IJPS INTERNATIONAL JOURNAL OF PLANT SCIENCES
Volume 7 | Issue 2 | July, 2012 | 356-359

RESEARCH ARTICLE

Micronutrients effect on soil enzyme activity and growth of *Vigna radiata*

■ B.N. PATEL, S.M. VASOYA AND M.V. PATEL

SUMMARY

Effects of metals such as Cu, Zn, Mn and Fe have been studied by growing the seeds of *Vigna radiata* under different concentrations of sulphate salts. These metals play a significant role in the growth of *Vigna radiata* and soil enzyme activity of amylase and cellulase. It was found that higher concentration of these metals significantly altered the growth of *Vigna radiata* and soil enzyme activity.

Key Words : Amylase, Cellulase, Micronutrient, Soil enzyme activity, *Vigna radiata*

How to cite this article : Patel, B.N., Vasoya, S.M. and Patel, M.V. (2012). Micronutrients effect on soil enzyme activity and growth of *Vigna radiata*. *Internat. J. Plant Sci.*, **7** (2) : 356-359.

Article chronicle : Received : 19.03.2012; **Revised :** 22.05.2012; **Accepted :** 13.06.2012

Different studies undertaken on soil plant physiology reveal that micronutrients play an important role on the growth of *Vigna radiata* and soil enzyme activity. It has been observed that soil enzyme activity is directly related to the soil health. Soil enzyme activity is indirectly proportional to the activity of growth of microorganisms in rhizosphere. Soil health refers to the biological, chemical and physical features necessary for long term sustainable agriculture productivity with minimal environment impact.

There are several indicators of soil health that can be measured by different methods. Several enzymes are known to be present in the soil which catalyzes the organic matter. Soil enzymes are mainly of fungal (Ex: *Trichoderma viride and Trichoderma* spp.) and bacterial (Ex: *Azetobacter* spp. *and Rhizobium* spp.) origin. The enzymes most often found in soil are dehydrogenase, catalase, phosphotase, pectinase, protease and urease.

The main focus is on effects of enzyme activity of amylase and cellulase and growth of *Vigna radaita* in presence of different concentrations of Cu, Fe, Zn and Mn in this research study.

The study determines the soil enzyme activity of cellulase and amylase, observing the growth of plant on the basis of their germination rate, development of leaves and the physical appearance of the plant.

MATERIALS AND METHODS

Experimental materials:

Healthy seeds of *Vigna radiata* were obtained from Krishi vigyan Kendra at Ganpat University, Kherva, Dist. Mehsana, Gujarat. The seeds were sown in the bags containing the soil taken from KVK nursery, Ganpat University. The study was conducted at the end of July to the 1st week of August. The salts used were $CuSO_4$, $MnSO_4$, $ZnSO_4$ and $FeSO_4$. All salt solutions were prepared in distilled water.

Experimental protocol :

Micronutrient effect on growth of Vigna radiata :

Firstly the soil was filled in the plastic bags and then seeds were sown in each bag containing 15 seeds. Each bags

MEMBERS OF THE RESEARCH FORUM

Author to be contacted :
B.N. PATEL, Department of Biotechnology, Mehsana Urban Institute of Biosciences (Ganpat University), Kherva, MEHSANA (GUJARAT) INDIA
E-mail: bharat.patel@ganpatuniversity.ac.in

Address of the Co-authors:
S.M.VASOYA, Department of Biotechnology, Mehsana Urban Institute of Biosciences (Ganpat University), Kherva, MEHSANA (GUJARAT) INDIA

M.V. PATEL, Department of Horticulture, Krishi Vigyan Kendra, MEHSANA (GUJARAT) INDIA

with different concentration of metal salt solution of 2 per cent, 4 per cent and 6 per cent with each concentration having two bags with six bags of control *i.e.* prepared without adding any solution (Add 200 ml of water). The seeds were regularly watered and other parameters like temperature, sunlight, humidity were also maintained.Three days after sowing the seeds were germinated and results were recorded. Physiological effects such as leaf colour, leaf size, stem size and stem strength were measured after these three days.

