Research on Seed Spices, SDAU, Jagudan, Dist.: Mehsana (Gujarat), to study the productivity of cumin under organic farming condition, during *rabi* 2005-2006 to 2009-2010. Fourteen treatments were studied in randomized block design with four replications (Table 1).Experimental soil was loamy sand in texture with poor organic matter (0.20 %), medium in available phosphorus, high in available potash (254 kg/ha) and slightly alkaline in soil reaction (pH : 8.10).Experiment was conducted on same site for five years . Cumin *cv*. GC 4 was sown during first fortnight of November by line sowing at 30 cm apart with uniform seed rate of 10 kg/ha. As per need of crop all recommended cultural practices were adopted timely.

Results and discussion

Growth and yield attributes

Effect of different organic farming treatments on growth and yield attributes of cumin were significant (Table 1) except plant height, number of seeds per umbellate. The maximum branches per plant was recorded under treatment T_1 and was at par with treatments T_6, T_{11} and T_{13} but remarkably higher than rest of the treatments. Number of umbels per plant were the maximum under treatment T_{13} and was at par with treatments T_1,T_2,T_5, T_6 and T_{11}. Number of umbellates per umbel was the highest under treatment T_1 and was at par with with treatments T_2 ,T_5 ,T_6,T_7 and T_{13}. Similarly, test weight was also

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Table 1: Growth and yield attributes of cumin as influenced by different sources of organic manures with and without bio fertilizers (pooled data of 2006-2008,2008-2009 and 2009-2010)

Tr. No.	Treatment	Plant height (cm)	Number of branches per plant	Number of umbels per plant	Number of umbellate per umbel	Number of seeds per umbellate	Test weight (g)	Volatile Oil (%)
T_1	100% Nitrogen through FYM + *Azotobacter* + PSB	28.11	3.66	13.04	**4.95**	**4.99**	4.22	4.05
T_2	75% Nitrogen through FYM + *Azotobacter* + PSB	26.00	3.13	12.25	4.69	4.86	4.09	3.99
T_3	50% Nitrogen through FYM + *Azotobacter* + PSB	26.49	3.14	11.68	4.58	4.83	3.89	4.20
T_4	25% Nitrogen through FYM + *Azotobacter* + PSB	27.17	3.33	11.68	4.45	4.75	3.89	3.96
T_5	100% Nitrogen through vermicompost + *Azotobacter* + PSB	26.85	3.32	13.53	4.76	4.87	4.02	3.99
T_6	75% Nitrogen through vermicompost + *Azotobacter* + PSB	26.33	3.56	12.47	4.70	4.92	3.97	4.07
T_7	50% Nitrogen through vermicompost + *Azotobacter* + PSB	26.57	3.13	11.93	4.67	4.87	3.94	4.01
T_8	25% Nitrogen through vermicompost + *Azotobacter* + PSB	26.33	3.15	11.27	4.48	4.78	3.90	3.87
T_9	Only *Azotobacter* culture	26.01	3.04	11.83	4.63	4.92	3.89	3.96
T_{10}	Only PSB culture	26.58	3.13	11.26	4.60	4.94	3.96	3.95
T_{11}	100% Nitrogen through FYM only	27.10	3.38	12.77	4.59	4.98	4.24	3.89
T_{12}	100% Nitrogen through vermicompost only	26.23	3.20	11.80	4.51	4.96	4.18	3.90
T_{13}	Only inorganic fertilizer as per recommendation	27.94	3.46	13.65	4.76	4.93	4.38	4.10
T_{14}	Absolute control	26.05	3.24	11.55	4.33	4.83	3.94	3.85
	S.Em.	0.52	0.11	0.54	0.11	0.12	0.088	0.089
	C.D. at 5%	NS	0.30	1.49	0.30	NS	0.24	NS
	c.v.%	8.71	14.35	20.25	10.13	10.46	9.91	6.64
	Y x T	NS	NS	NS	NS	NS	NS	Sign

Table 2: Seed yield (kg/ha) of cumin as influenced by different sources of organic manures with and without bio fertilizers (2006-2008, 2008-2009 and 2009-2010 and pooled data)

Tr. No.	Treatments	Cumin seed yield(kg/ha)					
		2005-06	2006-07	2007-08	2008-09	2009-10	Pooled
T_1	100% Nitrogen through FYM + *Azotobacter* + PSB	432	548	537	381	408	461
T_2	75% Nitrogen through FYM + *Azotobacter* + PSB	409	411	448	349	360	395
T_3	50% Nitrogen through FYM + *Azotobacter* + PSB	391	399	432	324	344	378
T_4	25% Nitrogen through FYM + *Azotobacter* + PSB	385	357	394	313	338	358
T_5	100% Nitrogen through vermicompost + *Azotobacter* + PSB	464	470	474	369	413	438
T_6	75% Nitrogen through vermicompost + *Azotobacter* + PSB	488	393	443	337	347	402
T_7	50% Nitrogen through vermicompost + *Azotobacter* + PSB	426	367	424	331	334	376
T_8	25% Nitrogen through vermicompost + *Azotobacter* + PSB	403	345	408	317	313	357
T_9	Only *Azotobacter* culture	368	341	420	300	212	328
T_{10}	Only PSB culture	341	327	431	325	205	326
T_{11}	100% Nitrogen through FYM only	390	500	479	325	373	413
T_{12}	100% Nitrogen through vermicompost only	434	448	408	315	358	393
T_{13}	Only inorganic fertilizer as per recommendation	495	688	615	402	385	517
T_{14}	Absolute control	255	304	378	278	191	281
	S.Em.	23	60	34	19	21	16
	C.D. at 5%	66	172	98	56	59	45
	C.V. %	11.38	28.58	15.17	11.67	12.60	18.07
	Y x T	-	-	-	-	-	NS

