

Evaluation of the Effect of Cd (II) on the Growth Parameters Leaf Area Index (LAI), Leaf Area Duration (LAD) and Crop Growth Rate (CGR) of Soybean [*Glycine max* (L.) Merr.]

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ABSTRACT

Heavy metals are important environmental pollutants and their toxicity is a problem of increasing significance for ecological, evolutionary, nutritional and environmental reasons. Plants possess homeostatic cellular mechanisms to regulate the concentration of metal ions inside the cell to minimize the potential damage that could result from the exposure to nonessential metal ions. This study aims to evaluate the effect of soybean growth parameters under heavy metal Cadmium stress given at varying concentrations (0, 5, 10, 15, 20 and 25 ppm). The Co-2 variety of soybean seeds was used for the study and was observed for various physical parameters by growing in pot culture method. The observation was done on 20th day and 40th day of its growth and the results were compared and evaluated.

Key words : Soybean, Cadmium toxicity, Leaf area index, Leaf area duration, Crop growth rate.

Environmental pollution by metals is a serious threat today due to increased industrial revolution and became extensive today. The current worldwide mine production of various heavy metals such as Cu, Cd, Pb and Hg is very high (Pinto *et al.*, 2004). This heavy metal source includes a number of diverse anthropogenic sources (textile, tannery and other industrial effluents, industrial solid wastes, urban runoff, sewage treatment plants, boating activities, agricultural fungicide runoff, domestic garbage dumps and also by mining operations). Metal toxicity and its effect on the growth and metabolism in higher plants is a subject that has a wide economical and ecological interest and also have been widely reviewed and gaining importance on several occasions over the last few decades (Brown and Jones, 1975; Foy *et al.*, 1978; Ernst *et al.*, 1992; Das *et al.*, 1997; Sanità di Toppi and Gabrielli, 1999; Hall, 2002; Clemens *et al.*, 2002). Another interesting reason for this is out of the ninety naturally occurring elements fifty-three are heavy metals (Weast, 1984).

Few metals are found to be essential for growth of plants, while few are found to be toxic for the growth of plants. Some of the heavy metals don't interact with the plant metabolism directly but decreases the level of soil microbes, affecting the growth of the plants (Niess, 1999). Soybean is an important pulse as well as oil seed crop. It is a legume crop, often called as a miracle crop. It is an excellent source of protein and is also referred to as poor man's meat (Tandale, 2007). When compared to other countries, a low productivity was observed in India than

other countries, which may be due to any physiological reason leading to lesser soybean seed yield. Hence new methodologies of agricultural practices or new irrigational techniques are to be developed and practiced in order to meet the current demand for soybean as a food source as well as the increasing demands of soybeans as source of non-conventional energy resource. The increase in the price of soybean and its related products in internationally, make the studies on soybean growth to be more valuable in the agricultural research. The increasing water scarcity worldwide is the serious threat in the modern world. The increasing amount of cadmium in the environment affects various physiological and biochemical processes in plants (Sanità di toppi and Gabrielli, 1999). The most pronounced effect of heavy metals in plant development is growth inhibition, which is in turn connected with cell division; however, the mechanisms involved in those processes are still not completely understood.

In the present study, we are interested in establishing a correlation between the Cadmium induced changes in growth parameters LAI, LAD, CGR of soybean and the pod yield as measured on 40th day. Hence, this study may help us for a better understanding of cadmium toxicity in soybean yield and may provide new insight in utilization of cadmium-contaminated water for irrigation. The statistical tools used are SPSS and Minitab.

MATERIALS AND METHODS

The synthetic effluent of cadmium was prepared using Cadmium chloride. A stock solution was prepared