

Response of cumin (*Cuminum cyminum*) to inorganic nitrogen, farmyard manure and biofertilizer

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ABSTRACT

A field experiment was conducted on loamy sand soils of Jobner (Jaipur) during winter (*rabi*) seasons of 2000–01 to 2003–04, to study response of cumin (*Cuminum cyminum* L.) to inorganic N, FYM and biofertilizer. Maximum number of branches/plant (5.92), umbels/plant (21.28), umbellets/umbel (5.28), seeds/umbel (32.8) and test weight of seeds (4.50 g) were recorded with the application of inorganic N (100%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, followed by 100% N through inorganic source alone and inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha. Combined application of 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha also recorded significantly higher seed and straw yields, being 80.4 and 42.8% higher over the control and the highest net returns of Rs 6,357/ha and benefit : cost ratio of 1.39 : 1. The highest uptake of N, P and K was also recorded under 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha.

Key words : Inorganic N, *Azospirillum*, FYM, Yield, Cumin

Fertilizer-use efficiency especially of nitrogen is very low. Hence there is a need to develop a system using inorganic fertilizers and organic manures in a complementary way. These may enhance the efficiency and reduce the requirement of inorganic fertilizers. Though availability of biofertilizer is easy, the use of *Azospirillum* in cumin is not so popular perhaps owing to lack of location-specific information. Hence, present investigation was undertaken to study the response of cumin to inorganic N, FYM and biofertilizer.

MATERIALS AND METHODS

A field experiment was conducted during winter (*rabi*) seasons of 2000–01 to 2003–04 at Agronomy Farm, S.K.N. College of Agriculture, Jobner (Jaipur), situated in semi-arid eastern plain zone of Rajasthan state (III a). The soil was loamy sand having pH 8.2, organic carbon 0.18%, low available nitrogen and phosphorus and medium available potassium. The experiment comprised a set of 10 treatments, viz. inorganic N (100%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, inorganic N (50%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, 5 tonnes FYM/ha alone, *Azospirillum* @ 1.5 kg/ha + 10 tonnes FYM/ha, 10 tonnes FYM/ha alone, inorganic N (100%)

alone, *Azospirillum* @ 1.5 kg/ha alone and control, was laid out in randomized block design with 3 replications. The recommended dose of inorganic N (100%) was 30 kg/ha, which was applied as per treatment in 2 equal splits, i.e. half 30 days after sowing and the remaining half 60 days after sowing as top-dressing. Well decomposed FYM was applied uniformly as per treatments and incorporated into the soil 3 weeks before sowing of the crop. A uniform basal dose of 20 kg P₂O₅/ha was given at the time of sowing. The seeds were treated with *Azospirillum* @ 1.5 kg/ha as per treatment just before sowing. The crop was sown during the fourth week of November during 2000–01 and third week of November during 2001–02 to 2003–04. The crop was raised with recommended package of practices.

RESULTS AND DISCUSSION

Growth and yield attributes

Application of 100% N through inorganic source alone recorded the maximum plant height which was significantly superior to all the treatments except inorganic N (100%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha and *Azospirillum* @ 1.5 kg/ha + 10 tonnes FYM/ha (Table 1). Jain and Poonia (2003) also reported similar findings. But maximum branches/plant were recorded in inorganic N (100%) + *Azospirillum* @ 1.5 kg/ha + 5

Table 1. Effect of inorganic N, FYM and biofertilizer on growth, yield attributes, yield and nutrient uptake as well as net returns of cumin (pooled over 4 years)

