SRI VENKATESWARA INTERNSHIP PROGRAM

FOR RESEARCH IN ACADEMICS

(SRI-VIPRA)

Project Report of 2023: SVP-2338

"Production of chelated minerals selenium and zinc through *Coriandrum sativum*"

IQAC

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SRIVIPRA PROJECT 2023

Title: Production of chelated minerals selenium and zinc through *Coriandrum sativum*

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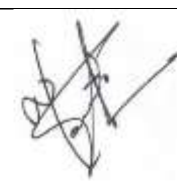
1		Mantosh Kumar Mandal	2021018	B.Sc. (Hons) Zoology	
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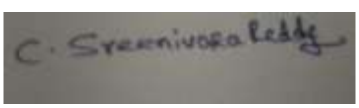
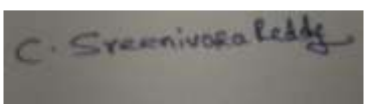


Signature of Mentor

Certificate of Originality

This is to certify that the aforementioned students from Sri Venkateswara College have participated in the summer project SVP-2338 titled "**Production of chelated minerals selenium and zinc through *Coriandrum sativum***". The participants have carried out the research project work under my guidance and supervision from 15 June 2023 to 15th September 2023. The work carried out is original and carried out in an offline mode.



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Production of chelated minerals selenium and zinc through *Coriandrum sativum*

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Abstract

Selenium and Zinc minerals play an important role in the metabolisms of living plants and animals. Chelated minerals play a more efficient role when compare with inorganic minerals. We studied on enrichment of selenium and zinc in *Coriandrum sativum*. We studied this experiment with maintaining different concentrations inorganic selenium and zinc minerals along with control in the soil separately selenium enrichment process we maintained 0,0.5,1,1.5,2,2.5,3,3.5,4 and 4.5ppm inorganic sodium selenite supplemented in the different concentrations of soil samples. In zinc enrichment process we supplemented $ZnSo_4$in various concentrations and maintained 0,50,100,150,200,250,300,350, 400, and 450 ppm in the soil. Then we inoculated with Coriandrum seeds equally in all trays. We conducted this experiment for one-month duration and then we collected the grown plant materials, and the weight of the samples were measured. The wet samples were dried at 45^0c for 48 hours. The dried samples' weights were measured. Through the study of the experiment, we observed that 200 ppm of inorganic zinc and 2.5 ppm of inorganic selenium were suitable supplemented concentrations to produce chelated selenium and zinc minerals production in the soil.

Key words: Coriander, growth, nutrient, Sulphur, yield, zinc

Introduction:

Model system: Coriandrum sativum

Biological Classification

Kingdom- Plantae
Division- Tracheophyta
Class- Magnoliopsida
Order-Apiales
Family-Apiaceae
Genus- *Coriandrum*
Species- *C. sativum*

Southern Europe, Northern Africa, and southwestern Asia are all places where coriander is indigenous. It is a delicate plant that reaches a height of 50 cm (20 in). Variable in shape, the leaves are extensively lobed at the plant's base and slender and feathery higher up on the stalks that bear the flowers.92% of the water, 4% the carbs, 2% the protein, and less than 1% of the fat in raw coriander leaves. Compared to fresh stems or leaves, coriander seeds have a different nutritional composition. Leaves are especially high in vitamins A, C, and K, with a reasonable amount of dietary minerals. Despite having lesser vitamin content than other foods, seeds are a good source of dietary fiber, calcium, selenium, iron, magnesium, and manganese.

Selenium:

A chemical element with the atomic number 34 and the symbol Se is selenium. It is a metalloid (rarely regarded as a nonmetal) having properties that are halfway between sulfur and tellurium, the elements above and below it in the periodic table, and it also resembles arsenic. There are chelated and inorganic forms of selenium. Both sodium selenite and sodium selenate are present in inorganic form. It is accessible in organic form as chelated with both plants and animals. It is enhanced with animal body, plant components, and yeast. Compared to inorganic Selenium, chelated minerals have a higher bioavailability. With its function as a cofactor in glutathione peroxidase, selenium participates in antioxidant actions.

Zinc:

With an atomic number of 30, zinc is a chemical element. Both inorganic and organic forms of zinc are available. Zinc is accessible in inorganic forms such as zinc sulphate, zinc carbonate, zinc nitrate, etc.It is offered in organic form chelated or supplemented with yeast, plant, or animal tissues. In enzymatic reactions, zinc functions as a cofactor. It functions as a cofactor in carbonic anhydrase and carboxy peptidase.

