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EFFECT OF VARIOUS GROWTH REGULATORS ON GROWTH AND PRODUCTIVITY OF *TRIGONELLA FOENUM-GRAECUM*

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The effects of growth regulators viz., IAA, IBA, NAA and GA_3 on seed germination and seedling growth of *Trigonella foenum-graecum* has been studied. Teatment with various growth regulators improved percent seed germination and seedling growth as compared to control. IAA improved rooting while GA_3 promoted shooting.

Keywords : GA_3; IAA; IBA; NAA; *Trigonella foenum-graecum.*

Introduction

Trigonella belonging to family Fabaceae is one of the most important genus of medicinal importance. *T. foenum-graecum* is the main cultivated species in India used for medicinal, spice and fodder purposes[1]. In Rajasthan, it occupies a prime position among the seed spices[2]. Under irrigation, the crop can be grown as a pot herb throughout the year. Its seeds are bitter, aromatic, carminative, tonic, thermogenic, galactagogue, astringent, emollient and aphrodisiac and have hypoglycaemic[3] and hypocholesterolaemic effects[4,5]. The seeds have also been reported as antioxidants and antineoplastic agents [6,7].

Since there is a world trend to a greater use of herbal medicines, it becomes necessary to increase the productivity of medicinal plants. The growth and productivity of medicinal plants is affected by several factors like physico-chemical factors, nutritional factors and growth regulators[8]. Growth regulators play a prominent role in seed germination and seedling growth [9,10].They, in general, include both natural and synthetic compounds which may bring a physiological response when applied in low concentrations. These compounds have been widely used to bring both the qualitative and quantitative changes in the plants[11,12].The present paper deals with the effect of growth regulators on seed germination and seedling growth of *Trigonella foenum-graecum.*

Material and Methods

Seed germination studies were carried out under sterilized conditions. Neutral glass petridishes of 10 cm diameter were taken. Single layer of cotton was placed in each petridish and was covered by double layer of filter paper. Healthy seeds of *Trigonella foenum-graecum* were surface sterilized with 0.1% $HgCl_2$ and then washed thoroughly with distilled water. Then, the seeds were soaked in different concentrations of growth regulators, i.e., 0.5, 1, 10, 50 and 100 ppm for 24 hours. The growth regulators used, were Indole-3yl-acetic acid, Indole-3yl-butyric acid, α-Naphthalene acetic acid and Gibberellic acid. Seeds soaked in distilled water were taken as control. Treated seeds were kept for germination in petridishes over filter paper moistened by distilled water. Three replicates of 10 seeds each were used. The experiments were conducted in laboratory conditions and observations were taken on 7^{th} day. The room temperature was 26 ± 2°C.

The observations of each parameter of the experiments were analysed statistically for mean, analysis of variance, standard error and critical differences by applying 'F' test. The results have been presented in Table 1-4.

Results and Discussion

(i) Indole-3yl-acetic acid (IAA)-Treatment with IAA improved percent seed germination upto 10 ppm which supported 100% seed germination. However, further increase in IAA reduced percent seed germination. Lower doses, i.e., 0.5 and 1 ppm significantly promoted rooting. Shooting was also improved at lower concentrations. Higher doses of IAA had inhibitory effect on both rooting and shooting. The influence of IAA on germination and shoot length was non-significant (Table 1).

(ii) *Indole-3yl-butyric acid (IBA)*- Lower doses of IBA, *i.e.*, 0.5 and 1 ppm improved percent seed germination (100%) as compared to control (93.3%). However, IBA inhibited seedling growth. A slight reduction in rooting and shooting was recorded as compared to the control. The results were non-significant (Table 2).

(iii) α-Naphthalene acetic acid (NAA)- NAA supported maximum percent seed germination (100%) at 0.5, 10 and

Table 1. Effect of Indole-3yl-acetic acid on seed germination and seedling growth of *Trigonella foenum-graecum.*

Concentration (ppm)	Germination (percent)	Root length (cm)	Shoot length (cm)
Control	93.3 ± 2.721	1.82 ± 0.100	2.97 ± 0.061
0.5	96.6 ± 2.721	2.42* ± 0.198	3.56 ± 0.097
1	100 ± 0.000	2.46* ± 0.067	3.07 ± 0.088
10	100 ± 0.000	2.12 ± 0.120	3.06 ± 0.097
50	96.6 ± 2.721	1.55 ± 0.055	2.85 ± 0.065
100	96.6 ±2.721	0.92 ± 0.083	1.93 ± 0.140
F ratio	0.85 N.S.	12.88*	2.28 N.S.
F value	3.11	3.11	3.11
C.D. at 5%	8.38	0.50	2.61

