IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

# Effect of Jeevamrutham on Seed Germination of *Phaseolus aureus* Roxb. under heavy metal stress conditions of different Cadmium concentrations

**Dr. Dande Swapna Sree, Lecturer in Botany, Silver Jubilee Government College, Cluster University, Kurnool, Andhra Pradesh, India**

**ABSTRACT:** The mung bean grows on a wide range of soils but prefers well-drained loams or sandy loams, with a pH range from 5 to 8. The intensity of some abiotic stresses has increased as water from the soil gets depleted faster under the conditions imposed by climate change. Hence it is essential to carry out studies on the impact of heavy metal stress on plants by simultaneous application of several stress factors such as heat, drought, light, and salinity. Since most of the information concerning plant defense mechanisms against heavy metal toxicity comes from adult plants, it is needed to conduct more studies with young plants to compare their defense system and adult plants against heavy metal stress. There is a great need to find out how heavy metals affect crop plants in low input sustainable farming practices where there is a considerable emphasis in terms of supplying soil with organic fertilizers with the objective of maintaining and boosting the association between naturally occurring or artificially introduced plants. The toxic effect of different concentrations of cadmium viz. 20, 40, 60 and 80 mg/l distilled water was evaluated on seed germination of *Phaseolus aureus* with and without organic liquid formulation jeevamrutham. The results of the present study showed that cadmium concentrations cause negative effect on seed germination of mung bean as the concentration of cadmium increases the germination percentage decreases. The seeds treated with jeevamrutham showed considerable increase in germination percentage. Application of Jeevamrutham showed positive effect on the germination of seeds under cadmium stress.

**Keywords:** Heavy metal stress, Cadmium, Seed germination, Phaseolus aureus, Jeevamrutham.

## INTRODUCTION:

Mung bean (Phaseolus aureus Roxb.) also known as green gram, golden gram, Oregon pea, chickasano pea, chiroko or simply mung is synonymous with Vigna radiata (L.) Wilczek. The crop must have been derived from var. sublobata which occurs wild throughout India and Burma and is said to have originated from India (Aykroyd and Doughty, 1964; Purseglove, 1977). Mung bean is a low altitude crop grown from sea level to approximately 2000 m, usually as a dry land crop. It thrives best on a good loam soil with well distributed rainfall of 70-90 cm year. The mung bean grows on a wide range of soils but prefers well-drained loams or sandy loams, with a pH ranging from 5 to 8. It is drought resistant and is susceptible to water-logging. Both short-day and day-neutral cultivars are found in India. It grows well between latitudes 0° and 30° north or south. The temperature range for optimum performance is between 20° and 45°C. The plant itself may be short and erect in growth or suberect with a slight tendency to twine and a vine length of 1.2-1.5 m.

Heavy metals are a group of nonbiodegradable, persistent inorganic chemical constituents that have cytotoxic, genotoxic, and mutagenic effects on humans or animals and plants through influencing and tainting food chains, soil, irrigation or potable water, aquifers, and surrounding atmosphere (Flora *et al*., 2008; Cirlakova,2009; Rascio and Navari-Izzo, 201; Wuana and F. E. Okieimen,2011). There are two kinds of metals found in soils, which are referred to as essential micronutrients for normal plant growth (Fe, Mn, Zn, Cu, Mg, Mo, and Ni) and nonessential elements with unknown biological and physiological function (Cd, Sb, Cr, Pb, As, Co, Ag, Se, and Hg). (Schützendübel and Polle, 2002; Tangahu *et al*., 2011; Zhou *et al.,* 2014). Both underground and aboveground surfaces of plants are able to receive heavy metals. Plants require them in tiny quantities for their growth, metabolism, and development; however, the concentration of both essential and nonessential metals is one single important factor in the growing process of plants so that their presence in excess can lead to the reduction and inhibition of growth in plants.

Cadmium (Cd), a well-known, transitional metal is one of highly dispersed metals by human activities [Morsy *et al*., 2011]. It is harmful for plants and causes various changes in their metabolism processes. The germination of seeds is an important stage of whole plant circle and is also the most susceptible stage of plants [Liu *et al*., 2011]. The application of organic liquid formulations such as jeevamrutham is useful to improve germination of seeds. Different beneficial microorganisms viz., nitrogen fixers, phosphorus solubilizers, actinomycetes and fungi are observed in jeevamrutham (Sreenivasa et al., 2011).The present research work was carried out to investigate the effect of jeevamrutham on seed germination of *Phaseolus aureus* Roxb. under different cadmium concentrations.

