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# Effects of Nickel on seed germination of *Pisum sativam*

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## ABSTRACT

The issue of heavy metal pollution is very much concerned because of their toxicity for plant, animal and human being and their lack of biodegradability. The present study aimed to determine the effects of various concentrations of Ni on seed germination of *Pisum sativum*. The maximum seed germination was observed at 50 mg/l of Ni for *Pisum sativum*.

Figure : 00 References : 07 Tables : 02

KEY WORDS : Heavy metal, Nickel, *Pisum sativam*, Toxicity.

## Introduction

Rapid increase of population, urbanization and progress in technology has created pollution of the environment. Heavy metal *e.g.* Nickel has created ecological crisis. Heavy metals are nondegradable and their content biomagnified in living organisms through the food chain. There are toxic levels both in plant and animal systems, generally, damaging and blocking enzymatic reactions. Nickel is not required by the plants for nutrition[3]. The excessive release of Nickel into the environment is hazardous. The metal *e.g.* Fe and Zn are required by the plants but they also become hazardous when their level is more than permissible limit.

Nickel belongs with Iron and Cobalt to the first long series and 8$^{th}$ sub group in the periodic table. The atomic number and atomic weight of this metal are 28 and 58.71 respectively. The outermost electron configuration of this metal is $3d^8$, $4s^2$. It has been suggested[4,5] that Nickel is bordered line metal ion and such is ambivalent, displaying both the class $O_2$ seeking and Nitrogen/Sulphur seeking.

This property depends on circumstances. Nickel is one of the major elemental constituents of earth. The average concentration of this metal is on the border of 2% by weight, making it the 5$^{th}$ most abundant element after Iron, Oxygen, Magnesium and Silicon. It was suggested that nickel is relatively minor constituent of earth's crust,[7] however, has an average of less than 0.01% and ranks as only the 25$^{th}$ most abundantly found element.

## Materials ad Methods

Healthy seeds of *Pisum sativum* Cultivar Organ and *Pisum sativum* Cultivar Azad were sterilized in hypochlorite solution 20% for 10 minute, then they were rinsed three times with distilled water and were disinfected in a Benomyl solution of one part in a thousand for 20 minutes. All appliances including Petri dishes and filter paper were autoclaved. This study was done in one randomized complete block design with four replications in T.D. P.G. College, Jaunpur. For the preparation of nickel treatments, nickel nitrate was used and their concentrations were 0, 500, 1000, 3000 milligrams per liter. After preparing Petri dishes, 50 seeds were placed between two filter papers in each Petri dish and different Ni treatments were applied.

Distilled water was used for control treatment. Petri dishes were incubated at 25$^0$C temperature. The daily numbers of germinated seeds in each plot were counted to estimate the rate of germination. The seeds were counted in each plot until the change in the number of germinated seeds was not observed for three consecutive days.

After the time of planting seeds (8 days) and the

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**TABLE-1 : Effect of Nickel Pretreatment to seed on germination and growth in dark grown seedlings of *Pisum sativum Cultivar* Organ**

**Days After Radicle Emergence**

| Parameter | - | - | 4 | - | - | 6 | - | - | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Organ | **Nickel Concentration mg.** | | | | | | | | |
| | 0 | 10 | 50 | 0 | 10 | 50 | 0 | 10 | 50 |
| Germination | 86.50 | 99.00 | 71.00 | - | - | - | - | - | - |
| Length, cm. Radicle | 4.10 | 6.70 | 2.25 | 5.90 | 9.90 | 5.00 | 10.00 | 12.15 | 7.00 |
| Epicotyl | 2.50 | 3.10 | 1.15 | 4.00 | 4.50 | 3.50 | 7.20 | 9.00 | 4.70 |
| Fresh weight, mg. Radicle | 62.00 | 92.00 | 43.00 | 92.10 | 121.00 | 71.90 | 165.00 | 210.70 | 140.50 |
| Epicotyl | 52.15 | 76.50 | 34.10 | 111.50 | 135.15 | 184.30 | 221.00 | 283.40 | 161.40 |

optimum growth of the seedlings, germination rate, germination percentage, radical length, plumule length, seedling length and vigor index were measured. Germination percentage[2] germination rate[6] and seedling vigor index[1] were calculated according to the following relationships.

