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An Investigation of Plant Growth and Nutrient Content by the Effect of Metal Ion and Their Complexes in Cassia Tora (Tarota) Plant

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Abstract

*In the present study Cassia Torawere taken as experimental plant in order to study effect of heavy metals and their complexes of (1S- cis)- 4- (3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine on to improve the yield of economically important plant.*Cassia tora *Linn. (Family: Leguminosae) is well known plant widely distributed in India. Different parts of the plant (Leaves, seed, and root) are reputed for their medicinal value.The seeds were immersed in Mg (II). ions, ligand and its complexes to study the germination and growth pattern and certain physiological processes. Effect of ligand, metal ion and complex solution on growth, determination of % of nitrogen, proteins and chlorophyll in the leaves of plants were studied. The data harvested indicates increased germinations in all seed treatments. The changes in growth pattern of roots length and shoots length are observed in the experimental plants. However, chlorophyll content was found to be higher in plant species. The percentage of nitrogen and proteins were found affected in the leaves of Tarota plant treated with Sartraline, complex and metal Mg(II). Nitrogen and protein contents are found higher in the treated plants as compared to control.*

Key words –Sartraline, Mg (II), Plant, Chlorophyll, Nitrogen, Protein.

Introduction:

India is virtually a herbarium of the world. In India, we are using plants and herbs as the basic source of medicine because we are rich in them. The plant physiologists not only to supply basic information regarding how plants grow and develop but also to undertake research program to increase yield of plant products. Seed germination behavior is important for horticulture and agriculture.[1,2]

Metals are acting a beneficial role for plant growth, development, and productivity at an optimum concentration in the form of the essential micronutrient[3]. To grow and complete the life cycle plants use the essential micronutrients[4]. The plant takes these essential heavy metals like iron, zinc, copper, and manganese from the soil due to concentration gradients and selective uptake of these metals[5]. These ions enthusiastically affected the function of many enzymes and cellular metabolism. These metals also play a prominent role in the synthesis of protein, nucleic acids, photosynthetic pigment, and it also take part in the structural and functional integrity of cell membranes[6].Agricultural scientists realize that crop plants grow in production to the amounts of various nutrients present in soils. Today the application of various salts to soils is a basic future of agricultural practice. With the application of these and other fertilizer to soils, the large crop yields obtained in developing. In modern agricultural practice, various chemicals in solution or aqueous suspension are sprayed on the crop plants with in the object of accelerating and modifying the plant growth and their development.Manganese (Mn) is an essential plant mineral nutrient, playing a key role in several physiological processes, particularly photosynthesis.

Some of heavy metals (Fe, Cu and Zn) are essential for plants[7].Oxines and Gibberlines are the growth promoting harmones.[8-10] Very dilute solution of these growths promoting hormone solutions, if sprayed over the plant, chlorophyll synthesis is accelerated and consequently vegetative growth has been observed. Experimental results indicate that, if the hormonal solution sprayed over crop plants, the crop yield increases to a considerable extent.

Since *(1S-cis)- 4-(3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine*has intense biological activities,antidepressant, selective competitive inhibitor. Sertralineinhibits the activity of the enzymes and since no work is reported on the biological application of binary complexes of Mg (II), with *(1S-cis)- 4-(3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine* and comparing with pure ligand, metal and control solution (double distilled water) to study the effect of complex, metal, ligand over control solution on germination, survival seedlings height etc, on *Tarota* plant in order to make suggestion whether complex, metal and ligands can be used as a plant growth regulator.

Also, biological analysis of chlorophyll contents and percentage of nitrogen and proteins in the leaves of leafy vegetables are carried out at room temperature.

Material And Experimental Methods:

The solution of Mg (II)in the form of nitrate and *(1S-cis)- 4-(3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine*of the concentration of 0.01 M was prepared in double distilled water. The applications of complex, metal, ligand solution is studied by dissolving it in proper solvent at 3.60, 7.00 and

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10.5 pH and at constant ionic strength of 0.01 M potassium nitrate solution. Fertilized soil was collected from agricultural land. It was then ground and filtered. This soil was filled in two wooden trays and tray was moistened with water. Sowing of seeds was done in the soil after one hour.Passioura J.B.[11] has studied on soil structure and plant growth. Many soils contain continuous macrospores that provided niches for the roots to grow in. The presence of such macrospores increases the extent of the root system, Soil structure not only affect the ability of root to grow and to supply the leaves with water and nutrients it also induces them to send hormonal signals that slow the growth of shoot.

