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STUDY ON THE EFFECT OF Zn AMENDED SOIL OF PHYSIOLOGY ON GROWTH AND DEVELOPMENT OF LEGUMINOUS PLANT (*Pisum sativum* cv. Azad)

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ABSTRACT

Zinc reaches in our body through water and food chain and causes several diseases as well as inhibits several enzymatic reactions. There occurs uptake of this heavy metals by the crop plants, because farmers use Zn for the enhancement of growth and yield of their crop. Through food chain Zn reaches in our body and causes damage of protein molecules specially by blocking activity of enzymes. The use of Zn beyond the permissible limit has toxic effect on plants and animals. Therefore, it was of interest to study on the topic which are widely cultivated in measure part of U.P.

KEYWORDS: Zinc, Heavy Metals, *Pisum sativum*, Toxic Effects, Protein.

The unfavorable conditions in our atmosphere are caused due to heavy industrialization. Today we have a good industrial infrastructure in core industries like metals, chemicals, fertilizers, petroleum, food etc. The pesticides, detergents, plastics, solvents, fuels, paints, dyes, food additives etc. are greatly produced and used by us.

When these products are used, they are not completely utilized and so they are released into the environment, Andersson (1976). Thus, cause undesirable change in physical chemical or biological characters of air, water, and soil that may harmfully affect the life or create a potential health hazard of any living organism.

Any substance which causes pollution is called a pollutant. A pollutant may thus include any chemical or geochemical substance like dust, sediment, grit etc., biotic component or its product, or physical factor like heat, that is released intentionally by man into the environment in such a concentration that they may have adverse harmful or unpleasant effects. Gases, Acids droplets, Agrochemicals, complex organic substances, photochemical oxidants, solid wastes, Noise radioactive wastes, and metals are chief environmental pollutants heavy metals like Mercury, Zinc, Lead, Cadmium & Nickel causes heavy metal damage both to plants and animals, heavy metal pollution has caused major ecological crises Asif *et al.*, (1976).

Heavy metals, the metallic ions having density greater than five and atomic number greater than twenty-three (Vanadium) except Rubidium, Stroncium etc. are non-degradation and are accumulated considerably and their content biomagnified in living organisms through the food chain Banerji and Kumar (1979). These are in toxic levels deleterious both to plant and animal systems, usually by damaging protein molecules and blocking enzymatic reactions.

Heavy metals as Fe or Zn, which are otherwise necessary, also become hazardous when their levels reach abnormal amounts Bhargava and Singh, (1982). Zn has created a biological hazard it is heavy metal with atomic number 30 and atomic weight 65.38 belongs to subgroup IIB in the periodic table (Singh, 2010). The chief source of Zinc pollution is chemical compounds used by human activities Singh and Singh, (2020). Toxic levels of Zinc in soils may be caused by its application by the farmers for the better yield of their crop plants.

Zinc is normally present in the body in such metalloenzymes as carbonic anhydrase, alkaline phosphatase and dehydrogenase or as co-factors in other enzymes (arginase and histamine deaminase), taking part in the synthesis of DNA, Proteins and insulin Gupta *et al.*, (1983). Thus, Zinc is necessary for the normal functioning of the cell, including protein synthesis, carbohydrate metabolism, cell division and growth recommended daily dietary allowances of Zinc are at 15 mg for adults and 10 mg for children over a year old. The average dietary intake of zinc in India is about 16.1 mg. Zinc at concentrations over 15mg/m^3 in air, in the work environment may produce metal fume fever. The emetic dose of Zn as a salt is about 300 mg. large doses of Zinc salts (220-440 mg of Zn as $ZnSo_4$) cause gastrointestinal disorders including vomiting and diarrhea. There is no evidence of its teratogenic, mutagenic or carcinogenic. Dutta and Mookarjee (1980) collected soil sample from different sites around a cable factory in Rupnaryanpur West Bengal and analyzed them for heavy metals.

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Zinc is an essential trace element to all organism as it is necessary for the functioning of various enzymes. Zn forms about 0.004% of the earth crust and ranks 25th in the order of abundance. Zn occurs in number of minerals- Zn blende, Smithsonite, Willemite, Zincite and others.

MATERIALS AND METHODS

To study the impact of Zn amended soil on growth development and yield of test plant various concentrations of Zn amended soil was taken i.e. 10mg/kg and 50mg/kg. *Pisum sativum* cv. Azad were taken as test plants soil was taken from Peeli Kothi experimental plot, this soil is sandy, clayey loam type and had acidic pH with high humas content.