Materials

1. 10 Plastic trays for zinc treatments
2. 10 Plastic tray for selenium treatments
3. Coriander seeds (250g per box)
4. Potting soil
5. Watering can or spray bottle
6. Labels or markers
7. Zinc sulphate and Sodium selenite.

Method

In the process, the soils were initially prepared in trays, each containing 2 kg of dirt. Then, in a standard flask, we made a sodium selenite stock solution with a concentration of 1000 ppm to supplement the selenium in the weighed soils that were maintained in the trays with labels. The sodium selenite liquid in the soil was added in accordance with the treatment requirement. According to their needs, weighed zinc sulphate chemicals were added to the soils that were present in the indicated trays. After adding minerals to the soil, we inoculated each tray with 4.5 gm of Coriandrum seeds and used to water it every day. The Sri Venkateswara College green house at the University of Delhi served as the site for this experiment.

We maintained each concentration in three replicates while using various quantities of inorganic zinc and selenium. For analysis, the average values were used. The table no. 1 below lists the various concentrations.

Table No:1.

Treatment	Coriandrum with Selenium (ppm)	Coriandrum with Zinc (ppm)
1	0	0
2	0.5	50
3	1	100

4	1.5	150
5	2	200
6	2.5	250
7	3	300
8	3.5	350
9	4	400
10	4.5	450

Results:

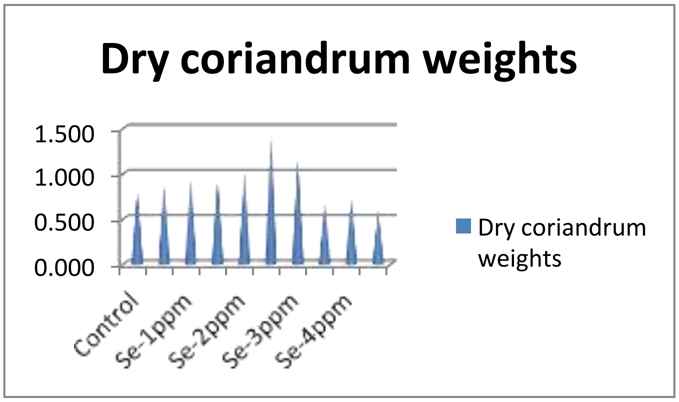
In the experimental observations of Selenium treatments, the biomass of Coriandrum sativum was increased from control to 2.5ppm of Selenium treatments and then biomass was decreased gradually with increasing selenium concentrations**.** The biomasses were represented in the table no-2. The plant height was increased at the concentration of 2.5 ppm when compare with control, and the root length was decreased in all treatments gradually. Therefore, selenium may not be promoting the growth of root in Coriandrum.

Table No:2

S.No	Treatment	Wet Coriandrum sativum weights	Dry Coriandrum sativum weights	Plant height	Root length
1	Control	5	0.833	10	6
2	Se-0.5ppm	5.2	0.866	6	4
3	Se-1ppm	5.5	0.916	6	4
4	Se-1.5ppm	5.8	0.966	6.5	4
5	Se-2ppm	6	0.999	8.5	3.5
6	Se-2.5ppm	8.3946	1.398	11	3
7	Se-3ppm	7.11	1.184	10	3
8	Se-3.5ppm	4.02	0.670	10	3

9	Se-4ppm	4.306	0.717	8	3
10	Se-4.5ppm	3.5	0.583	7.5	3

Fig:1



In the experimental observation of Zinc treatments in the soil, we got the results were the biomass of Coriandrum was increased from control to 200ppm of Zinc sulphate, after exceeding that concentration the biomass was decreased. The plant height and root length were increased in 200ppm of zinc sulphate in the soil.

Table No 3.: Effect of Zinc Sulphate on the growth of Coriandrum sativum

S.No	Treatment	Wet Coriandrum sativum weights	Dry Coriandrum sativum weights	Plant height	Root length
1	Control	5.2	0.866	10	6
2	Zn-50ppm	5.4	0.899	8.5	2.5
3	Zn-100ppm	5.4316	0.905	7.5	5.2
4	Zn-150ppm	6.53	1.088	8	5.2
5	Zn-200ppm	8.2399	1.373	13	7
6	Zn-250ppm	6.5232	1.087	12	3.6
7	Zn-300ppm	5.5	0.916	10	5
8	Zn-350ppm	5.1	0.850	10	5