(1) $GP = \left(\frac{G}{N}\right) \times 100$

Where $GP$ = Germination percentage

$G$ = the number of germinated seeds until X days

$N$ = Total number of seeds

(2) $GR = \sum_{i=i}^{n} \left(\frac{S_i}{D_i}\right) \times 100$

Where $GR$ = Germination rate

$S_i$ = The number of germinated seeds in each counting

$D_i$ = Number of days to $n$ counting

$n$ = Number of numeration

(3) Seedling vigor index = the final of germination percentage × seedling length

Data were subjected to analysis of variance. Data were analyzed using Graphpad 6 software. Significance differences between means were done using Duncan test at the 5% level.

## Results and Discussion

The results of the analysis of variance showed that the levels of nickel nitrate had a significant effect on radical and plumle length, seedling length, seed vigor, germination rate and germination percentage of both species. With increasing concentration of nickel nitrate from 0 to 3000 mg per litre, seed germination percentage of Pea Cultivar Organ and Pea Cultivar Azad was declined (Tables- 1 & 2).

The present investigation was undertaken to assess the effect of various concentrations of nickel chloride on seed germination and seedling growth. Based on doses response curve obtained from studies of concentrations of $NiCl_2$ was selected.

The investigations carried out the finding suggest that:

(i) Pretreatment as well as post radical emergency treatment with various concentrations of nickel chloride (1, 5, 10, 25, 50 and 100 mg) Ni/l have promontory and inhibitory effect on growth respectively at the lower (1, 5 and 10 mg Ni/l) and higher (25, 50 and 100 mg Ni/l) concentrations of nickel.

(ii) Seedling growth is inhibited by phasic pretreatment in all the regimes of phasic pretreatment, however it is maximum in mid phase treatment set.

(iii) Growth and yield of certain vegetable crop plants grown on nickel amended soil is promoted at 10 mg Ni/Kg soil and inhibited at 50 mg Ni/Kg soil. There are Cultivar and Organ specific differences in response to

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**TABLE-2 : Effect of Copper Pretreatment to seed on seed germination and growth in dark grown seedlings of *Pisum sativum Cultivar Azad***

| Parameter | - | - | 4 | - | - | 6 | - | - | 8 |
|---|---|---|---|---|---|---|---|---|---|
| Azad | **Nickel Concentration mg.** | | | | | | | | |
| | 0 | 10 | 50 | 0 | 10 | 50 | 0 | 10 | 50 |
| Germination | 85.50 | 98.00 | 70.00 | - | - | - | - | - | - |
| Length, cm. Radicle | 4.00 | 6.60 | 2.00 | 5.50 | 9.50 | 4.00 | 10.00 | 10.15 | 6.00 |
| Epicotyl | 2.20 | 3.10 | 1.12 | 4.00 | 4.40 | 3.00 | 7.00 | 8.00 | 4.60 |
| Fresh weight, mg. Radicle | 60.00 | 90.00 | 41.90 | 91.10 | 111.00 | 70.90 | 155.00 | 210.60 | 140.40 |
| Epicotyl | 50.15 | 75.50 | 33.10 | 111.40 | 134.15 | 174.30 | 211.00 | 273.40 | 171.40 |

**Days After Radicle Emergence**

these two nickel concentrations. With environmental condition the effects are partly modified.

(iv) Growth and yield of test crop plants irrigated by polluted water is enhanced. This polluted water is generally used for irrigation in local area which constituents a deceptive type of pollution. The growth of vegetable crop plants is increased by polluted water irrigation. This gives satisfaction to farmers and consumers. But this practice is responsible for heavy metal accumulation in the edible parts of plant which is highly hazardous.

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