

Introduction

Heavy metals such as Arsenic (As) are toxic pollutants in the soil. It has no biological function in plants and can cause toxicity to most organisms. Uncontaminated soils typically contain <10 mg/Kg total As. In the United States, As in contaminated soils ranges from 13 mg/Kg to as high as 2553 mg/Kg while As concentrations in uncontaminated soils can be as high as 80mg/kg (Wash et al., 1977).

Arsenic is delivered into the environment through the weathering of rocks, volcanic emission, and during the mining and smelting of ore, such as, copper and lead. Arsenic can be deposited into water sources through the release of industrial waste into rivers, lakes or underground water. This can also occur through the use of pesticides, herbicides and wood preservatives containing As.

Since plants can't differentiate between nutrients and these heavy metals due to their similarities, As is taken up from the soil or water into their roots and shoots. Arsenic can slow plant growth by inhibiting the organic nutrients in the plants and it causes a reduction in food production (ATSDR, 2007).

The dietary intake of As ranges from 1-20mg/day from grains in the United States. Arsenic can affect human health by entering the body through the food we eat and the water we drink. It can cause skin irritation and circulatory and nervous disorder. Commercial bran products in the US intended for human consumption have found to have inorganic As concentrations as high as 2000 mg kg⁻¹.

Cereal crops such as rice absorbs As faster than any other cereal crops due to enhanced bioavailability in anaerobic conditions (Meharg et al., 2009). The main goal of the study is to understand the mechanisms of As transport and partitioning in wheat.



Fig 1: *Triticum aestivum* grown in hydroponic solution

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Materials and Methods

Wheat (*Triticum aestivum*) seeds were obtained from Carolina Biological Supply Company. Seeds were first sterilized with a 1% sodium hypochlorite and were imbibed in distilled water for 24 hours. The seeds were then germinated on filter paper for bioaccumulation studies. After germination, the plants were transferred to pots containing a complete nutrient solution. The nutrient solution consists of, 2.0 mM KNO₃, 1.0 mM Ca(NO₃)₂, 1.0 mM MgSO₄, 1.0 mM KH₂PO₄, 25 mM H₃BO₃, 25 mM CaCl₂, 2.0 mM MnSO₄, 2.0 mM ZnSO₄, 0.5 mM CuSO₄, 0.5 mM H₂MoO₄, 0.1 mM NiSO₄, 20 μM FeHEDTA N(2Hydroxyethyl)ethylenediaminetriacetic acid, and the solutions were buffered with 2 mM MES[2(morpholino)ethanesulfonic acid] so that the pH level can be regulated at 5.5. The solution was continuously aerated and was replaced weekly.

The plants were treated with arsenate at the 3 leaf stage. The As treatment chosen for the studies are 0, 2, and 5 μM. The As concentration chosen for the studies represent the upper bound concentration usually found in As contaminated soils. They were treated for 21 days after which the plants were harvested.

Visible symptoms, such as chlorosis, and growth were noted throughout the experiment. Relative chlorophyll content (RCC) was recorded weekly using SPAD 502 Chlorophyll meter to ensure proper growth and development of the plants.

The harvested plants were separated into roots and shoots and the tissues were dried in an oven at 52°C and the dry weights were calculated. Tissues were then ground and subsamples (~0.25 g) were digested following EPA method 3050b (<http://www.epa.gov/epaoswer/hazwaste/test/pdfs/3050b.pdf>), using nitric acid (trace metal grade) and hydrogen peroxide. After digestions, samples were then resuspended in 1% nitric acid. The tissue extracts will be analyzed for the element of interest (As) using a SpectraAA 220FS atomic absorption spectroscopy (Varian, Walnut Creek, CA) in flame and the furnace mode.



Fig 2: Relative chlorophyll content measurement

Fig3: Digestion of *Triticum aestivum* samples

References

- ATSDR (2007) Arsenic.
- Meharg et al. (2009) Environ. Sci. Technol. 43(5): 1612-7.
- Wash, L, M, et al. (1977) Environ. Health Perspect. 19, 67-71.

Results and Conclusions

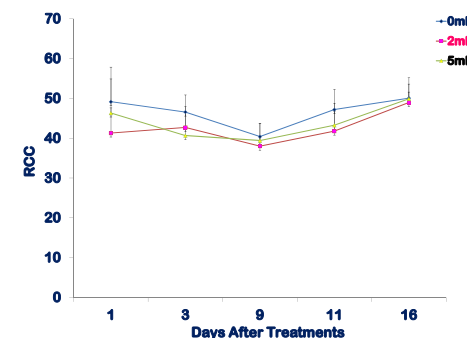


Fig 4: Relative Chlorophyll Content (RCC) of *Triticum aestivum* plants grown in different concentrations of As. Values represent mean $\pm$ s.d

There were no differences in RCC between the different treatments during the course of the experiment

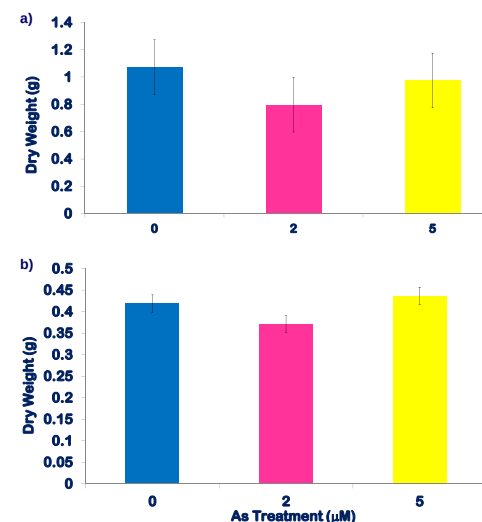


Fig 5: Tissue biomass (g DW) of a) shoots and b) roots of *Triticum aestivum* plants grown in different concentrations of As. Values represent mean $\pm$ s.d

There were no significant effects of treatments on biomass which indicates that the treatment were not high enough to cause a significant decrease in biomass

Tissue As concentrations will help us understand the method of transport and partitioning of arsenate in the different tissues in *T. aestivum*.