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RESEARCH PAPER

Response of bio-fertilizer *Azospirillum* on growth and yield of fenugreek *(Trigonella foenum graecum* L.) cv. RAJENDRA KANTI

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Abstract : The experiment was conducted at experimental field of department of Horticulture, Tirhut College of Agriculture, Dholi, Muzaffarpur, (Bihar) in *Rabi* season during 2007-2008 to 2009-2010. Combination of bio-fertilizer *Azospirillum* + inorganic nitrogen + FYM gave better performance as compared to alone application of bio-fertilizer *Azospirillum*, organic FYM inorganic nitrogen and other combination. The combination treatment (T_1) as soil application of inorganic N (100%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5 t ha^{-1} gave the maximum number of branches per plant (7.30), number of pods per plant (74.00) and yield per plot (1.18) or per hectare (2.62 t ha^{-1}) and increased the yield 91.24% over control and gave the maximum net profit Rs.45,100 ha^{-1} or benefit: cost (Rs.2.35) followed by treatment (T_2) as soil application of inorganic N (75%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5 t ha^{-1} *i.e.* number of branches per plant (7.00), number of pods per plant (69.67) and yield per plot (1.09 kg/4.8m^2) or yield per hectare (2.42 t ha^{-1}) and increased the yield 76.64 per cent over control and found the maximum net profit Rs.39,172.00 ha^{-1} or benefit: cost (Rs.2.17).

Key Words : FYM, *Azospirillum*, Inorganic nitrogen, Fenugreek, Economics

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INTRODUCTION

The spices fenugreek or Methi is known as minor spices, fenugreek is an important condiment occupying third place in area and fourth in production among all the minor spices grown in our country, it is a small seed with yellowish brown colour. It is rich in protein, carbohydrate, mineral, vitamins and yellowish brown seed. It is botanically known as (*Trigonella foenumgraecum* L.). Fenugreek belongs to family Leguminosae, subfamily papilionaceae and genus *Trigonella*. It has chromosome No. 2n = 2 x 8 = 16. It is an annual crop. The nodules found at the tip of side roots have nitrogen fixing bacteria which fix the nitrogen in the soil and thus add to the fertility of the soil. Saxena and Ahmed (1983), reported that fenugreek fixes about 283 kg nitrogen per hectare per year. The ability of the *Azospirillum* to proliferate in the rhizosphere of crop suggests its ability to improve the nutrient availability to the plants and can supplement the expensive inorganic and organic fertilizers. Therefore, the present study was under taken to investigate the impact of bio-fertilizers singly or in combination with different level of inorganic nitrogen and FYM on yield and yield parameters.

MATERIALS AND METHODS

The experiment was carried out from 2007-2008 to 2009-2010 at Department of Horticulture, Tirhut College of Agricultural, Dholi, Muzaffarpur (Rajendra Agricultural University, Bihar) during *Kharif* season (2007-2008 to 2009-2010). The experiment was laid out in randomized block design with three replications using variety Rajendra Kanti. There were ten treatments and three replications. The treatment details are given below.

T_1 : Inorganic N (100%) of RDF + *Azospirillum* (15kg ha^{-1})

+ FYM-5t ha^{-1}.

T_2 : Inorganic N (75%) of RDF + *Azospirillum* (15kg ha^{-1}) + FYM-5t ha^{-1}.

T_3 : Inorganic N (50%) of RDF + *Azospirillum* (15kg ha^{-1}) + FYM-5t ha^{-1}.

T_4 : FYM- 5 t ha^{-1} + *Azospirillum* (15kg ha^{-1}).

T_5 : FYM-5 t ha^{-1} alone.

T_6 : FYM-10t ha^{-1} + *Azospirillum* (15kg ha^{-1}).

T_7 : FYM-10t ha^{-1} alone.

T_8 : 100% inorganic nitrogen of RDF.

T_9 : *Azospirillum* @ 15 kg ha^{-1}.

T_{10}: Control.