**MATERIAL AND METHODS:** The present study was carried out at the Department of Botany, Silver Jubilee Government college, Cluster University, Kurnool in two different seasons. Healthy seeds of Phaseolus aureus Roxb. were surface sterilized using 0.5% $HgCl_2$ for 10 minutes, and then washed in double distilled water for three times. Seeds with similar size were cultured in petri dishes (90 cm diameter) on filter paper to germinate at 25 ºC room temperature. The filter paper was moistened with 10 ml of double distilled water contained cadmium concentrations of 20,40, 60 and 80 mg/l distilled water and to check the effect of jeevamrutham, seeds were treated with cadmium concentrations contained jeevamrutham. Each treatment had three replicates. Germination of seeds was recorded every day, and germination percentage was calculated after seeds were fully germinated, using the following formula:

Germination percentage = Number of seeds germinated / Total number of seeds in all replicates× 100

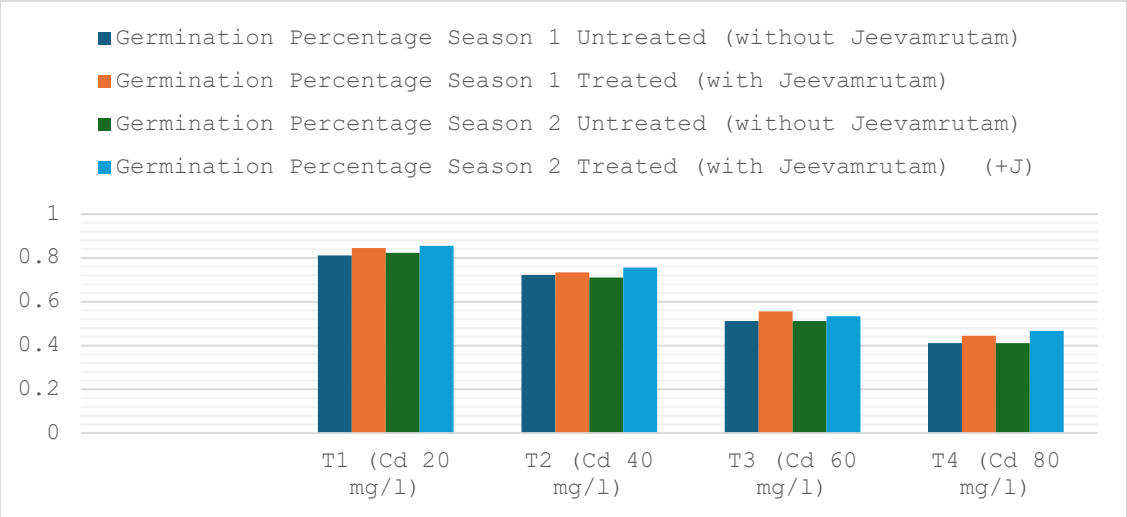
**Preparation of jeevamrutham**: Organic liquid formulation jeevamrutham was prepared according to the method given by Palekar, 2006. About 10 kg cow dung, 10 litre cow urine, two kg jaggery, two kg of bengal gram flour, rhizospheric soil were mixed by adding 200 litre water in a container with the help of wooden stick. The mixture was stirred regularly twice a day and kept for fermentation for 7 days. The prepared organic liquid formulation was used for the treatment of seeds.

**RESULTS:** The results revealed that cadmium in different concentrations causes negative effect on germination of seeds. As the concentration of cadmium increases the germination percentage was decreases in all the treatments. In seeds treated with Jeevamrutham and cadmium concentrations, germination percentage was considerably higher compared to untreated seeds thus concluding that jeevamrutham was able to enhance the germination of seeds under cadmium stress. These were tabulated in Table 1. and graphical illustration was presented in Figure 1.

Table 1: Effect of different dosages of Cadmium with & without Jeevamrutham on Germination percentage of *Phaseolus aureus* during season 1 and season 2.

| Sl. No | Treatments | Germination Percentage | | | |
|---|---|---|---|---|---|
| | | Season 1 | | Season 2 | |
| | | Untreated (without Jeevamrutam) (-J) | Treated (with Jeevamrutam) (+J) | Untreated (without Jeevamrutam) (-J) | Treated (with Jeevamrutam) (+J) |
| 1 | T1 (Cd 20 mg/l) | 81.11% | 84.45% | 82.22% | 85.56% |
| 2 | T2 (Cd 40 mg/l) | 72.22% | 73.33% | 71.11% | 75.55% |
| 3 | T3 (Cd 60 mg/l) | 51.11% | 55.55% | 51.11% | 53.33% |
| 4 | T4 (Cd 80 mg/l) | 41.11% | 44.44 % | 41.11% | 46.67% |

Figure 1. Effect of different dosages of Cadmium with & without Jeevamrutha on Germination percentage of *Phaseolus aureus* during Season 1 and Season 2.




## DISCUSSION AND CONCLUSIONS:

In the present study cadmium showed a strong inhibitory effect on germination, root elongation and coleoptile growth of seeds especially at high cadmium concentrations. High levels of cadmium supply can inhibit seed germination and subsequent seedling growth (Tao 2015). The results, like this study were obtained by Zhang *et al*., (2010), Guilherme *et al*., (2015). Jeevamrutham treated seeds were found to be significantly superior in comparison to untreated seeds. This might be due to their composition by plant and animal products, which have anti-pathogenic properties. It protects the seeds from seed borne pathogens, which could affect them during the germination processes. Jeevamrutham contains various types of microorganisms, which improves germination of seeds. Cow dung and cow urine would provide the nutrition for seeds which could give good germination and seedling length (Dhapke *et al*., 2013). The similar results were also reported by Gadewar *et al*., 2014. The results of the present study clearly showed that organic liquid formulation, jeevamrutham causes positive effect on seed germination of *Phaseolus aureus* Roxb. seeds under cadmium stress in comparison with untreated seeds.

