SUMMARY
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The present thesis is comprised of six chapters. Chapter 1 (Introduction) highlights the substance of the research problem "Growth, Yield and Active Constituents of Fenugreek (Trigonella foenum-graecum L.) as influenced by Foliage-Spray of Selected Depolymerised Polysaccharides and PGRs Applied with or without Phosphorus."

Chapter 2 (Review of Literature) presents the general description on fenugreek, including its botany, cultivation, medicinal uses, functional properties and bioactive constituents. Moreover, a brief description of influence of plant growth regulators (gibberellic acid and kinetin), irradiated polysaccharides (irradiated sodium alginate and irradiated chitosan) and phosphorus (P) and that of their combined application is presented on various aspects of plant processes.

Chapter 3 (Materials and Methods) deals with the methodology, describing different techniques used [High performance liquid chromatography (HPLC), Gel permeation liquid chromatography (GPC), Scanning electron microscopy (SEM)], which were employed during the present research work. The pertinent information on meteorological and edaphic data has also been given in this chapter.

Chapter 4 (Experimental Results) comprises the results of experiments conducted, showing significance of data at P=0.05. Salient points regarding the results obtained are summarized below.

Experiment 1 was conducted on fenugreek according to randomized design to study the effect of aqueous solutions of different concentrations of gibberellic acid (GA₃), viz. 0 (water-spray), 10⁻³, 10⁻⁶ and 10⁻⁵ M applied alone and in combination with soil-dressing with phosphorus [40 kg P ha⁻¹ (P₄₀)]. Control plants were sprayed with deionised water. The aim of this experiment was to find out the optimum dose of GA₃ and the best combination of GA₃ and phosphorus regarding growth characteristics (shoot and root length per plant, fresh and dry mass of shoot per plant, fresh and dry mass of root per plant, number of leaves per plant and leaf-area per plant), physiological and biochemical attributes (total content of leaf-chlorophyll and -carotenoids, activities of nitrate reductase and carbonic anhydrase enzymes and leaf-N, -P and -K contents), quality attributes (seed alkaloids content and seed trigonelline content) and yield parameters (seed yield, seed alkaloids yield and seed trigonelline
yield) of fenugreek. The effect of different concentrations of GA$_3$ was significant on
the parameters studied. $10^{-6}$ M of GA$_3$ proved to be optimum concentration. Among
combinations, P$_{40}$ + $10^{-6}$ M of GA$_3$ proved to be the best.

Experiment 2 was conducted on fenugreek according to randomized design to
study the effect of aqueous solutions of different concentrations of kinetin (Kn), viz. 0
(water-spray), $10^{-6}$, $10^{-5}$ and $10^{-4}$ M applied alone and in combination with soil-
dressing with phosphorus [40 kg P ha$^{-1}$ (P$_{40}$)]. Control plants were sprayed with
deionised water. The aim of this experiment was to find out the optimum dose of Kn
and the best combination of Kn and phosphorus with regard to growth attributes
(shoot and root length per plant, fresh and dry mass of shoot per plant, fresh and dry
mass of root per plant, number of leaves per plant and leaf-area per plant),
physiological and biochemical attributes (total content of leaf-chlorophyll and
-carotenoids, activities of nitrate reductase and carbonic anhydrase enzymes and leaf-
N, -P and -K contents), quality parameters (seed alkaloids content and seed
trigonelline content) and yield attributes (seed yield, seed alkaloids yield and seed
trigonelline yield) of fenugreek. The effect of different concentrations of Kn was
found significant for the parameters studied. $10^{-6}$ M of Kn concentration proved to be
optimum. Among combinations, P$_{40}$ +$10^{-6}$ M Kn proved to be the best. The lowest
value was invariably recorded for control.

Experiment 3 was conducted according to randomized design to study the
effect of aqueous solution of different concentrations of irradiated sodium alginate
(ISA) on the growth attributes (shoot and root length per plant, fresh and dry mass of
shoot per plant, fresh and dry mass of root per plant, number of leaves per plant and
leaf-area per plant), physiological and biochemical attributes (total content of leaf-
chlorophyll and carotenoids, activities of nitrate reductase and carbonic anhydrase
enzymes and leaf-N, -P and -K contents), quality parameters (seed alkaloids content
and seed trigonelline content) and yield attributes (seed yield, seed alkaloids yield and
seed trigonelline yield) of fenugreek. The plants were treated with three different
concentrations of aqueous solution of ISA (irradiated at a dose of 520 kGy), viz. 0
(water-spray), 40, 80 and 120 mg L$^{-1}$ applied alone and in combination soil-dressing
with phosphorus [40 kg P ha$^{-1}$ (P$_{40}$)]. To compare the results regarding the effect of
irradiated sodium alginate (USA), un-irradiated sodium alginate applied at 40 mg L$^{-1}$
was used. Plants, sprayed with double distilled water, served as control. Among
different concentrations of ISA, 80 mg L\(^{-1}\) proved to be the optimum one and its combination with the 40 kg P ha\(^{-1}\) (P\(_{40}\) + ISA 80 mg L\(^{-1}\)) proved to be the best treatment.