Experimental plot soil was sandy loam texture with PH-7.4, EC-0.33 dsm^{-1}, organic carbon 0.34% and available N,P,K was 110.0, 15.0, 101.0 kg ha^{-1}, respectively. The seeds were sown in the 3rd week of October every year under All India Co-ordinated Research Project (ICAR) on spices. The plot size for each treatment was 3.0m x 1.5m with spacing of 30cm x 15cm. The crop was harvested at mature stage. The plant height, number of branches per plant, number of pods per plant, length of the pods, number of grains per pod and yield per plot (kg) or t ha^{-1} were recorded.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Growth parameter :

The data was presented in Table 1 indicated that the all the treatment of bio-fertilizer *Azospirillum*, FYM and inorganic nitrogen alone and combined effect were found significant as compared to control regarding number of branches per plant. Among the treatment, soil application of (T_1) inorganic N (100%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5t ha^{-1} produced maximum number of branches per plant (7.30) followed by soil application of (T_2) inorganic N (75%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5t ha^{-1} *i.e.* number of branches per plant (7.00). The better plant growth observed in the present investigation may be attributed to the fact that *Azospirillum* has specific role in fixing atmospheric nitrogen in soil when enhances the soil fertility. Application of nitrogen encourages the formation of new cells, cell division and cell elongation. Thus, results in vigorous growth of root system which ultimately helps in better absorption and utilization of nutrients from soil solution as well as applied nitrogen and bio-fertilizer which reflected in terms of better overall plant growth. These findings are in accordance with the results of Panchal *et al.* (2010) in chrysantheamum, Chauhan (2005) in chrysantheamum, Mathew and Singh (2003) and Suthar (2005) in marigold. The same trend with respect to effect of chemical

Table 1: Response of bio-fertilizer *Azospirillum* on fenugreek

Characters / Treatments	Height of the plant				No. of branches per plant				No. of pods plant				Length of the pods (cm)			
	2007-2008	2008-2009	2009-2010	Pooled mean	2007-2008	2008-2009	2009-2010	Pooled mean	2007-2008	2008-2009	2009-2010	Pooled mean	2007-2008	2008-2009	2009-2010	Pooled mean
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
T_1	82.33	84.87	99.26	88.75	6.93	7.57	7.40	7.30	71.73	81.47	68.80	74.00	9.80	10.10	10.53	10.14
T_2	90.27	86.83	93.66	90.25	6.93	7.00	7.97	7.00	64.27	78.63	66.13	69.67	9.67	10.03	10.33	10.01
T_3	87.47	86.00	90.66	88.04	6.87	7.00	6.73	6.86	59.87	75.23	61.13	65.41	10.40	10.10	10.13	10.21
T_4	82.40	80.03	80.46	80.96	6.40	5.73	5.66	5.93	46.27	52.47	47.46	48.73	10.33	9.77	8.60	9.56
T_5	87.67	80.16	84.13	83.98	7.20	5.37	5.46	6.01	44.80	48.97	49.00	47.59	10.33	10.10	9.20	9.87
T_6	79.90	79.43	87.40	82.24	6.67	4.93	6.06	5.88	53.20	47.43	55.06	51.89	9.93	9.80	10.00	9.91
T_7	81.07	80.77	80.86	80.90	7.27	5.00	6.00	6.09	47.33	48.63	51.46	49.14	10.00	9.37	9.80	9.72
T_8	81.80	84.13	88.06	84.67	6.27	6.00	6.33	6.20	48.86	64.93	59.20	57.66	10.40	9.93	10.60	10.31
T_9	91.40	82.83	80.66	84.96	5.93	5.33	5.53	5.59	36.87	45.50	46.40	42.92	10.40	8.73	9.66	9.57
T_{10}	92.73	73.10	69.20	78.34	6.93	4.53	4.66	5.37	39.80	44.70	39.06	41.18	10.46	8.67	7.83	8.98
S.E.±	4.12	3.38	1.61	3.28	0.60	0.25	0.34	0.35	3.86	2.49	2.59	2.55	0.80	0.49	0.28	0.34
C.D. (P=0.05)	20.12	NS	NS	4.78	NS	0.73	1.01	1.03	11.49	7.42	7.70	7.58	NS	NS	0.84	NS
C.V. (%)	7.59.	8.32	7.16	3.26	6.74	15.67	7.29	9.67	9.65	13.06	7.36	8.26	8.07	8.61	8.92	5.11	6.13

Table 1: Contd.....

