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Growth, yield and profitability of fenugreek (*Trigonella foenum-graecum* L.) as influenced by varying levels of growth regulators and vermin-wash

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Abstract

A field experiment was conducted at Sardarkrushinagar (Gujarat) to study influence of growth regulators (naphthalene acetic acid (NAA) and ethephon) on growth, yield and profitability of fenugreek (*Trigonella foenum-graecum*). Dry matter accumulation, crop growth rate, relative growth rate, seed, straw and biological yields, net realization and benefit : cost ratio were significantly higher with foliar spray of NAA 30 ppm, followed by ethephon 150 ppm and NAA 20 ppm.

Keywords: fenugreek, growth regulator, *Trigonella foenum-graecum*, yield.

Use of growth regulators such as naphthalene acetic acid (NAA) and ethephon has been reported to influence growth and yield in various crops including fenugreek *(Trigonella foenum-graecum* L.). (Bairwa & Kushik 2007; Bedge *et al*. 1993) The present study was undertaken to assess the effect of growth regulators and vermi-wash on growth, yield and profitability of fenugreek.

The field experiment was conducted during *rabi* season of 2008-09 on loamy sand soil of research farm of S D Agricultural University, Sardarkrushinagar (Gujarat). The soil had pH value of 7.4, low in organic carbon content (0.20%) and available nitrogen (170 kg ha^{-1}), medium in available P_2O_5 (39.1 kg ha^{-1}) and good in available K_2O (310 kg ha^{-1}). The experiment consisted of 10 treatments, namely, NAA (10, 20 and 30 ppm), ethephon (50, 100 and 150 ppm), vermi-wash (1, 2 and 3 l ha^{-1}) and water spray. Full recommended dose of nitrogen and phosphorus was applied manually through DAP and urea at the time of sowing. The fenugreek variety GM-2 was sown on 18th November 2008 at 30 cm row to row spacing at 20 kg seeds ha^{-1}. The foliar spray of ethephon and NAA was done at pre-flowering stage using a spray volume of 600 l ha^{-1}. Spray of vermi-wash @ 1.0, 2.0 and 3.0 l ha^{-1} with dilution of 1:5 in water was done at pre-flowering stage. Observations on plant height and dry matter accumulation $plant^{-1}$ at different growth stages were recorded. Relative growth rate (RGR) and crop growth

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rate (CGR) was calculated by the formulae given by Redford (1967). Economic analysis of various treatments was done based on current market prices of inputs and output.

Growth parameters

Plant height, dry matter accumulation, CGR and RGR at different growth stages were significantly higher with foliar spray of NAA 30 ppm that was on par with ethephon 150 ppm and NAA 20 ppm. The lowest values of these attributes were obtained with water spray (Tables 1 and 2). CGR increased up to 80 days after sowing (DAS), thereafter it declined drastically but RGR was higher during initial growth stages and declined afterward. The beneficial effect of growth regulators on plant height might be due to increased cell division, cell enlargement and cell elongation (Devlin & Witham 1986). These results corroborated with the findings of Begde *et al.* (1993) who obtained higher plant height and dry matter production with application of 50 ppm NAA in fenugreek.

Yield and economic analysis

Higher seed, straw and biological yields as well as net return and benefit : cost ratio (BCR) were recorded with foliar spray of NAA 30 ppm followed by ethephon 150 ppm and NAA 20 ppm which were at par with each other and significantly higher over rest of treatments (Table 3). The possible reason for increased yield was due to higher photosynthetic activity of treated plants resulting in higher accumulation of photosynthates as compared to control (Audus 1960). Foliar spray with NAA 30 ppm followed by NAA 20 ppm and ethephon 150 ppm gave the highest gross realization and net realization and BCR which was due to higher yield recorded under these treatments. Bairwas & Kaushik (2007) in a field study conducted at Udaipur, also found higher yield attributes and yield of fenugreek with application of 20 ppm NAA at pre-flowering stage. Similarly, with the application of 50 ppm NNA in fenugreek, higher yield attributes and yield of fenugreek was reported by Bedge *et al*. (1993). Thus, foliar application of NAA 30 ppm can be recommended for increasing yield attributes, yield and higher net realisation in fenugreek.