Experiment 4 was conducted according to randomized design to study the effect of aqueous solution of different concentrations of irradiated chitosan (IC) on the growth attributes (shoot and root length per plant, fresh and dry mass of shoot per plant, fresh and dry mass of root per plant, number of leaves per plant and leaf-area per plant), physiological and biochemical attributes (total content of leaf-chlorophyll and -carotenoids, activities of nitrate reductase and carbonic anhydrase enzymes and leaf-N, -P and -K contents), quality parameters (seed yield, seed alkaloids content and seed trigonelline content) and yield attributes (seed alkaloids yield and seed trigonelline yield) of fenugreek. The plants were treated with three different concentrations of aqueous solution of IC (irradiated at a total dose of 250 kGy), viz. 0 (water-spray), 40, 80 and 120 mg L\(^{-1}\) applied alone in combination with soil-dressing with phosphorus (40 kg P ha\(^{-1}\) or P\(_{40}\)). To compare the results of irradiated chitosan, un-irradiated chitosan (UC) at 40 mg L\(^{-1}\) was used. Plants, sprayed with double distilled water, served as control. Of the different concentrations of IC, 80 mg L\(^{-1}\) proved to be the optimum one. Among combination treatments, P\(_{40}\) + IC 40 mg L\(^{-1}\) proved to be the best treatment.

Experiment 5 was conducted according to randomized design. It aimed at exploring the combined effect of foliar spray of the best doses of GA\(_3\), Kn, ISA, and IC (recorded in the first four experiments) and that of their combination on the growth attributes (shoot and root length per plant, fresh and dry mass of shoot per plant, fresh and dry mass of root per plant, number of leaves per plant and leaf-area per plant), physiological and biochemical attributes (total content of leaf-chlorophyll and -carotenoids, activities of nitrate reductase and carbonic anhydrase enzymes and leaf-N, -P and -K contents), quality attributes (seed yield, seed alkaloids content and seed trigonelline content) and yield parameters (seed alkaloids yield and seed trigonelline yield) of fenugreek. There were three controls in this experiment, viz. Control 1 (absolute Control), Control 2 (deionised-water-spray treatment) and Control 3 (deionised-water-spray treatment + P\(_{40}\)). Among all the combination treatments, treatment 5 (GA\(_3\) 10\(^{-6}\) M + ISA\(_{80}\) + P\(_{40}\)) proved to be the best for most of the
parameters, while for some parameters treatment 7 (Kn10⁻⁶ M + ISA₈₀ + P₄₀) and treatment 10 (GA₃ 10⁻⁶ M + Kn 10⁻⁶ M + ISA₈₀ + P₄₀) gave the best results.

In Chapter 5 (Discussion), the important results of the five experiments have been discussed in the light of scientific literature and earlier findings published by other researchers.

The present chapter 6 (Summary) is the resume of the present thesis. It is followed by a list of up to date references cited in the text. An appendix containing the various formulations employed for chemical analysis, has also been given at the end of the thesis.

On the basis of this study it is concluded that the application of plant growth regulators (GA₃ and Kn) and radiation-processed natural polysaccharides (ISA and IC) applied alone and in combination with phosphorus soil-dressing (40 kg P ha⁻¹) proved highly beneficial and very economical because very little quantity of the irradiated natural polysaccharides were used for the foliar application treatments. The combined effect of foliar application of GA₃, Kn and irradiated polysaccharides has been studied for the first time in terms of the changes that occurred regarding the growth, yield and alkaloids content of fenugreek.

The mechanism and mode of action of GA₃ and Kn regarding plant growth and development are well documented, however further investigations are required to comprehend the mechanism and mode of action of radiation-processed natural polysaccharides with regard to productivity and quality of the medicinal and other crop plants.