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# Efficacy of plant growth regulators on yield of fenugreek (*Trigonella foenum-graecum* L.)

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**Abstract**
Field experiment entitled "Efficacy of plant growth regulators on yield of fenugreek (*Trigonella foenum-graecum* L.)" was conducted at Instructional farm, Department of Horticulture, BTC College of Agriculture and Research Station, Bilaspur (C.G.) during *rabi* season 2023-24. Experiment comprised of three levels of each plant growth regulators namely $GA_3$ (75,100 and 125 ppm), NAA (75,100 and 125 ppm), Ethrel (75,100 and 125 ppm) along with control. Treatments were evaluated under randomized block design comprised of ten treatments replicated thrice. On the basis of results obtained, yield attributes and yield were significantly affected by growth regulators imposed on fenugreek.Results emanated from experiment that yield attributes *viz.*; number of pods plant$^{-1}$ (32.94), number of seeds pod $^{-1}$ (16.87), length of pod (13.03 cm), test weight (17.95 g) and seed yield (13.92 q ha$^{-1}$) recorded maximum under treatment $T_4$ ($GA_3$ 125 ppm) which was significantly superior over other treatments but was found statistically at par with treatment $T_3$ ($GA_3$ 100ppm).

**Keywords:** Fenugreek, PGR, $GA_3$, NAA, ethrel, yield attributes, yield

## 1. Introduction
Fenugreek scientifically known as *Trigonella foenum-graecum* belongs to family Fabaceae is an important multipurpose crop grown during rabi season. It is diploid, self-pollinated, small-seeded annual legume and has been used as a spice worldwide to enhance the sensory quality of food. Fenugreek is believed to be originated in Southern-Europe and Western Asia. In most parts of India, it is called Methi.

India, often referred to as "The Land of Spices," is the world's leading producer, consumer and exporter of spices. Fenugreek holds a vital place in Indian agriculture, being the third-highest seed spice after coriander and cumin. India occupied 4528.176 thousand hectare area with 10679.221 tonnes of spices, of which 1.20 million tonnes valued Rs. 22,062.80 crore exported in 2020-21(Anon., 2021) [3]. In Chhattisgarh, spices occupy an area of about 67,702 ha. With the production of 4,53,604MT during 2022-23 (Directorate of Horticulture, Government of Chhattisgarh, 2021-22) [2].

This crop has gained popularity due to its medicinal and nutritional characteristics; it can be referred to as "miraculous herb". It is cultivated throughout India for herbs, culinary as well as for medicinal purposes. Apart from its culinary significance, plant is used in therapy atherosclerosis (Nandini *et al*., 2007), [8] rheumatism, sugar lowering (Gupta *et al*., 2009) [6], blood lipids lowering (Xue *et al*., 2007) [15], appetizer and contain antioxidant activity (Birjees Bukhari *et al*., 2008) [4]. More importantly, it is used to develop healthy and nutritious extruded and baked goods. Yadav and Kaushik remarked that the gelatinous texture of fenugreek seeds helpful in soothing irritation caused by eczema.

Plant growth regulator is one of the crucial component in horticulture considered as useful tool to enhance crop growth and development in both quantitative and qualitative terms. These regulators serve as chemical catalysts within plants enhances both physiological and reproductive efficiency. The most commonly used growth regulator is auxin (NAA). Naphthalene acetic acid (NAA) belongs to the synthetic forms of auxins plays a central role in cell elongation, cell division, root initiation, tip dominance, leaf senescence, leaf and fruit abscission, fruit set and flowering (Davies, 1987) [5].

Gibberellic acid is one of the most important growth stimulating substances that helps in increasing stalk length and improving vegetative growth, flower initiation, hastening maturity and improving fruit quality in various crops (Swamy, 2012 and Haq *et al*., 2013) [12, 7]. Ethrel is versatile growth regulator accelerates uniform ripening. In recent years, the growth regulators play crucial role in overcoming the factors limiting the yield and quality for obtaining maximum benefit from seed production. Effectiveness of plant growth regulators depends upon several factors, such as concentration, application method, and timing (Saxena, 1989) [11]. However, there is a dearth of information regarding the suitability of different plant growth regulators and the optimal timing of their application. Thus, the present investigation designed to evaluate effects of plant growth regulators in order to enhance yield potential in fenugreek.

