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REGULAR ARTICLE

CHANGES IN BIOCHEMICAL CONSTITUTION OF RADISH (*RAPHANUS SATIVUS* L.) UNDER COPPER TOXICITY

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ABSTRACT

The effect of copper stress on the biochemical content of *Raphanus sativus* L. were studied. The plants were grown in pots containing the soil with different concentrations of copper (0, 50, 100, 150,200 and 250 mg kg^{-1}). Five replicates were maintained for each level. Biochemical contents such as total sugar, starch, amino acid, proline and protein) contents were analyzed on 45th day. Biochemical contents such as total sugar, starch, amino acid and protein were increased in low level of copper (50 mg kg^{-1}) and decreased in high level of copper in the soil (100-250 mg kg^{-1}). But the proline content increased in high level of copper in the soil (100-250 mg kg^{-1}) when compared to control and 50 mg kg^{-1}.

Keywords Copper, Biochemical content, *Raphanus sativus*, Amino acid, Proline, Protein.

INTRODUCTION

Copper (Cu^{2+}) is one of the trace element required for the growth and development of plants. If the concentration is high or low from an optimal level, it will create cellular and metabolic problems in plants [1]. In high level, it can affect important processes in plants like photosynthesis and respiration [2-3]. Copper is a constituent of some enzymes and proteins in optimum levels only [4].

Among the myriad to heavy metals copper occupies the prominent position, since it plays a vital role in the growth and development of plants. The present investigation deals with the effect of copper on biochemical constitution of radish.

METERIALS AND METHODS

The plants were grown in pots containing the soil with different concentrations of copper (0, 50, 100, 150, 200 and 250 mg kg-1).

Biochemical analysis

Estimation of total sugars [5], starch [6], total free amino acids [7], proline [8] and protein [9] were done by following standard methods.

RESULTS AND DISCUSSION

Total sugar content of radish leaves under copper stress is represented in table 1. Sugar content of leaves was maximum at 50 mg kg^{-1} (5.011) soil level. Minimum sugar content of radish leaves (2.897) was recorded at 250 mg kg^{-1} soil level.

Starch content of leaves of radish plants is presented in table 1. Starch content of leaves of radish plants increased at 50 mg kg^{-1} (3.401) soil level and decreased further with an increase in copper level in the soil. Minimum starch content of radish leaves was observed at 250 mg kg^{-1}(1.746) soil level.

Amino acid content in the leaves of radish was found to be the highest at 50 mg kg^{-1}(6.119) soil level (table 1). Amino acid content of radish leaves was the lowest at 250 mg kg^{-1}(3.613) copper level in the soil. Proline content of radish leaves decreased at 50 mg kg^{-1} (0.705) soil level and increased further with an increase in copper in the soil (table 1).

Protein content of the radish leaves was found to be the highest at 50 mg kg^{-1}(27.628) soil level (table 1). Protein content of radish leaves (13.602) was lowest at 250 mg kg^{-1} copper in the soil. Total sugar and starch contents were decreased with increase in copper level in the soil. However, 50 mg kg^{-1} copper level produced positive effect on the total sugar contents. The reduction in the carbohydrate level may be due to its role on the enzymatic reactions related to the cycles of carbohydrate catabolism under coper toxicity [10-11]. This reduction corresponded with the photosynthetic inhibition [12]. Al-Lahham *et al.* [13] showed transport heavy metals in tomato with various heavy metals.

Copper at 50 mg kg^{-1} soil level increased the amino acid and protein contents of radish plants. Protein and amino acid are regarded to play a significant role in metal chelating by which heavy metal detoxification and tolerance in plants take place [4]. The inhibitory action of excess copper on amino acids and protein content may be due to binding of metals with sulfhydryl group of protein, causing deleterious effect in the normal protein form [11-17].

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Table 1: Effect of copper on bio chemicals content (mg g^{-1} fresh wt.) of radish (45^{th} day)

Copper added in the soil (mg kg^{-1})	Total sugar	Starch	Amino acid	Proline	Protein
Control	4.598	3.162	5.164	0.861	23.149
50	5.011 (+8.98)	3.401 (+7.55)	6.119 (+18.49)	0.705 (-18.11)	27.628 (+19.34)
100	4.139 (-9.98)	2.810 (-11.13)	4.868 (-5.73)	1.021 (+18.58)	19.139 (-17.32)
150	3.913 (-14.89)	2.648 (-16.25)	4.702 (-8.94)	1.145 (+32.98)	18.372 (-20.63)
200	3.498 (-24.57)	2.186 (-30.86)	4.198 (-18.70)	1.169 (+35.77)	17.257 (-25.45)
250	2.897 (-36.99)	1.746 (-44.78)	3.613 (-30.03)	1.201 (+39.48)	13.602 (-41.24)

Average of five replications, Percent over control values are given in parentheses

The content of proline was elevated in plants treated with excess of copper (100-250 mg kg^{-1}) in contrast with the lower level of copper treatment (50 mg kg^{-1}). This may be due to the abiotic stress posed by the copper treatment [2, 18-20]. These results are in agreement with previous reports [21-24].

CONCLUSION

Biochemical contents *viz*., total sugar, starch, amino acid and protein contents of radish plants showed a decreasing trend with progressive increase in copper level in the soil. However, 50 mg kg^{-1} copper level produced positive effect on the biochemical contents. Overall decrease in biochemical contents *viz*., total sugar, starch, amino acid and protein content of radish in high levels of copper was due to the toxic effect of copper. But the proline content of radish was increased in higher concentration of copper level. Increase of proline content in plants is a general response to some abiotic stress. This leads to increase in the proline content of the stressed plants.

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