Treatment	Plant height (cm)	Branches/plant	Umbels/plant	Umbels/plant	Seeds/umbel	Test weight (g)	Seed yield (q/ha)					Straw yield (q/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	Benefit : cost ratio	Nutrient upake (kg/ha)		
							2000-01	2001-02	2002-03	2003-04	Pooled					N	P	K
Inorganic N (100%) + <i>Azospirillum</i> + 5 tonnes FYM/ha	35.9	5.92	21.28	5.28	32.8	4.50	1.96	2.18	5.47	3.30	3.23	8.44	22,610	6,357	1.39	17.05	5.46	12.08
Inorganic N (75%) + <i>Azospirillum</i> + 5 tonnes FYM/ha	35.4	5.78	19.30	5.12	30.0	4.37	1.83	1.98	5.00	2.86	2.92	7.98	20,440	4,262	1.26	15.37	5.01	11.25
Inorganic N (50%) + <i>Azospirillum</i> + 5 tonnes FYM/ha	34.7	5.38	18.81	4.98	30.4	4.29	1.83	1.90	3.97	2.53	2.56	8.05	17,920	1,817	1.11	14.17	4.74	10.94
<i>Azospirillum</i> + 5 tonnes FYM/ha alone	35.2	5.23	18.48	4.94	28.0	4.26	1.42	1.96	3.91	2.42	2.43	7.33	17,010	1,057	1.07	13.01	4.35	10.89
5 tonnes FYM/ha alone	33.7	5.14	17.47	4.74	27.1	4.22	1.14	1.45	3.74	2.44	2.19	7.15	15,330	-598	0.96	11.62	3.99	9.34
<i>Azospirillum</i> + 10 tonnes FYM/ha	35.6	5.38	18.07	4.91	27.1	4.29	1.53	1.69	3.97	2.19	2.35	6.98	16,450	-753	0.96	12.29	4.14	9.33
10 tonnes FYM/ha	34.6	5.07	17.96	4.71	27.0	4.29	1.44	1.82	3.79	2.03	2.27	6.55	15,890	-1288	0.93	11.34	3.85	8.74
Inorganic N (100%)	37.1	5.84	20.93	5.08	31.8	4.43	1.78	1.88	4.36	2.94	2.74	8.29	19,180	4,202	1.28	15.13	4.98	11.40
<i>Azospirillum</i>	32.3	4.77	17.83	4.54	27.3	4.15	1.98	2.00	3.51	1.75	2.31	6.11	16,170	1,467	1.10	11.17	3.75	8.22
Control	32.2	4.54	15.53	4.58	23.7	4.10	1.44	1.07	2.64	2.00	1.79	5.91	12,530	-2148	0.85	9.45	3.25	7.69
CD (P=0.05)	1.6	0.26	1.78	0.22	2.0	0.18	0.25	0.31	1.39	NS	0.41	0.48				0.72	0.29	0.56

tonnes FYM/ha treatment, followed by 100% N through inorganic source alone and inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha. These treatments were at par with each other. The lowest number of branches/plant was obtained in the control (4.54). The results are in agreement with the findings of Khoja (2004).

Significantly more umbels/plant, umbellets/umbel, seeds/umbel and test weight of cumin seeds were recorded in the plots receiving inorganic N (100%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha over rest of the treatments and was comparable with application of inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha (only umbellets/umbel and test weight) and 100% N through inorganic source alone. The lowest values of these parameters were recorded in the control. This might have helped in fulfilling the nutrients requirement of the crop vis-a-vis in creating proper environment in crop root zone for growth and nutrient uptake. Gaur (1998) also reported similar results.

Yield

Combined application of 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha resulted in significantly higher seed and straw yields of cumin, being 80.4 and 42.8% higher over the control and remained comparable with the application of 75% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha for seed yield, while straw yield was found statistically at par with inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha, inorganic N (50%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha and 100% N through inorganic source alone. This can be attributed to the beneficial effect of FYM in combination with N fertilizer on growth and yield-attributing parameters, which ultimately resulted in higher seed yield. Thus, neither the use of organic manure nor chemical fertilizers alone may be adequate in maintaining sustained productivity under intensive farming. Further, biofertilizers also perform better when soil is well supplied with nutrients particularly nitrogen and phosphorus. The results confirm the findings of Ramesh *et al.* (1997) and Kachot *et al.* (2001).

Nutrient uptake

All the treatments recorded significantly higher uptake of N, P and K over the control except K uptake under *Azospirillum* treatment (Table 1). Application of 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha recorded significantly higher uptake of N, P and K over all the other treatments by 80.4, 68.0 and 57.1% over the control respectively.

Economics

Economic analysis of the different treatments showed that the highest gross returns, net returns and benefit : cost ratio were obtained from the application of 100% inorganic N + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha and it was followed by inorganic N (75%) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha and 100% N through inorganic source.

Thus, it was concluded that application of 100% inorganic N (30 kg/ha) + *Azospirillum* @ 1.5 kg/ha + 5 tonnes FYM/ha could be recommended for obtaining higher seed yield as well as net returns from cumin crop.

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