## 2. Materials and Methods

Experiment was undertaken at Instructional Farm, Department of Horticulture, Barrister Thakur Chhedilal College of Agriculture and Research Station, Bilaspur (C.G.) during rabi season 2023-24 to evaluate effects of plant growth regulators on yield of fenugreek. Experiment was laid out in randomized block design (RBD) with ten treatments replicated thrice. Experiment comprised of three levels of plant growth regulators namely $GA_3$ (75,100 and 125 ppm), NAA (75,100 and 125 ppm), Ethrel (75,100 and 125 ppm) along with control. Weather during crop growth and development period remained favorable for crop production. The field was properly ploughed and brought to fine tilth thereafter, field was levelled properly and then experimental plots of size 3m × 3 m were prepared according to the plan of layout. Incorporation of well rotten FYM @ 10 t/ha performed before 15 days of sowing promotes vegetative growth. In addition to this, recommended dose of fertilizers was applied in the form of urea, single super phosphate and muriate of potash respectively. Nitrogen was applied in 2 equal split doses i.e. half basal and remaining nitrogen was applied 30 days after first application whereas full dose of phosphorus and potassium were applied as basal. Before sowing, seeds were treated with Trichoderma @ 5g/kg in order to produce disease-free, healthy and vigorous seeds. Sowing done on 6th November, 2023. Seeds were sown in lines with row spacing of 25 cm. Growth regulators were applied at 30 and 60 days after sowing as per treatment. Observations recorded during investigation were number of pods plant$^{-1}$, number of seeds pod$^{-1}$, length of pod (cm), test weight (g) and seed yield (q ha$^{-1}$).

## 3. Results and Discussion

### Yield and yield attributes

### 3.1 Number of pods plant$^{-1}$

Results revealed that application of PGR significantly improve yield of fenugreek. Since number of pods is directly linked to number of seeds produced. So, maximum number of pods contributes to higher seed yield.

Among different PGR utilized for experiment, maximum number of pods plant$^{-1}$ (32.94) noted in treatment $T_4$ ($GA_3$ 125 ppm) which was superior over other treatments but was found statistically at par with treatment $T_3$ ($GA_3$ 100 ppm) (32.77) whereas statistically significant minimum number of pods plant$^{-1}$ (29.36) were observed in treatment $T_1$ (control). Number of pods plant$^{-1}$ could be linked to increased number of primary and secondary branches induced by $GA_3$. Similar results reported by Sahu *et al*. (2023) [10] in fenugreek.

### 3.2 Number of seeds pod$^{-1}$

Maximum number of seeds pod$^{-1}$ (16.87) obtained in treatment $T_4$ ($GA_3$ 125 ppm) which was superior over other treatments but was found statistically at par with treatment $T_3$ ($GA_3$ 100 ppm) (16.72). Number of seeds pod$^{-1}$ increased possibly due to better efficacy of $GA_3$ contributed in promoting both vegetative and reproductive parameters reported earlier by Tania *et al*., (2015) [13]. However, statistically significant and minimum number of seeds pod$^{-1}$was observed in treatment ($T_1$) Control (13.18).

### 3.3 Length of pod (cm)

Highest length of pod (13.03 cm) obtained in $T_4$ ($GA_3$ 125 ppm) closely followed by treatment$T_3$ ($GA_3$ 100 ppm) (12.94 cm) whereas statistically significant and minimum pod length (9.46 cm) was noticed in treatment ($T_1$) Control. Increase in pod length by the application of $GA_3$ and NAA might be due to rapid cell division and increased elongation of individual cell. Similar results were reported by Rathod *et al.*, (2023) [9].

### 3.4 Test weight (g)

Test weight is one of the important measure in evaluating yield potential of fenugreek. Test weight was significantly affected due to application of plant growth regulators at various concentration. Among various treatments, maximum test weight (17.95 g) noted in $T_4$ ($GA_3$ 125 ppm) considered significantly superior over other treatments but it was found at par with treatment $T_3$ ($GA_3$ 100 ppm) (17.88 g) whereas statistically significant and minimum test weight (14.11 g) was obtained in treatment ($T_1$) Control. This result was in close accordance with findings of Tania *et al*., (2015) [13] and Rathod *et al*. (2023) [9].