*Significant, N.S. – Non-significant

Table 2. Effect of Indole-3yl-butyric acid on seed germination and seedling growth of *Trigonella foenum-graecum.*

Concentration (ppm)	Germination (percent)	Root length (cm)	Shoot length (cm)
Control	93.3 ± 2.721	1.82 ± 0.100	2.97 ± 0.061
0.5	100 ± 0.000	1.76 ± 0.086	2.79 ± 0.150
1	100 ± 0.000	1.12 ± 0.071	2.80 ± 0.082
10	90 ± 4.7111	1.47 ± 0.077	2.82 ± 0.087
50	96.6 ± 2.721	1.06 ± 0.042	2.19 ± 0.080
100	93.3 ± 2.721	0.81 ± 0.169	1.38 ± 0.164
F ratio	1.46 N.S.	3.05 N.S.	17.35*
F value	3.11	3.11	3.11
C.D. at 5%	10.27	0.71	0.61

N.S. – Non-significant

Table 3. Effect of α-Naphthalene acetic acid on seed germination and seedling growth of *Trigonella foenum graecum.*

Concentration (ppm)	Germination (percent)	Root length (cm)	Shoot length (cm)
Control	93.3 ± 2.721	1.82 ± 0.100	2.97 ± 0.061
0.5	100 ± 0.000	1.67 ± 0.059	3.49* ± 0.118
1	96.6 ± 2.721	1.50 ± 0.094	3.32* ± 0.61
10	100 ± 0.000	0.75 ± 0.071	2.70 ± 0.114
50	100 ± 0.000	0.40 ± 0.140	1.68 ± 0.058
100	93.3 ± 2.721	0.27 ± 0.215	1.34 ± 0.090
F ratio	1.33 N.S.	31.38*	84.51*
F value	3.11	3.11	3.11
C.D. at 5%	7.26	0.37	0.29

*Significant, N.S. – Non-significant

Table 4. Effect of Gibberellic acid on seed germination and seedling growth of *Trigonella foenum-graecum.*

Concentration (ppm)	Germination (percent)	Root length (cm)	Shoot length (cm)
Control	93.3 ± 2.721	1.82 ± 0.100	2.97 ± 0.061
0.5	96.6 ± 2.721	1.40 ± 0.165	2.82 ± 0.097
1	93.3 ± 5.438	1.44 ± 0.100	3.24 ± 0.078
10	100 ± 0.000	1.62 ± 0.116	3.54 ± 0.190
50	93.3 ± 5.438	1.73 ± 0.104	4.09* ± 0.172
100	100 ± 0.000	1.24 ± 0.166	3.79* ± 0.110
F ratio	0.58 N.S.	2.00 N.S.	3.96*
F value	3.11	3.11	3.11
C.D. at 5%	13.26	0.49	0.75

*Significant, N.S. – Non-significant

50 ppm. The influence of all concentrations of NAA on germination was non-significant. Root length decreased with the increasing concentration of NAA. Lower doses of NAA, i.e., 0.5 and 1 ppm significantly promoted shooting whereas higher doses inhibited the same (Table 3).

(iv) Gibberellic acid (GA_3)-Treatment with GA_3 improved percent seed germination. All concentrations of GA_3 inhibited rooting whereas shooting increased with increasing concentrations from 1 to 50 ppm as compared to control. The effect of higher doses of GA_3, i.e. 50 and 100 ppm on shooting was significant. The influence of GA_3 on percent seed germination and root length was non-significant (Table 4).

It was observed that lower concentrations of IAA increased rooting while higher concentrations decreased. Higher concentrations of IAA inhibited seedling growth because higher concentrations of IAA is already present endogenously in seeds and further application of IAA exogenously might have increased the auxin level to lethal dose resulting in growth inhibition[13,14]. Application of different concentrations of GA_3 increased shoot length whereas root length was decreased. This may be due to activation of α-amylase, Gibberellin lipase, proteases and cytolytic enzymes which promote cell wall degradation. Promotion of shooting and inhibition of rooting by treatment with GA_3 have also been observed in *Glycine max* Linn.[15].

It can be concluded that treatment with various growth regulators improved percent germination and seedling growth as compared to the control. IAA promoted rooting while GA_3 treatment improved shooting.

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