RESULTS AND DISCUSSION

The results of the present study as well as relevant discussions have been presented under following sub heads:

Effect of metal on seed germination after day 1 :

After 3 days mostly all seeds in control bags have germinated very well but seeds in metal containing bags had germinated only 70 per cent. While 10 per cent growth was observed in the same seeds and they had grown two or more than two leaves having less stem size. The plants grown in control bags were observed to have two or more than two leaves and 6 to 8 cm stem size which was quite large than metal containing plant bags.

Table 1: Effect of metal on seed germination

		Germination					
		Conc. (%)	Cu	Mn	Zn	Fe	Control
Day 2	Water (ml) 50ml/ Beg	2	3	--	--	7	----
		4	4	--	2	4	18
		6	2	--	--	3	----
		Germination					
		Conc. (%)	Cu	Mn	Zn	Fe	Control
Day 3		2	10	5	4	14	----
		4	9	4	10	8	25
		6	7	2	4	9	----

Effect of metal on growth and development of *Vigna radiata* :

The plants grown in metal containing bags took long time to germinate as compared to control bags. Plants in Zn and Cu containing bags showed yellow in colour while Fe containing plants showed dark green and Mn containing plants showed yellowish green colour.

Cu :

The plants grown in presence of Cu showed very well germination as compared to other metals. Leaves were found to be wrinkled in some cases and generally dark green (bluish shine) in colour with leaf size varied from 1.5 cm to 2.2 cm and stem size ranged from 4.0cm to 5.4 cm.

Mn :

The plants that were grown in presence of Mn were found yellow coloured. In bag containing 6 per cent concentration only 2 seeds were germinated and overall germination time was much longer in comparison to other metals. Leaf size ranged from 1.0 cm to 3.0 cm while stem size varied from 3.5 cm to 4.5 cm.

Zn :

The plants were not germinated well and germination time was quite long as compared to control. The colour of leaves were observed yellow with size varying from 0.8 cm to 1.2 cm while stem size was also less ranging from 2.5 cm to 3.4 cm.

Fe :

The only plants which germinated very well like control were in presence of Fe. There were no side effects observed on leaf colour and they were turned dark green. Leaf size ranged as 1.8 cm to 2.2 cm while stem size varied from 4.1 cm to 5.3 cm

Micronutrient effect in soil enzyme activity (Amylase and cellulase) :

Table 2: Amylase enzyme activity by KI method

Concentration (%)	Cu	Mn	Zn	Fe	Control
2	48	62	37	20	------
4	24	48	20	55	87
6	13	22	9	18	------

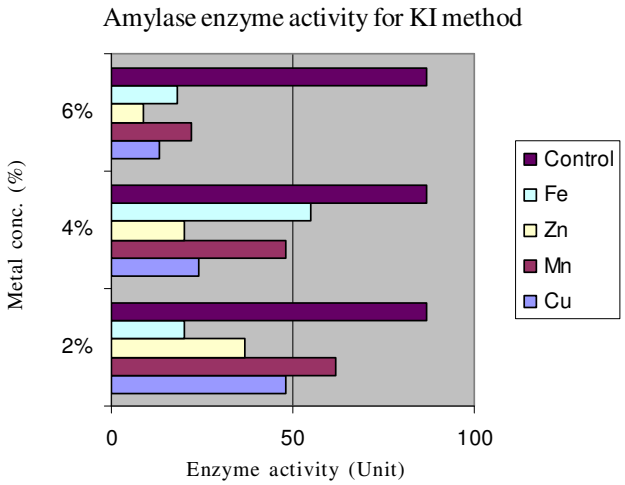

Fig. 1 : Comparison of amylase enzyme activity

Table 3: Observation table of cellulase activity by CMC method

Concentration (%)	Cu	Mn	Zn	Fe	Control
2	0.2	4.5	1.2	2.3	------
4	0.1	2.8	0.3	1.8	0.3
6	--	1.9	--	0.9	------