### 3.5 Seed yield (q ha$^{-1}$)

Data presented in Table 1 pertaining to seed yield depicts that $T_4$ ($GA_3$ 125 ppm) producedsignificantly maximum seed yield(13.92 qha$^{-1}$) considered superior over treatments $T_2$ ($GA_3$ 75 ppm), $T_5$ (NAA 75 ppm), $T_6$ (NAA 100 ppm), $T_7$ (NAA 125 ppm), $T_8$ (Ethrel 75 ppm), $T_9$(Ethrel 100 ppm), $T_{10}$ (Ethrel 125 ppm) and $T_1$(Control) but it was found statistically at par with treatment $T_3$ ($GA_3$ 100 ppm) (13.80 q ha$^{-1}$).Statistically significant and minimum seed yield (10.14 q ha$^{-1}$) noted in treatment $T_1$ (control). Increase in yield might be due to improved vegetative growth due to plant growth regulators application coupled with increased photosynthates towards reproductive sites on one hand and greater mobilization of photosynthesis towards reproductive sites on other hand might have been found to increase growth and yield attributing parameters. These results were in close accordance with findings reported by Alam and Shahin (2018) [1] investigated effect of gibberellic acid on morphology, vegetative growth and seed yield of fenugreek.

**Table 1:** Effect of various growth regulators on number of pods plant$^{-1}$, number of seeds pod$^{-1}$, length of pod, test weight and seed yieldof fenugreek.

| | Treatments | No. of pods plant$^{-1}$ | No. of seeds pod$^{-1}$ | Length of pod (cm) | Test weight (g) | Seed yield (q ha$^{-1}$) |
|---|---|---|---|---|---|---|
| $T_1$ | Control | 29.36 | 13.18 | 9.46 | 14.11 | 10.14 |
| $T_2$ | $GA_3$ @ 75 ppm | 32.07 | 16.05 | 12.09 | 17.00 | 13.01 |
| $T_3$ | $GA_3$ @ 100 ppm | 32.77 | 16.72 | 12.94 | 17.88 | 13.80 |
| $T_4$ | $GA_3$ @ 125 ppm | 32.94 | 16.87 | 13.03 | 17.95 | 13.92 |
| $T_5$ | NAA @ 75 ppm | 31.02 | 15.04 | 11.07 | 16.02 | 12.10 |
| $T_6$ | NAA @ 100 ppm | 31.76 | 15.77 | 11.87 | 16.89 | 12.89 |
| $T_7$ | NAA @ 125 ppm | 31.89 | 15.98 | 11.94 | 16.98 | 12.98 |
| $T_8$ | Ethrel @ 75 ppm | 30.08 | 14.11 | 10.13 | 15.00 | 11.00 |
| $T_9$ | Ethrel @ 100 ppm | 30.73 | 14.79 | 10.78 | 15.85 | 11.81 |
| $T_{10}$ | Ethrel @ 125 ppm | 30.92 | 14.82 | 10.89 | 15.97 | 11.90 |
| | SEm ± | 0.20 | 0.22 | 0.18 | 0.28 | 0.26 |
| | CD at 5% | 0.60 | 0.66 | 0.54 | 0.83 | 0.78 |

## 4. Conclusion

On the basis of results obtained, yield attributes and yield were significantly affected by plant growth regulators imposed on fenugreek. Thus, treatment ($T_4$) $GA_3$ 125 ppm considered most promising and proved to be effective for realization of higher seed yield (13.92 q ha$^{-1}$) closely followed by treatment ($T_3$) $GA_3$100 ppm.

## 5. Acknowledgement

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## 6. Conflict of the Study

Nil.

## 7. Future scope of study

- Effect of quality parameters might be studied.
- It is suggested to analyze the response of other plant growth regulators like CCC, Maleic hydrazide etc. in fenugreek.
- It is suggested that other concentrations of Ethrel should also be applied in fenugreek

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