EFFECT OF CADMIUM ON GROWTH, UPTAKE AND ACCUMULATION IN NEW IMPROVED AND TRADITIONAL RICE (*Oryza sativa*) VARIETIES IN SRI LANKA

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Cadmium is a non essential element; it is the fifth most toxic metal to vertebrates and the fourth most toxic metal to vascular plants. It is believed that contamination of water sources and agricultural lands with fertilizers and agrochemicals is the main reason for accumulation of Cd[1]. Therefore Cd accumulation in agricultural soil can become dangerous to crops. It has been reported that plant species and also genotypes within same species differ greatly in their tolerance to Cd stress[2]. Rice is considered to be a possible source of Cd intake. There is a lack of informations are available on rice grain Cd accumulation with different soil Cd levels and effect of Cd on growth performances of locally available rice genotypes. This study was conducted to investigate the variations among rice varieties for Cd tolerance with respect to plant growth parameters and to determine the Cd uptake and accumulation by selected rice varieties grown in Sri Lanka.

The study was performed as pot trial in a planthouse of the Department of Plant Sciences, Faculty of Agriculture, RUSL from April to August 2012 with eight rice (*Oryza sativa*) varieties. The soil was collected from Faculty field and samples were analyzed for basic soil properties and specially to detect the available Cd content. Twenty five kilograms of soil was placed in each pot and Cd in the form of $CdCl_2.2\frac{1}{2}H_2O$ was added to soil to obtain following Cd levels as; 50 mg Cd/kg of soil (T2) and 100 mg Cd/kg of soil (T3) and the soil receiving no external Cd was used as the untreated soil (T1). Eight different rice varieties were used in the experiment. Those were BG 300, AT 307, BG 352 and BG 358 (new improved rice varieties) and *Suwadel, Kaluheenati, Pachchaperumal* and *Kuruluthudu* (traditional rice varieties). The pots were arranged as a Two Factor Factorial Experiment with Completely Randomized Design with three replicates. Fertilizers were provided according to the Department of Agriculture, Sri Lanka recommendations. During the vegetative growth plant height, number of tillers and leaf area were measured at tillering stage. Rice plants were uprooted at the end of the ripening stage and separated in to grains, stems and roots. 0.3g of plant samples, were put on microwave digester (Model: Milestone start D) and digested by following modified US EPA method 3052. Sample Cd concentrations were recorded using a GF-AAS (Model: GBC GF3000) at IFS, Kandy.

The toxicity effect of Cd on plant height also differed with rice varieties. The eight tested rice varieties showed significant differences ($P < 0.05$) in plant height for all three soil Cd treatments. Results showed that rice variety *Suwandel* was completely died at 50 and 100 mg/kg Cd and BG 300, BG 352, BG 358, *Kaluheenati, Pachchaperumal* and *Kuruluthudu* reduced plant height with increasing soil Cd levels. Both BG 300 and BG 358 were reduced their height significantly with the increasing soil Cd level. Addition of Cd was not significantly affected on the plant height of AT 307. Leaf area values of the rice cultivars were all reduced by Cd at 50mg/Kg and 100mg/kg. There were significant differences in leaf area in all three treatments. Results revealed that leaf area was drastically reduced at 100 mg/kg Cd level. In addition there were significant differences in number of tillers in plants. Increasing soil Cd level from 50 to 100mg/kg numbers of tillers were drastically reduced except *Pachchaperumal* and *Kuruluthudu*.

Grain Cd content of these rice varieties were increased significantly with increasing soil Cd concentration. The total grain Cd content in each rice variety of BG 300, AT 307, BG 352, BG 358, *Kaluheenati, Pachchaperumal* and *Kuruluthudu* was significantly different with three soil Cd levels. Generally, the mean grain Cd levels were increased with increasing soil Cd levels except BG 300. In BG 300, the grain Cd content in 100 mg/kg soil Cd was lower (2.26 mg/kg) than the 50 mg/kg (2.719 mg/kg) soil Cd. AT 307, BG 352, BG 358, *Kaluheenati*, *Pachchaperumal* and *Kuruluthudu* showed the same pattern in grain Cd accumulation. Variety BG 300 showed the lowest amount of Cd (0.111 mg/kg) while variety *Suwandel* accumulated the highest (0.597 mg/kg) under this Cd treatment. For the all tested rice varieties the mean shoot Cd content was increased significantly with increasing soil Cd levels. Cd content in roots of all tested rice varieties except *Suwandel* was highly significantly different at the tested soil Cd levels. The results showed that *Suwandel* can accumulate more Cd (16.415 mg/kg) without addition of cadmium chloride and *Pachchaperumal* accumulated the lowest (1.346 mg/kg).
The study showed that the each and every rice variety were accumulated Cd as the sequence of grain < shoot < root for every soil Cd levels[3] i.e. rice grains accumulated the lowest, while roots accumulated the highest. Rice variety *Suwandel* is highly sensitive than the other tested rice varieties for both 50 and 100 mg/kg soil Cd levels. Results obtained from the study indicated that a great proportion of Cd taken up by rice plant was retained in roots. Traditional rice varieties can accumulates a considerable amount of Cd within their body than new improved rice varieties with normal soil conditions. BG 300 accumulate lower amount of Cd from normal soil, hence BG 300 may most safe to human consumption than other tested varieties.

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