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Characters / Treatments	No. of grains per pod			Pooled mean	Yield per plot (kg/4.5m^2)			Pooled mean	Yield (t/ha)			Pooled mean	Increase in yield over control	
	2007-2008	2008-2009	2009-2010		2007-2008	2008-2009	2009-2010		2007-2008	2008-2009	2009-2010		t/ha	%
	18	19	20	21	22	23	24	25	26	27	28	29	30	31
T_1	15.07	16.47	17.98	16.50	0.98	1.10	1.46	1.18	2.18	2.24	3.25	2.62	1.25	91.24
T_2	16.31	16.57	17.80	16.83	0.90	1.00	1.38	1.09	2.00	2.20	3.07	2.42	1.05	76.64
T_3	14.93	16.43	17.20	16.18	0.86	0.92	1.31	1.03	1.91	2.04	2.92	2.29	0.92	67.15
T_4	17.07	16.10	15.60	16.25	0.83	0.70	0.90	0.81	1.85	1.56	2.00	1.80	0.43	31.38
T_5	17.13	15.93	15.60	16.22	0.76	0.73	1.05	0.84	1.71	1.63	2.33	1.89	0.52	37.95
T_6	16.73	15.33	16.40	16.15	0.76	0.60	1.15	0.83	1.71	1.33	2.55	1.86	0.49	35.76
T_7	16.00	16.30	16.26	16.18	0.78	0.60	1.10	0.82	1.78	1.33	2.44	1.85	0.48	35.03
T_8	15.80	16.07	17.13	16.33	0.75	0.90	1.21	0.95	1.67	1.67	2.70	2.02	0.65	47.44
T_9	16.20	15.07	14.93	15.40	0.72	0.62	0.95	0.76	1.59	1.37	2.11	1.69	0.32	23.35
T_{10}	15.60	14.60	13.00	14.40	0.61	0.58	0.65	0.61	1.37	1.30	1.11	1.37	_	_
S.E. ±	0.80	0.57	0.52	0.55	0.04	0.04	0.05	0.06	0.09	0.12	0.10	0.12	_	_
C.D. (P=0.05)20.12	NS	NS	1.55	NS	0.13	0.13	0.14	0.17	0.28	0.37	0.30	0.38	_	_
C.V. (%) 7.59.	8.61	6.25	5.59	6.03	9.15	10.19	7.04	11.21	9.14	12.82	7.04	11.26	_	_

Table2 : Economics of the bio-fertilizer *Azospirillum* on fenugreek

1	Gross income (Rs/ha) 2	Cost of cultivation (Rs/ha) 3	Net profit (Rs)(Rs/ha) 4	Cost: benefit ratio (Rs/ha) 5
T_1	78,500	33,500	45,100	1:2.35
T_2	72,500	33,428	39,172	1:2.17
T_3	68,700	33,350	35,350	1:2.06
T_4	54,000	33,200	20,800	1:1.63
T_5	56,700	32,000	24,700	1:1.77
T_6	55,300	35,200	20,600	1:1.59
T_7	55,500	34,000	21,500	1:1.63
T_8	60,500	30,300	30,300	1:2.00
T_9	50,700	31,200	19,500	1:1.63
T_{10}	41,100	30,000	11,100	1:1.37

nitrogenous fertilizer application was reported by Joshi and Barad (2002) and Singh *et al.* (2002) in marigold.

Yield and yield parameters :

