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Changes in nutrient contents of radish under cadmium toxicity

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SUMMARY

In the pot culture experiment, radish (*Raphanus sativus* L.) plants were grown up to 60 days, in soil amended with various levels of cadmium (*viz*, 10, 20, 30,40 and 50 mg kg^{-1}). The inner surface of pots was lined with a polythene sheet. Each pot contained 3kg of air dried soil. Six seeds were sown in each pot. All pots were watered to field capacity daily. Plants were thinned to a maximum of two per pot, after a week of germination. Control plants were maintained separately. Cadmium at all levels (10-50 mg kg^{-1}) tested, decreased the macro (nitrogen, phosphorus and potassium) and micro (copper, iron, manganese and zinc) nutrient contents of treated plants compared to untreated plants. Cadmium content of the radish plants increased with an increase of cadmium level in the soil.

Key words : Cadmium, Toxicity, Radish and nutrients

Cadmium is a non-essential element that negatively affects plant growth and development. It is released into the environment by power stations, heating systems, metalworking industries and urban traffic. Increase in the cadmium concentration of soils is generally caused by the application of cadmium-rich phosphate fertilizers and mining (Nolan *et al.*, 2003). It can alter the uptake of minerals by plants through its effects on the availability of minerals from the soil, or through a reduction in the population of soil microbes (Moreno *et al.*, 1999). Cadmium accumulation in the soil and crop plants is an increasing concern affecting human health and crop production (Hall, 2002). The present study was aimed to find out the extent of changes in macro and micro nutrient contents and uptake and accumulation of cadmium by radish plants due to cadmium toxicity.

MATERIALS AND METHODS

The certified seeds of *Raphanus sativus* (L.) cultivar, Pusa Chetki were purchased from Tamil Nadu Agricultural University, Agricultural Research Station, Paramakudi, Ramanathapuram district. Seeds with uniform size, colour and weight were chosen for the experimental purpose. The soil used in the experiment was sandy loam in nature and the pH of the soil was 7.1. It contains 118 kg available N, 28.8 kg available P and 10.9 kg available K/ha. The cadmium chloride (Cd Cl_2 2½ H_2O) was used as a cadmium source.

The seeds were grown in pots containing untreated soil (control) and in soil mixed with cadmium (*viz*, 10, 20, 30, 40 and 50 mg kg^{-1} of soil). The inner surfaces of pots were lined with a polythene sheet. Each pot contained 3 kg of air-dried soil. The cadmium was applied to the soil, as cadmium chloride ($CdCl_2$ 2½ H_2O). Six seeds was sown in each pot. All pots were watered to field capacity twice a day. Plants were thinned to a maximum of two per pot, after a week of germination. Each treatment including the control was replicated five times.

Sampling:

The plant samples were collected on 60th day after sowing. The contents of macro nutrient such as nitrogen, phosphorus and potassium were estimated from dried and powdered plant samples of leaves of treated and control plants by using (Peach and Tracey, 1956), (Black, 1965), (Yoshida, 1972) and (Williams and Twine, 1960) methods and contents of micro nutrients such as copper, iron, manganese and zinc were estimated by (De Vries and Tiller, 1980) method. The cadmium contents of dried and powdered root and shoots of treated and control plants were estimated by using (Khan, 1972) and (Slavin, 1983) methods.

RESULTS AND DISCUSSION

Increasing cadmium levels (10, 20, 30, 40 and 50 mg kg^{-1}) in the soil, gradually reduced the nitrogen, phosphorus and potassium contents of the leaves of radish plants (Table 1). The minimum nitrogen (21.88), phosphorus (4.85) and potassium (30.34) content were estimated at 50mg kg^{-1} cadmium level of the soil. The maximum of all macro nutrients were observed in control plants. The macro nutrient contents decreased significantly ($P< 0.01$) with increase in the cadmium levels (10, 20, 30, 40 and 50 mg kg^{-1}) of the soil.

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