Test plant ie Pea was imbibed in distilled water for their full imbibition period and after that the seeds were transferred to polythene bags which contain 1kg of soil amended with 10mg and 50mg of Zinc sulphate. These polythene bags are then kept in dark for their germination control and experimental sets were irrigated with tube well water. The experiments were performed in open fields measurement were carried out after 40 days (which is considered as Nodulation stage, vegetative growth stage) 70 days (which is considered as flowering stage) and 120 days (which is harvest stage)

Effect of Zinc Amended Soil on Growth and Development

Pisum sativum cv. Azad- Effect of Zn amended soil on Azad is given in Table 1. Zn concentration which was used are 10mg and 50mg/kg of soil. After 40 days of sowing following measurement were taken. Stem length is 7.92,7.99 and 5.21 for control, 10mg Zn/kg and 50mg Zn/kg of soil respectively. Stem fresh weight 425, 424.09, 385 mg, stem dry weight 57.09, 58.02 and 47.0mg. Root length 27.86, 27.92 and 24.0 cm Root fresh weight 1405.0, 1412.0 and 980.0 mg and root dry weight is 158.9, 160.21 and 145.0 for control.

After 70 days which is called as flowering stage stem length is 15.21, 15.01 and 11.92 cm, stem fresh weight 895.0, 898.91 and 725.0 mg, stem dry weight 168.9, 172.0 and 125.09 mg, Root length 48.9, 49.99 and 39.09 cm and Root fresh weight is 2024.0, 2028.0 and 1558.0 mg for control.

In all these plant parts 10 mg Zn/kg of soil shows slightly promotory effect and 50 mg Zn/kg shows inhibitory effect, leaf number show no promotory effect in 10mg/kg soil, it is near about equal to the control set. Leaf fresh weight, leaf dry weight also show this type of pattern.

In *Pisum sativum* cv.Azad pod number/plant is 20,20.4 and 13.92in control, 10mg/kg and 50mg/kg Zn amended soil respectively. Pod fresh weight is 872.0, 818.8 and 434, Pod dry weight is 62.0, 60.0 and 42.0, Seed number/Pod is 5.6, 5.0 and 3.3 in control, 10mg and 50 mg Zn amended soil given in Table 2.

RESULTS AND DISCUSSION

The results on the effect of 10 mg/kg and 50 mg/kg of soil on cultivar *Pisum sativum* Azad suggest that.

Table 1: Effect of zinc amended soil on growth of *Pisum sativum* cv. Azad zinc concentrations are 10, 50 mg/kg of soil

Parameter/Organ	Days after germination…					
	40 (Nodulation stage) 70 (Flowering stage)					
	Zinc concentrations in mg/kg.					
	0	10	50	0	10	50
Stem length in cm.	7.92	7.99	5.21	15.21	15.01	11.92
Stem fresh weight, mg.	4.25.0	4.24.09	385.0	895.90	898.91	725.0
Stem dry weight, mg.	57.09	58.02	47.0	168.9	172.0	125.09
Root length in cm.	27.86	27.92	24.0	48.9	49.99	39.09
Root fresh weight, mg.	1405.0	1412.0	980.0	2024.0	2028.0	1558.0
Root dry weight, mg.	158.9	160.21	145.0	285.0	262.0	199.90
Nodule number.	8.52	8.61	5.23	25.0	24.2	15.93
Nodule fresh weight, mg.	84.60	83.09	64.92	256.0	264.0	189.0
Nodule dry weight, mg.	8.92	8.99	7.23	42.90	48.29	19.0
Leaf number.	19.29	20.01	16.23	39.04	38.99	26.02
Leaf fresh weight, mg.	278.23	276.21	246.0	824.92	824.0	658.0
Leaf dry weight, mg.	38.92	39.20	36.0	163.0	163.0	89.0

Average of 15 plants were taken

Seedling growth promoted at 10 mg/kg Zn of soil and inhibited at 50 mg/kg Zn of soil. By performing experiments on Pea genotypes we had found various information about their growth yield and germination. When soil was amended with Zink sulphate and the test plant were shown in it.

The lowermost concentration of ZnSo4 ie 10 mg/kg showed promotary effect and higher concentration ie 50 mg/kg showed inhibitory effect cultivar and organ specific differences. Our finding on effect of ZnSo4 to Pea showed that Zn start its effects from germination stage or we can say that from inhibition. When the seed germinate and seedling was formed its effects became more clear. At seedling stage we can measure its effect by measuring plant parts and comparing it with control set in the observation it was clear that maximum inhibition was recorded in highest concentration were more or less similar to the earlier ones.

Table 2: Effect of zinc amended soil on yield of *Pisum* sativum cusarkel azad zinc concentrations are 10, 50 mg/kg of soil

Parameter/Organ	Days from seedling emergence.		
	120 days (Harvest stage.)		
	Zinc concentrations in mg/kg of soil.		
	0	10	50
Pod number/plant.	20.0	20.4	13.92
Pod fresh weight, mg.	872.0	818.8	434.0
Pod dry weight in mg.	62.0	60.0	42.0
Seed number/pod.	5.6	5.0	3.3

Average of 20 plants were studied

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