Experiments Performed:

In general practice various chemicals are used in agriculture as an ingredient of various pesticides, insecticides, fertilizers etc., to improve the crop yield. Amongst several economical important plants *Tarota* is selected as a plant system.

1. 100 healthy seeds of *Tarota* were taken 3.5 and 7.00 pH for about two hours. These seeds soaked were taken out of each solution and sowed in the wooden tray in a row, the wooden tray was kept under atmospheric pressure at room temperature.
2. Effect of ligand, metal ion, complex solution on growth of Tarota (*Cassia tora) speciesplants* was studied at different pH (3.5 and 7.00).
3. Effect of ligand, metal Mg (II), complex on percentage of Nitrogen, Proteins and Chlorophyll in the leave of *Cassia tora* plants were studied.
4. Chlorophyll content in fresh leaves were determined by spectrophotometric method given by Jahagirdar[12].

Parameters:

Plant growth is decided on the basis of parameter such as percentage of germination, survival, seedling height, shoot length; root length and thickness of young leaf having high values compare to control systems. Germination was noted after 3 days and survival was noted after 10 days. After noting the survival of plant, they were taken out of soil. The seedling height and thickness of leaves of survived *Tarota*plants were measured.

Table 1.1-Effect of Ligand, Metal ion and Complex on Germination, Survival, Seedling height etc. on *Cassia tora*Test System.

Test System	Effect of	pH	Parameters						
			%Germination after 2&1/2 days	% Survival after 10 days	Seedling height (cm)	Root length (cm)	Shoot length (cm)	Root / Shoot	Width of young leaf (cm)
Tarota Test System	Water (Control)	3.5	60.00	60.00	23.072	8.621	14.450	0.590	1.65
		7.0	66.66	66.66	23.62	8.84	14.78	0.5981	1.620
	Ligand	3.5	73.33	73.33	22.984	8.718	14.603	0.5970	1.761
		7.0	80.00	86.66	25.24	9.14	16.08	0.5440	1.541
	Complex	3.5	60.00	60.00	23.614	8.712	14.702	0.5925	1.421
		7.0	73.33	80.00	24.49	9.07	15.41	0.5885	1.490
	Metal	3.5	80.00	73.33	23.881	8.804	15.077	0.584	1.550
		7.0	30.00	93.33	27.71	8.22	14.44	0.5692	1.543

Table 1.2- Estimation of Chlorophyll for *Cassia tora*Plants System

Sr.No.	Treatment	Leaves of plant	Total Chlorophyll gm/Lit.x10^{-3}	Chlorophyll 'a' gm/lit. x 10^{-3}	Chlorophyll 'b' gm/lit. x 10^{-3}
1	Control	*Tarota*	5.125	3.714	1.754
2	Ligand		6.755	3.921	2.025
3	Complex		6.821	4.039	2.316
4	Metal		7.413	6.154	2.392

Table 1.3 - Estimate of Total Nitrogen and Protein in Leaf Powder of *Cassia tora*

Sr. No	Plant	Treatment	% Element			% Protein
			Nitrogen	Carbon	Hydrogen	
1		Control	7.35	18.18	6.85	38.657

2	*Tarota*	Ligand	7.87	37.23	6.78	39.213
3		Complex	8.11	35.54	6.67	39.443
4		Metal	8.32	33.76	6.39	39.574

Results And Discussion:

Germination starts when the seed shows emergence phase of growth, which begins, with penetration of embryo from the seed coat and end with the development of root and shoot system. Elongation of shoot axis follows emergence of radical.

The rate and extent of elongation is subjected to the variety of controls, including nutrition, hormones and environmental factors. Though the root and shoot development start within a fraction of time but the further developments may vary according to the nutrients required for the development of root length and length shoot independently. Therefore, root length and shoot length differs. The observation table 1.1 clearly indicates that average root length in *(IS-cis)- 4-(3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine*, complex, Mg (II), at all pH increases over control.

Chlorophyll control / chlorophyll pigment were found affected in *Tarota*plant by the treatments. Total chlorophyll was found to be higher in *Tarota*.

Percentage of nitrogen and proteins were found affected in leaves of *Tarota* by the treatment of *(IS-cis)- 4-(3,4- di chloro phenyl)- 1,2,3,4- tetra hydro-N-methyl-1-naphthalenamine*, complex, Mg (II). It is observed that percentage of nitrogen and protein are higher than that of control.

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