It is evidence from the result (Table 1) showed that application of bio-fertilizer, inorganic nitrogen and organic fertilizer alone and combination effect were found significant regarding number of pods per plant and yield per plot or per hectare as compared to control except soil application of *Azospirillum* alone. Among the treatment, soil application of treatment (T_1) inorganic N (100%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5 t ha^{-1} produced the maximum number of pods per plant (74.00) and yield per plot (1.18 kg 4.5 m^{-2}) or per hectare (2.62 t ha^{-1}) and increased the yield 91.24% over control followed by treatment (T_2) inorganic N (75%) + *Azospirillum* @ 15 kg ha^{-1} + FYM @ 5 t ha^{-1} *i.e.* number of pods per plant (69.67) and yield per plot (1.09 kg 4.5 m^{-2}) or yield per hectare (2.42 t ha^{-1}) and increased the yield 76.64% over control. The increase yield per plot or per hectare might be due to the bio-fertilizers, which stimulated root growth and induced changes in root morphology, which in turn affected the assimilation of the nutrients. The increase in yield production could be ascribed to accelerated growth parameters like number of branches etc. registered under the present investigation. The results of the present study are in conformity with those of Mathew and Singh (2003) and Suthar (2005) in marigold; Nandre *et al.* (2002) and Panchal (2006) in China aster; Parmar (2006) in gaillardia; Panchal *et al.* (2010) and Chauhan (2005) in chryasanthemum.

Economics :

The maximum gross income (Rs.78,600 ha^{-1}), net income (Rs. 45,100 ha^{-1}) and benefit: cost ratio (2.35) were recorded with treatment (T_1) inorganic N (100%) of RDF + *Azospirillum* @ 15.0 kg ha^{-1} + FYM – 5t ha^{-1}. The total cost of cultivation was highest with treatment (T_1) inorganic N (100%) of RDF + *Azospirillum* @ 15 kg ha^{-1} + FYM - 5 t ha^{-1} (Rs.33,500 ha^{-1}) and lowest with treatment (T_{10}) control (Rs.30,000 ha^{-1}) in Table 2.

REFERENCES

Chauhan, P.A. (2005). Effect of bio-fertilizers and chemical nitrogenous fertilizer on growth and flower yield of chrysanthemum (*Chrysanthemum morifolium* Ramat). M.Sc. (Ag.) Thesis, Anand Agricultural University, Anand, GUJARAT (INDIA).

Joshi, A.S. and Barad, A.V. (2002). Effect of N, P and pinching on growth, yield and quality of Aferican marigold *(Tagetes erecta* L.) cv. CRACKRJACK. *Gujarat J. Appl. Hort.* **1**(1): 57-65.

Mathew, B. and Singh, B.P. (2003). Effect of bio-fertilizers on growth and yield of Aferican marigold. National Symposium on Recent Advances in Indian Floriculture, Trichur, pp. 14-15.

Nandre, D.R. (2002). Effect of *Azotobactor* on growth, yield and quality of China aster, M.Sc. (Ag.). Thesis, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola, M.S. (INDIA).

Panchal, K.J. (2006). Effect of bio-fertilizers and nitrogenous fertilizer on growth and flower yield of China aster [*Callistephus chinensis* (L.) *Nees*] cv. PURNIMA. M.Sc (Ag.) Thesis, Anand Agricultural University, Anand, GUJARAT (INDIA).

Panchal, R.V., Prakesh N.S., Parmar, A.B. and Patel, H.C. (2010). Effect of bio-fertilizers and nitrogenous fertilizer on growth, flowering and yield of annual white chrysanthemum *(Chrysanthemum coronarium* L.) under middle Gujarat Agro climatic conditions. *Asian J. Hort.,* **5**(1): 22-25.

Parmar, V.R. (2006). Influence of bio-fertilizer and nitrogenous fertilizer on growth and flower yield of gaillardia *(Gaillardia pulchella* Fouger) cv. Local. M. Sc. (Ag.) Thesis, Anand Agricultural University, Anand GUJARAT (INDIA).

Saxena, P. and Ahmed, S.T. (1983). Spices crops of India. *Intensive Agric.,* **20**:15-16.

Singh, D.R., Attri, B.L. and Nair, S. (2002). Effect of N and P fertilization on Aferican marigold. Proceedings of the National Symposium on Indian Floriculture in New Millennium, Bengaluru, (KARNATAKA) INDIA. pp.336-337.

Suthar, J.B. (2005). Influence of bio-fertilizer and chemical nitrogenous fertilizer on growth and flower yield of Aferican marigold *(Tagetes erecta* L.) cv. LOCAL. M.Sc. (Ag.) Thesis, Anand Agricultural University, Anand,GUJARAT (INDIA).

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