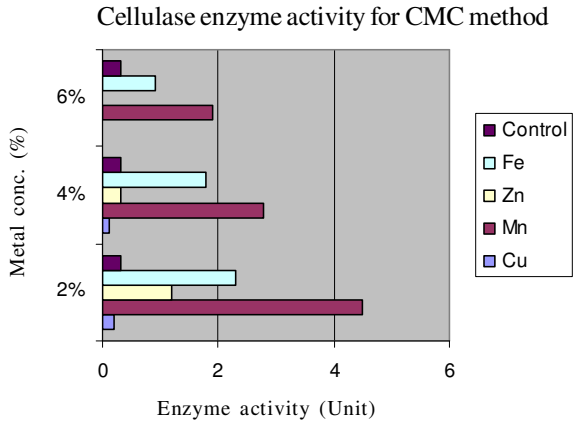

Fig. 2 : Comparison of cellulase enzyme activity

Discussion :

The seeds treated with $FeSo_4$ gave better germination and growth as compared to Cu, Zn, Mn, but it was lowered than control.

Plate : (a) Plate : (c)

Plate : (b) Plate : (d)

Plate (a,b,c,d) : Colour variation on leaf and stem

Fe was found to be beneficial for development and growth of plant without any adverse effect. The size of stem and leaf was also similar to the control plants. While in case of Mn, most difficult results were observed. The germination rate and the growth rate were very low. The leaf colour was yellow in Mn treated plant. The stem and leaf size were also not as good as Fe and control. Treatment of seeds with Cu and Zn gave moderate results. The germination rate and effect of metal was extended and observed. Some leaves treated with Cu were wrinkled and green. Zn treated plants had dark yellow leaves.

The stem and leaf size were reduced compared to Fe and control :

As cellulose is complex polysaccharide as its degradation is a complex process. The effects of Cu, Zn, Mn and Fe have been observed on cellulase and amylase activity. The high concentrations of these metals were proved to be lethal to the enzyme. So the enzyme activities of amylase and cellulase have decreased by increasing the concentration of the metals ions.

Plate : (e)

Plate : (f)

Plate (e and f) : Variation on stem and root size

This indicates that the high concentration of these metal ions may prove to be harmful for enzyme activity. It is, therefore, necessary to carry out the biochemical analysis of the soil before cultivating any agricultural crops in order to know the concentration of the metals on the soil, and thus we can treat the soil according to the requirement. It is also necessary to carry out water analysis to know the concentration of any of the above metal ions, which may prove lethal for the plant growth and also to enzyme activity of soil. Water must be analyzed before it is used and accordingly treatment should be given. Maurya and Jadhav (2004) and Shah (2005) have also made some observation related to the present investigations.

REFERENCES

Banerjee, L.K.and Ghosh, D. (1998). Species diversity distribution of mangroves in India, 20-24. In: *An anthology of Indian Mangroves,* T. Kannupandi (Ed.).

Loder, J.W. and Russell, G.B. (1969). Tumor inhibitory plants. The alkaloids of Bruguiera saxangula and Bruguiera exaristata. *Australian J.Chem.*, **22**: 1271-1275.

Maurya, B. and Jadhav, B.L. (2004). Methanol extracts of mangrove plants *Sonnertia apetala.* Proc. National Conference on Human Health and Nutrition: A Biotechnological Approach. pp. 246-251.

Shah, N.J. (2005). Pharmacognosy studies on methanol extracts of Mangrove species Aegicerus corniculatum. Ph.D. Thesis, (Life Science). University of Mumbai, Mumbai, M.S. (INDIA).

Spooner, D.F. and Sykes, G. (1972). Laboratory assessment of antimicrobial activity. In method: Methods of microbiology Vol. **7** B: pp.217-224. J.R. Norris and D.W. Ribbons (Ed.) Academic Press, LONDON (UNITED KINGDOM).

Suraiya, N.N. and Jadhav, B.L.(2000). Screening of the antimicrobial properties of Acanthus illucifolius and excoecaria agallocha species of the Mumbai coast. *Trends in Life Sciences* (India), **15** (2) : 85-92.

Untawale, A.G. and Wafar, S. (1991). Socio-economic significance of Mangroves in India, 4-7. *Proceedings of symposium on signifance of mangroves. Maharastra Association of Cultivation of Science Research Inst.* Pune (M.S.) INDIA.

Vogel, A.I. (1972). In: *A textbook of Practical Organic Chemistry.* 3rd Ed., English language book Soc. And Longman Group Ltd.

****
*****