Table 3: Uptake of nutrients by Cumin seed as influenced by different sources of organic manures with and without bio fertilizers (pooled data of 2006-2008,2008-2009 and 2009-2010)

Tr No	Treatments	Nutrients Uptake (Kg/ha)		
		N	P	K
T_1	100% Nitrogen through FYM + *Azotobacter* + PSB	9.59	1.90	7.81
T_2	75% Nitrogen through FYM + *Azotobacter* + PSB	7.82	1.27	6.13
T_3	50% Nitrogen through FYM + *Azotobacter* + PSB	7.19	1.22	5.89
T_4	25% Nitrogen through FYM + *Azotobacter* + PSB	6.91	1.93	5.50
T_5	100% Nitrogen through vermicompost + *Azotobacter* + PSB	9.52	1.67	7.88
T_6	75% Nitrogen through vermicompost + *Azotobacter* + PSB	8.29	1.42	6.66
T_7	50% Nitrogen through vermicompost + *Azotobacter* + PSB	7.38	1.33	6.09
T_8	25% Nitrogen through vermicompost + *Azotobacter* + PSB	7.03	1.05	5.82
T_9	Only *Azotobacter* culture	6.73	0.92	4.97
T_{10}	Only PSB culture	6.75	1.08	5.01
T_{11}	100% Nitrogen through FYM only	8.71	1.38	6.69
T_{12}	100% Nitrogen through vermicompost only	8.80	1.41	6.44
T_{13}	Only inorganic fertilizer as per recommendation	10.53	1.98	8.13
T_{14}	Absolute control	5.22	0.75	4.10
	S.Em.	0.36	0.08	0.27
	C.D. at 5%	1.02	0.22	0.78
	C.V.%	9.07	11.74	8.84

Table 4: Effect different sources of organic manures with and without bio fertilizers on nutrient status of soil (after fifth year)

Tr. No.	Treatments	Organic Carbon (%)	pH (1:2.5)	E.C. (1:2.5) (dSm^{-1})	Available nutrients (Kg/ha)	
					P	K
T_1	100% Nitrogen through FYM + *Azotobacter* + PSB	0.49	7.9	0.22	38.7	292.3
T_2	75% Nitrogen through FYM + *Azotobacter* + PSB	0.48	7.9	0.21	37.6	268.8
T_3	50% Nitrogen through FYM + *Azotobacter* + PSB	0.37	8.0	0.27	35.3	257.8
T_4	25% Nitrogen through FYM + *Azotobacter* + PSB	0.39	8.0	0.27	35.7	252.3
T_5	100% Nitrogen through vermicompost + *Azotobacter* + PSB	0.51	7.9	0.19	42.6	297.8
T_6	75% Nitrogen through vermicompost + *Azotobacter* + PSB	0.47	8.0	0.22	39.6	290.3
T_7	50% Nitrogen through vermicompost + *Azotobacter* + PSB	0.48	8.1	0.28	36.6	276.8
T_8	25% Nitrogen through vermicompost + *Azotobacter* + PSB	0.44	8.0	0.32	36.4	267.5
T_9	Only *Azotobacter* culture	0.38	8.0	0.26	37.2	268.8
T_{10}	Only PSB culture	0.39	8.0	0.31	38.8	270.8
T_{11}	100% Nitrogen through FYM only	0.45	8.1	0.25	34.9	295.8
T_{12}	100% Nitrogen through vermicompost only	0.44	8.0	0.29	37.8	288.8
T_{13}	Only inorganic fertilizer as per recommendation	0.33	8.2	0.36	33.9	288.5
T_{14}	Absolute control	0.30	8.1	0.32	32.9	267.5
	S.Em.	0.02	0.04	0.01	2.9	3.2
	C.D. at 5%	0.07	0.1	0.04	NS	9.2
	C.V.%	10.76	0.89	7.56	10.42	2.32

Table 5: Economics of cumin as influenced by by different sources of organic manures with and without bio fertilizers different sources of fertilizes (on pooled data basis)

