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Effect of bioregulators on productivity and profitability of fenugreek (*Trigonella foenum-graecum* L.)

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Abstract

A field study was carried out during 2008-09 at research farm of ATC, Ajmer to find out the effect of bio-regulators on yield and profitability of fenugreek. Two bio-regulators, Triacontanol (500 ppm and 1000 ppm) and NAA (50 ppm), sprayed once and twice, were compared with water sprays (control) in randomized block design with three replications. Application of NAA significantly improved the seed yield and yield attributes in fenugreek crop compared with Triacontanol and water sprays. Two sprays of NAA @ 50 ppm at 40 and 60 DAS produce maximum yield (19.34 q ha^{-1}) with 20% increase over control, and registered statistical superiority over both the doses of Triacontanol sprayed either once or twice, however it was at par with one spray of NAA (18.40 q ha^{-1}) at 40 DAS. In economic terms two sprays of NAA also fetched maximum gross (Rs. 54152) and net returns (Rs. 36006) with highest benefit: cost ratio (1.98), closely followed by one spray of NAA (Rs. 51520 and Rs.33697, respectively) at 40 DAS with B: C ratio of 1.89. Therefore, one spray of 50 ppm NAA at 40 DAS followed by two sprays of NAA (at 40 and 60 DAS) is recommended for better growth, yield and economics of fenugreek crop.

Key words : Bio-regulators, triacontanol, NAA, *trigonella foenum graecum*

Introduction

Fenugreek *(Trigonella foenum-graecum* L.) commonly known as Methi, is one of the important seed spices of India. In India the area under fenugreek is 81220 ha with production of 118360 tonnes and the productivity is 1457 kg ha^{-1} (Spices Board,8). Fenugreek has a good potential for export to many countries. Looking to good potential for export and multipurpose uses of fenugreek, farmers largely include it in their cropping plan. There is a wide gap between existing productivity (14.57 q ha^{-1}) and potential productivity (25 q ha^{-1}) of the crop. Scientific intervention of low cost may acts as a bridge to minimize the gap between its current productivity and potential productivity.

Use of bio regulators is one of the scientific inputs to explore the possibilities in this direction. The role of plant bio-regulators in enhancing the production of crops has been long recognized and now this low cost technology has emerged as a boon for enhancing the agricultural production. It has been observed that plant hormones regulate the various physiological processes and balance the source and sink thereby increase the productivity. These chemicals act as chemical catalyst in plant and improve physiology and reproductive efficiency of the plant and also possibly improve the gene expression for efficient sucrose transport and increase dry matter partitioning for grain production (Werdan *et al.,* 9). Use of growth regulators delays senescence and retards abscission of reproductive organs (Balraj *et al.,* 2; Gardner *et al.,* 3). Application of growth regulators is also known to increase sink strength *viz.,* flowering, fruit and seed setting, seed size, seed weight and grain filling duration in different crops (Pandey and Sinha, 6). Auxin stimulates cell division and cell enlargement in apical region, it enhances the nucleic acid activities, flowering, fruit set, fruit retention and fruit quality of various crops. Triacontanol increases dry weight, leaf area, and level of reducing sugars, amino acids, soluble proteins, and total nitrogen (Ries, 7). An increase in dry weight has been assumed as the result of the increased photosynthetic activity and the accumulation of photosynthates (Haugstad *et al*., 4). It increases photosynthesis activity at a wide range of photosynthetic photon flux densities, since a large number of the Triacontanol-responsive genes were photosynthesis-associated ones.

To achieve the maximum production from existing improved varieties, it is necessary that the chemical reactions take place in the plants are in balanced and in efficient manner which help in formation of quality seed. This is only possible with the use of plant growth regulators. Taking these facts under consideration an experiment entitled "Effect of bio-regulators on yield and profitability of fenugreek (*Trigonella foenum graecum* L.)" was conducted.

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Materials and methods

The present investigation on "Effect of bio-regulators on yield and profitability of fenugreek (*Trigonella foenum graecum* L.)" was carried out at research farm of Adaptive Trial Centre, Tabiji, Ajmer during 2008-09. The soil was sandy loam, having pH 8.1, low in organic carbon (0.21%) and available N (142.0 kg ha^{-1}) and medium in available P (24.2 kg ha^{-1}) and K (188.5 kg ha^{-1}). A long chain aliphatic (saturated primary alcohol) compound, Triacontanol (*n*-$C_{30}H_{61}OH$), and Auxin based bioregulator NAA were evaluated in this study. Seven treatments were tested in randomized block design with three replications. The treatments were, T_1-One spray of Triacontanol @ 500 ppm at 40 DAS, T_2-Two sprays of Triacontanol @ 500 ppm at 40 & 60 DAS, T_3- One spray of Triacontanol @ 1000 ppm at 40 DAS, T_4-Two sprays of Triacontanol @ 1000 ppm at 40 & 60 DAS, T_5-One spray of NAA @ 50 ppm at 40 DAS, T_6-Two sprays of NAA @ 50 ppm at 40 & 60 DAS and T_7-Control (two sprays of water at 40 & 60 DAS). A fenugreek variety RMt-351 was sown at 30 cm row spacing on 7th November using recommended dose of 40 kg N and 40 kg P_2O_5 and all other intercultural practices and plant protection measures were followed as per the recommended schedule. Seed yield with yield attributes of fenugreek were recorded from net plot to draw inference. Economics was worked out on the basis of prevailing market prices of inputs and outputs.