9	Zn-400ppm	4.2627	0.710	9.3	5
10	Zn-450ppm	2.7586	0.460	9	3

Fig:2

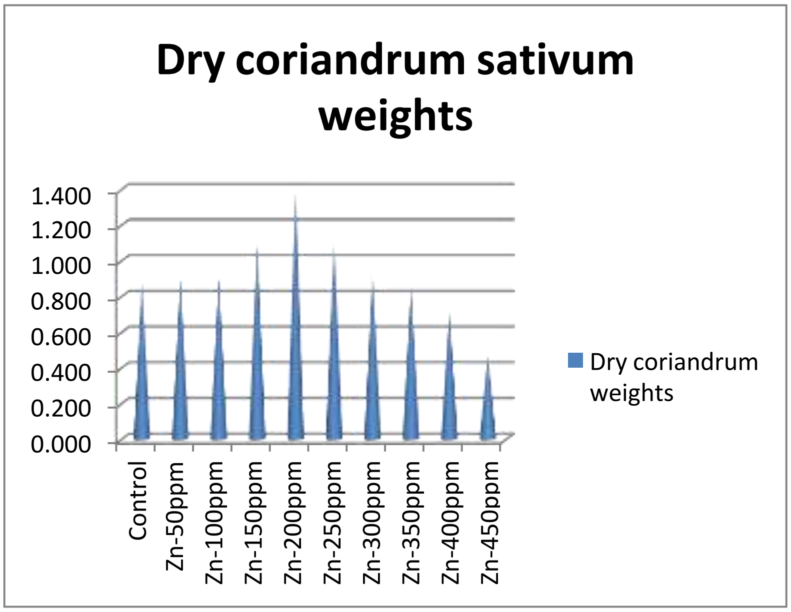


Fig:3

<u>Experimental set up</u>

a. Coriandrum sativum Plant material

b. Coriandrum Treatments with Selenium.

c. Coriandrum treatments with Zinc.

Discussion:

The procedure of enriching minerals was only done to chelate with biomolecules like protein and RNA. To enrich minerals, scientists used yeast, mushrooms, azolla, algae, and various plants. These minerals were added to the feed of veterinary animals to supplement it. This will boost the bioavailability of the minerals and the metabolic activities of the enzymes, which will promote body weight gain and immune response to disease. The 5.92 mg/gm of selenium in the yeast pellet is enhanced in yeast cells by 30 ppm of sodium selenite in YPD medium (Prakash et al., 2019). Under the right circumstances, yeast cells have the capacity to store huge amounts of inorganic Se and have the capacity to convert it into organic Se (Suhajda et al. 2000). Alternative routes (Webb et al. 2005), better bioavailability, and reduced mineral excretion (Leeson et al. 2003) are all characteristics of organic trace minerals. The Azolla plant was utilized to enrich selenium, and in the H 40 media, it collects 1.732 mg/gm of sodium selenite. Reddy and coworkers 2023.

The highest rate of Zn enrichment of mycelia and fruiting bodies was 9.12 ± 0.09% and 0.44 ± 0.27% at Zn concentration of 100 mg/L, respectively (Mehrabi et al.,2022). The highest amount of zinc in yeast cells was achieved when added in the form of zinc nitrate in concentration of 200 mg.100 ml -1 YPD medium. The increment of intracellular zinc was up to 18.5 mg. g-1 of yeast biomass (Sillerová et al. 2012). Azolla plants accumulated Se efficiently during cultivation at different concentrations. Selenium content in Azolla increased significantly with increasing Se concentration in the culture media up to 5 ppm Se (Hassan Ama et al.,2016).

Zn metal concentrations in coriander leaves ranged from 33.1 to 54.8 mg/kg (Abdella et al., 2018). Selenite from the substrate can be effectively converted into its organic species by the fruiting body of F. velutipes. According to Z. Dong et al. (2002), the ideal selenite application concentrations for the growth of the F. velutipes fruiting body were 5.0 g/g. With a Se absorption of 29 g/g dry weight, L. minor was chosen to remove Se from an actual seleniferous soil leachate that contained 74 g/L of selenium. A 76% efficiency was attained (Ohlbaum, M., et al., 2018). Zn buildup in yeast rose from 138.9 mg/kg to 290.2 mg/kg using different fermentation conditions and ultrasounds (Esfahani, Z.C., et al., 2022). In this manner, numerous researchers attempted to transform inorganic minerals into organic or chelated forms. In the current effort, we experimented with selenium and zinc in the Coriandrum sativum plant.

Conclusion:

We experimented individually with various quantities in the selenium and zinc mineral enrichment. We found that 2.5 ppm of sodium selenite in the soil is the ideal quantity to enrich the Coriandrum sativum plant with selenium. We found that the optimal concentration of Zinc Sulphate in the soil to support Zinc enrichment in the Coriandrum sativum was 200 ppm. In the Coriandrum sativum, zinc supported the growth of the root while selenium did not.

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