Table 1. Effect of growth regulators and vermi-wash on plant height and dry matter accumulation in fenugreek

Treatment	Plant height (cm)			Dry matter accumulation (g plant^{-1})		
	40 DAS	80 DAS	Maturity	40 DAS	80 DAS	Maturity
Control (Water spray)	6.3	32.3	41.1	0.36	5.39	9.05
NAA 10 ppm	6.9	37.2	47.6	0.37	6.63	10.55
NAA 20 ppm	7.5	43.1	54.6	0.37	8.11	12.18
NAA 30 ppm	7.6	44.4	55.1	0.38	8.33	12.40
Ethephon 50 ppm	7.3	34.6	44.9	0.36	6.55	10.29
Ethephon 100 ppm	6.8	37.9	47.9	0.36	6.87	10.70
Ethephon 150 ppm	7.5	43.9	54.9	0.37	8.20	12.27
Vermi-wash 1 l ha^{-1}	6.5	33.1	44.5	0.36	6.13	9.68
Vermi-wash 2 l ha^{-1}	6.9	33.5	45.6	0.37	6.24	9.85
Vermi-wash 3 l ha^{-1}	7.0	37.5	47.8	0.38	6.72	10.64
SEm (±)	0.3	1.6	2.2	0.02	0.38	0.48
C D (P=0.05)	NS	4.7	6.4	NS	1.14	1.43

DAS = Days after sowing; NAA = Naphthalene acetic acid

Table 2. Effect of growth regulators and vermin-wash on crop growth rate (CGR) and relative growth rate (RGR) in fenugreek

Treatment	CGR (g $m^{-2}day^{-1}$)			RGR (g $g^{-1}day^{-1}$)	
	40 DAS	80 DAS	Maturity	40 DAS	80 DAS
Control (water spray)	0.3013	5.1344	1.0212	0.0327	0.0012
NAA 10 ppm	0.3108	6.2566	1.3243	0.0347	0.0015
NAA 20 ppm	0.3108	8.2315	1.7019	0.0359	0.0019
NAA 30 ppm	0.3164	8.7496	1.7450	0.0364	0.0022
Ethephon 50 ppm	0.2985	6.1232	1.2943	0.0344	0.0014
Ethephon 100 ppm	0.2991	6.4132	1.3522	0.0352	0.0017
Ethephon 150 ppm	0.3025	7.5647	1.7126	0.0354	0.0020
Vermi-wash 1 l ha^{-1}	0.2997	5.8532	1.2011	0.0339	0.0013
Vermi-wash 2 l ha^{-1}	0.3080	6.1039	1.2234	0.0349	0.0014
Vermi-wash 3 l ha^{-1}	0.3164	6.3242	1.3921	0.0348	0.0016
SEm (±)	0.0157	0.3605	0.1000	0.0008	0.0001
C D (P=0.05)	NS	1.0710	0.2971	NS	0.0002

NAA=Naphthalene acetic acid

Table 3. Effect of growth regulators and vermin-wash on harvest index and benefit : cost ratio in fenugreek

Treatment	Seed yield (kg ha^{-1})	Straw yield (kg ha^{-1})	Biological yield (kg ha^{-1})	Harvest index (%)	Gross realization (Rs. ha^{-1})	Net realization (Rs. ha^{-1})	Benefit : cost ratio
Control (Water spray)	920	1664	2584	35.6	30096	13557	0.81
NAA 10 ppm	1064	1916	2980	35.7	34794	18195	1.09
NAA 20 ppm	1218	2175	3393	36.0	39803	23144	1.38
NAA 30 ppm	1235	2186	3421	36.1	40329	23510	1.39
Ethephon 50 ppm	1004	1816	2820	35.6	32844	16196	0.97
Ethephon 100 ppm	1074	1926	3000	35.8	35109	18352	1.09
Ethephon 150 ppm	1220	2178	3398	35.9	39867	23002	1.36
Vermi-wash 1 ha^{-1}	971	1749	2720	35.7	31754	15195	0.91
Vermi-wash 2 ha^{-1}	998	1790	2788	35.8	32625	16046	0.96
Vermi-wash 3 ha^{-1}	1070	1919	2989	35.8	34979	18375	1.10
SEm (±)	48	83	117	0.9	-	-	-
C D (P=0.05)	142	247	348	NS	-	-	-

DAS=Days after sowing , NAA=Naphthalene acetic acid

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