Result and discussion

Effect on growth and yield attributes

Growth and yield attributes of fenugreek registered marked variation with application of growth regulators. The higher values of growth and yield attributes viz., plant height, number of branches $plant^{-1}$, pod length, number of pods $plant^{-1}$, number of seeds pod^{-1},1000 seed weight and seed yield $plant^{-1}$ in fenugreek were recorded with application of NAA (Table-1). Two foliar application of NAA @ 50 ppm increased plant height, number of branches, pod length, pods $plant^{-1}$, seeds pod^{-1}, 1000 seed weight and seed yield $plant^{-1}$ in tune of 17.4, 23.0, 12.7, 27.7, 15.2, 11.90 and 13.8 per cent, respectively over control. However it was at par with one spray of NAA applied at 40 DAS. Application of NAA enhanced cell division and cell enlargement in apical region, nucleic acid activities, flowering, fruit set and fruit retention, this might be the cause of higher growth and yield attributes (Pandey and Sinha, 6). There was non significant difference between 500 ppm and 1000 ppm triacontanol either applied once or twice with regards to plant height, length of pod, number of pods $plant^{-1}$, number of seeds pod^{-1}, test weight and seed yield $plant^{-1}$.

Table 1. Effect of bio-regulators on growth and yield attributes of fenugreek

Treatments	Plant height at harvest (cm)	Number of branches $plant^{-1}$	Length of pod (cm)	No of Pods $plant^{-1}$	No of Seeds pod^{-1}	Test weight (g)	Seed yield $plant^{-1}$ (g)
T_1-Triacontanol @ 500 ppm at 40 DAS	43.5	11.7	12.3	42.4	11.4	11.52	8.42
T_2-Triacontanol @ 500 ppm at 40& 60 DAS	44.2	12.4	12.6	45.3	11.7	12.14	8.72
T_3- Triacontanol @ 1000 ppm at 40 DAS	43.1	12.0	12.4	43.2	11.6	11.68	8.56
T_4- Triacontanol @1000 ppm at 40& 60 DAS	45.4	13.1	12.9	46.3	12.2	12.48	8.94
T_5- NAA @ 50 ppm at 40 DAS	47.2	13.3	13.1	48.6	12.8	12.56	9.11
T_6- NAA @ 50 ppm at 40 & 60 DAS	49.3	13.9	13.3	50.3	12.9	12.69	9.26
T_7-Control (two water spray)	42.0	11.3	11.8	39.4	11.2	11.34	8.14
CD (P=0.05)	5.24	1.32	1.20	4.54	1.46	1.21	1.04

Effect on yield and harvest index

Application of growth regulators had direct and positive effect on seed and biological yield of fenugreek. Seed yield plant^{-1}, seed yield ha^{-1}, biological yield ha^{-1} and harvest index were maximum with application of NAA. (Table 1 & 2). However, increase in harvest index was not up to level of statistical significance. Application of Triacontanol did not influence significantly the seed yield, biological yield and harvest of fenugreek crop. Application of NAA @ 50 ppm either once or twice produced significantly higher grain yield over two sprays of water. Two sprays of NAA @ 50 ppm at 40 & 60 DAS produced maximum fenugreek yield (19.34 q ha^{-1}) i.e. 20.27 per cent higher over water spray, which was at par with one spray of NAA at 40 DAS (18.40 q ha^{-1}). As discussed above, application of NAA enhanced plant growth and yield attributes which ultimately increased the seed and biological yield of the crop. Alagukannan and Kumar (1) observed increase in fenugreek yield at lower doses of NAA. Similar results were also reported by Mehra and Kamal (5).

Economics

Economic analysis of experiment (Table-2) revealed that two spray of NAA @ 50 ppm at 40 & 60 DAS fetched maximum gross returns Rs.54152 followed by Rs.51520 from one spray of NAA at 40 DAS. Same trend was also observed in terms of net returns. Economic viability of treatments was evaluated by computing benefit: cost ratio of treatments. Two sprays of NAA @ 50 ppm at 40 & 60 DAS possessed maximum benefit: cost ratio of 1.98 which was followed by one spray of NAA (1.89) at 40 DAS.

Table 2. Effect of bioregulators on yield, harvest index and economics of fenugreek

Treatment	Yield (q ha^{-1})	Biological yield (q ha^{-1})	Harvest index	Gross return (Rs.)	Total cost (Rs.)	Net return (Rs.)	Benefit : cost ratio
T_1- Triacontanol @ 500 ppm at 40 DAS	16.55	52.01	31.82	46340	17805	28535	1.60
T_2- Triacontanol @ 500 ppm at 40& 60 DAS	17.26	53.37	32.34	48328	18110	30218	1.66
T_3- Triacontanol @ 1000 ppm at 40 DAS	16.72	51.48	32.48	46816	17910	28906	1.61
T_4- Triacontanol @1000 ppm at 40& 60 DAS	17.45	52.54	33.21	48860	18320	30540	1.66
T_5- NAA @ 50 ppm at 40 DAS	18.40	54.96	33.48	51520	17823	33697	1.89
T_6- NAA @ 50 ppm at 40 & 60 DAS	19.34	57.02	33.92	54152	18146	36006	1.98
T_7-Control (two water spray)	16.08	52.48	30.64	45024	17500	27524	1.57
CD (P=0.05)	1.88	4.26	NS				

Conclusion

After going through the results obtained in the investigation, it is inferred that though the values with respect to growth, yield attributes and seed yield of fenugreek were maximum under T_6 treatment (two sprays of NAA at 40 & 60 DAS) with highest net returns (Rs. 36006 ha^{-1}) and B: C ratio (1.98), however, all the values obtained under T_5 treatment (one spray of NAA at 40 DAS) were at par with B: C ratio of 1.89. Hence, one foliar spray of NAA (50 ppm) on fenugreek crop at 40 DAS followed by two foliar sprays of NAA (50 ppm) at 40 & 60 DAS is recommended to have healthy crop stand with higher economic yield and returns.

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