Tr No	Treatments	Seed Yield (Kg\ha)	Gross realization (Rs.\ha)	Cost of production (Rs.\ha)	Net realization (Rs.\ha)	BCR	Net ICBR
T_1	100% Nitrogen through FYM + *Azotobacter* + PSB	461	62235	18123	44112	2.43	1:6.18
T_2	75% Nitrogen through FYM + *Azotobacter* + PSB	395	53325	17284	36041	2.08	1:4.94
T_3	50% Nitrogen through FYM + *Azotobacter* + PSB	378	51030	16447	34583	2.10	1:6.46
T_4	25% Nitrogen through FYM + *Azotobacter* + PSB	358	48330	15639	32691	2.09	1:9.97
T_5	100% Nitrogen through vermicompost + *Azotobacter* + PSB	438	59130	26323	32807	1.25	1:0.82
T_6	75% Nitrogen through vermicompost + *Azotobacter* + PSB	402	54270	23436	30834	1.32	1:0.86
T_7	50% Nitrogen through vermicompost + *Azotobacter* + PSB	376	50760	20548	30212	1.47	1:1.19
T_8	25% Nitrogen through vermicompost + *Azotobacter* + PSB	357	48195	17661	30534	1.73	1:2.45
T_9	Only *Azotobacter* culture	328	44280	14732	29548	2.00	1:1.57
T_{10}	Only PSB culture	326	44010	14732	29278	1.99	1:1.51
T_{11}	100% Nitrogen through FYM only	413	55755	18041	37354	2.03	1:4.21
T_{12}	100% Nitrogen through vermi compost only	393	53055	26242	26813	1.02	1:0.31
T_{13}	Only inorganic fertilizer as per recommendation	517	46530	18420	31110	2.02	1:10.8
T_{14}	Absolute control	281	37935	14692	23243	1.58	--

Cumin market price 90 Rs./kg, Organic cumin market price 135 Rs./kg

maximum when crop was fertilized with chemical fertilizers only (T_{13}) and was not differ remarkably with treatments T_1 ,T_{11} and T_{12} . However, volatile oil content of seed was not influenced significantly due to different treatments of organic farming.

Seed yield

Seed yield of cumin was significantly influenced by different treatments of organic farming during the course of investigation and in pooled data also (Table 2) . When RDF applied through inorganic fertilizer (T_{13}) recorded the maximum yield of cumin during individual years and in pooled analysis except in fifth year where it was the highest with 100 percent RDN supplied through vermicompost with seed treatment of bio fertilizers (T_5).The lowest seed yield of cumin was recorded when crop was not received any kind of fertilizer (T_{14}). During the course of investigation, treatment T_{13} was more effective than different organic treatments except T_1 and T_5. During first, fourth and fifth years application of 100 % RDN through organic manures with biofertilizers or organic manures alone were not differ significantly.In pooled data, application of 100 % organic manures with biofertilizers were significantly superior than organic manures alone. Both the organic sources (FYM and vermicompost) were statistically near to equal but FYM was slightly more effective than vermicompost. Similar results were also obtained by Patel *et al*., (1) and Amin *et al.*, (2).

Uptake of plant nutrients

Uptake of N, P and K by seed was significantly influenced by different treatments of organic farming in cumin (Table 3). The maximum removal of nitrogen, phosphorus and potash by seed was recorded when crop received RDF through fertilizers (T_{13}) and was at par with treatments T_1 and T_5.

Nutrient status of soil

Organic carbon, pH, E. C. and available potash were significantly influenced by different organic farming treatments (Table 4). Application of 100 percent recommended nitrogen through vermicompost (T_5) with bio fertilizers recorded the maximum content of organic carbon and was at par with treatments T_1, T_2, T_6, T_7,T_8, T_{11} and T_{12}. but significantly superior than rest of treatments. E.C. and soil pH reduced remarkably with application of organic manures alone or in combination with bio fertilizers. The minimum E.C. of soil was recorded with treatments T_5 and was at par T_1, T_2 and T_6 but appreciably lower than rest of the treatments. Content of available soil potash was the maximum with treatment T_5 and was at par with treatments T_1, T_6, T_{11} and T_{12} but significantly superior than rest of the treatments. Soil available phosphorus also followed the similar pattern but effect was non-significant. Thus, replacement of more than 50

percent nitrogen through organic manures with bio fertilizers not only improved the soil physical properties but sustain the soil fertility also.

Economics

Based on premium price of organic products, application of 100% RDN through FYM with bio fertilizers (T_1) recorded the maximum net realization and BCR which was closely followed by FYM alone. In view to economics and yield effect, FYM is more economically viable than vermicompost due to higher cost of production and poor effect of on yield (Table 6). Thus, to grow the cumin organically apply 30 kg N/ha through FYM and give seed treatment with *Azotobacter* (ABA 1) and PSB (PBA 4) cultures.

References

1. Patel B. S., Amin A. U. and Patel K. P. 2004. Response of cumin (*Cuminum cynimum* L) to integrated nutrient management. I*ndian Journal of agronomy* ***49***(3):135-139

2. Amin A. U., Patel B. S., Patel S. G., Patel P. K. and Aglodia A. V. 2007. Feasibility of organic farming in seed spices Paper presented in national seminar on Production, development, quality and Export of seed spices-issues and strategies held at Tabiji, Ajmer abstract of papers: 38.

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