**REFERENCES:**


1. A. Schützendübel and A. Polle. (2009). "Plant responses to abiotic stresses: heavy metal-induced oxidative stress and protection by mycorrhization," *The Journal of Experimental Botany,* Vol. 53, no. 372, pp. 1351–1365.

2. Aykroyd, W. K. and Doughty, J. (1964). Legumes in human nutrition. *Food and Agriculture Organization of the United Nations*, p. 125.

3. Cirlaková, A. (2009). "Heavy metals in the vascular plants of Tatra mountains," *Oecologia Montana,* Vol. 18, pp. 23–26.

4. Dhapke Suresh, Charjan Sanjiv, Lambat Ashish and Gadewar Rajesh. (2013). Efficacy of eco-friendly non-toxic indigenous organic preparation on germination ability, seedling length, seedling vigour, field emergence and seed mycoflora of Redgram (Cajanus cajan L.), International Journal of Researches in Biosciences. Agriculture & Technology, Issue-1, Vol.1, pp. 50-56.

5. Gadewar Rajesh, Lambat Ashish, Charjan Sanjeev, Lambat Prachi and Dongare, Vinod. (2014). Influence of EcoFriendly Non-Toxic Indigenous Organic Preparation on Physiological And Mycological Changes In Lentil. International Journal of Researches In Biosciences, Agriculture & Technology Issue-2, Volume-II, pp. 696-702.

6. Guilherme Maria de Fátima de Souza, Oliveira Habyhabanne Maia de and Silva Edevaldo da (2015). Cadmium toxicity on seed germination and seedling growth of wheat Triticum aestivum, Acta Scientiarum. Biological Sciences, Vol. 37, No. 4, p. 499-504.

7. Liu TT, Wu P, Wang LH, Zhou Q. (2011). Response of Soybean Seed Germination to Cadmium and Acid Rain. Bio Trace Elem Res., 144(1-3): 1186-1196.

8. Morsy FM, Hassan SHA and Koutb M. (2011). Biosorption of Cd (II) and Zn (II) by Nostoc commune: Isotherm and Kinetics Studies. Clean–Soil Air Water, 39: 680–687.

9. N. Rascio and F. Navari-Izzo. (2011). "Heavy metal hyperaccumulating plants: how and why do they do it? And what makes them so interesting?" *Plant Science,* vol. 180, no. 2, pp. 169–181. 2011.

10. Palekar S. (2006). Text book on Shoonya Bandovalada naisargika Krushi, published by Swamy Anand, Agri Prakashana, Bangalore.

11. Purseglove, J.W. (1977).*Tropical Crops: Dicotyledons*, Vols 1 and 2. The English Language Book Society and Longman Publishers, London, pp. 273–6, 290–4, 318–21.

12. R. A. Wuana and F. E. Okieimen, (2011). "Heavy metals in contaminated soils: a review of sources, chemistry, risks and best available strategies for remediation," *ISRN Ecology,* vol. 2011, Article ID 402647, 20 pages.

13. S. J. S. Flora, M. Mittal, and A. Mehta. (2008). "Heavy metal induced oxidative stress & its possible reversal by chelation therapy," *Indian Journal of Medical Research,* vol. 128, no. 4, pp. 501–523.

14. Sreenivasa MN, Naik N, and Bhat SN. (2011). Nutrient status and microbial load of different organic liquid manures. Karnataka J. Agric. Sci., 24 (4): 583- 584.

15. Tao, Ling, Guo, Meiying, Ren, Jun. (2015). Effects of Cadmium on Seed Germination, Coleoptile Growth, and Root Elongation of Six Pulses. Pol. J. Environ. Stud. Vol. 24, No. 1, pp. 295-299. 9. Varban D.L., Duda M.M., Varban R. (2010) The study of the Ocimum basilicum L. species cultivated in organic system. Pro Environ, 3, pp. 284–288.

16. V. Tangahu, S. R. S. Abdullah, H. Basri, M. Idris, N. Anuar, and M. Mukhlisin. (2011). "A review on heavy metals (As, Pb, and Hg) uptake by plants through phytoremediation," *International Journal of Chemical Engineering*, vol. 2011, Article ID 939161, 31 pages.

17. Zhang Xingxu, Fan Xiaomei, Li Chunjie and Nan Zhibiao. (2010). Effects of cadmium stress on seed germination, seedling growth and antioxidative enzymes in Achnatherum inebrians plants infected with a Neotyphodium endophyte, Plant Growth Regul, 60:91–97.

18. Zhou, W. Yao, S. Wang, X. Wang, and T. Jiang. (2014). "The metallothionein gene, *TaMT3*, from *Tamarix androssowii* confers $Cd^{2+}$ tolerance in Tobacco," *International Journal of Molecular Sciences*, vol. 15, no. 6, pp. 10398–10409.