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STUDY OF TOLERANCE IN SOME SPECIES OF PLANTS NEAR COPPER MINES IN KHETRI, JHUNJHUNU, RAJASTHAN

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Abstract

Bioaccumulation of copper in soil increases toxicity and this causes further phytotoxicity i.e. plant toxicity and environmental pollution risk increases. Some plant species are weakened due to copper toxicity whereas some plant species can tolerate it, due to high mineral content in soil as compared to copper, more absorption facilities promoted by VAM fungi and high nutrient supply by external sources. Water provision also washes away the effect of copper toxicity. The fertilizers can also subdue the copper toxicity effect i.e. NPK fertilizers.

Keywords: tolerance, plants, species, copper mines, Khetri, Jhunjhunu, Rajasthan, mineral, toxicity, pollution

Introduction

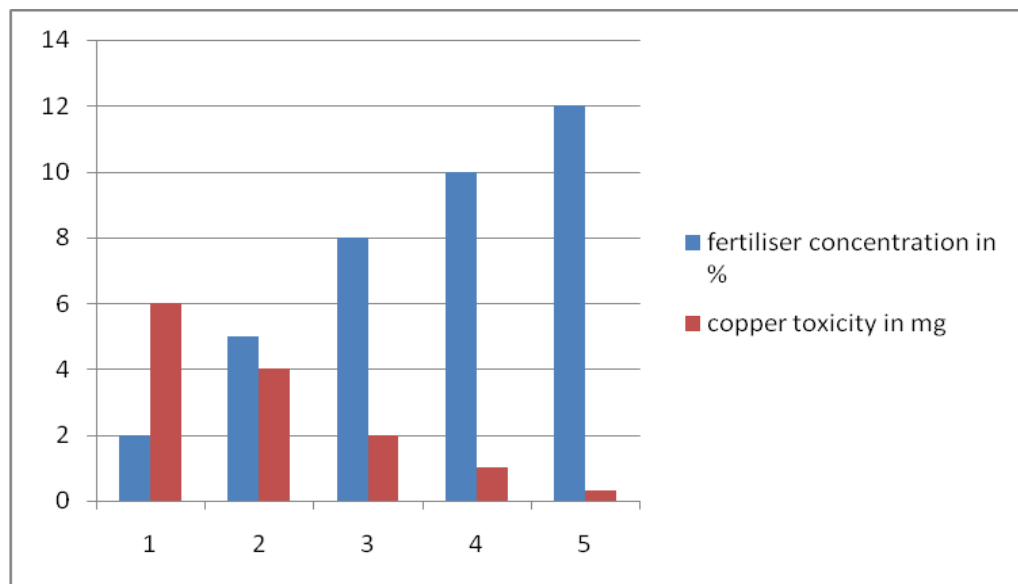
Copper tolerance was found in plant species colonizing soils with high concentrations of soil copper in Khetri, Jhunjhunu, Rajasthan. Seven of the eight plant species tested were found at more than one copper mine in the present study.[1,2] The mines are geographically isolated, which makes dispersal of seeds from one mine to another unlikely. Tolerance has probably evolved independently at each site in this area. The plant in this region namely *Vulpia microstachya* displays significantly higher tolerance to copper at all copper concentration levels. The shoot tissue of the copper mine plants of *Arenaria douglasii*, *Bromous mollis*, and *V. microstachya* accumulated less copper in drought region of Khetri due to stress conditions and more water supply externally. [3,4]The root tissue of these mine plants contain more copper than the roots of the non mine plants in the drought region due to presence in soil. No difference in the tissue copper concentration was detected between tolerant and non tolerant plants of *Lotus purshianus*, *Lupinus bicolor*, and *Trifolium pratense* even though the root tissue had more copper than the leaves.

This is a fact that copper (Cu) is an essential element for humans and plants when present in lesser amount, while in excessive amounts it exerts detrimental effects. There subsists a narrow difference amid the indispensable, positive and detrimental concentration of Cu in plants, which substantially alters with Cu speciation,[5,6] and form in plants. Mechanisms related to detoxification strategies like antioxidative response and generation of glutathione and phytochelatins to combat Cu-induced toxicity in plants can be done due to which copper tolerance increases in plants and plants can survive. [7,8]

Cu concentration in plants beyond critical limits affects the plant growth, promotes leaf chlorosis and causes cytotoxicity as seen in drought region in Khetri, Jhunjhunu, Rajasthan. Phytoremediation is an evolving approach which uses plants to decontaminate the polluted soil/water especially near copper mines in Khetri region. There are many plants which have phytoremediation potential and are best accrual of heavy metals like copper The tolerance, accrual and transport of metals to the aerial tissues of plants are vital features which are taken into consideration

during species choice in phytoremediation strategy[9,10] . The application of Cu-amended fertilizers is usual in nation’s deficient of Cu in the soils. Certain NPK fertilizers increase soil minerals and mineral content in plants thus decreasing copper toxicity in plants and increasing copper tolerance in stress conditions of Khetri region[11,12].

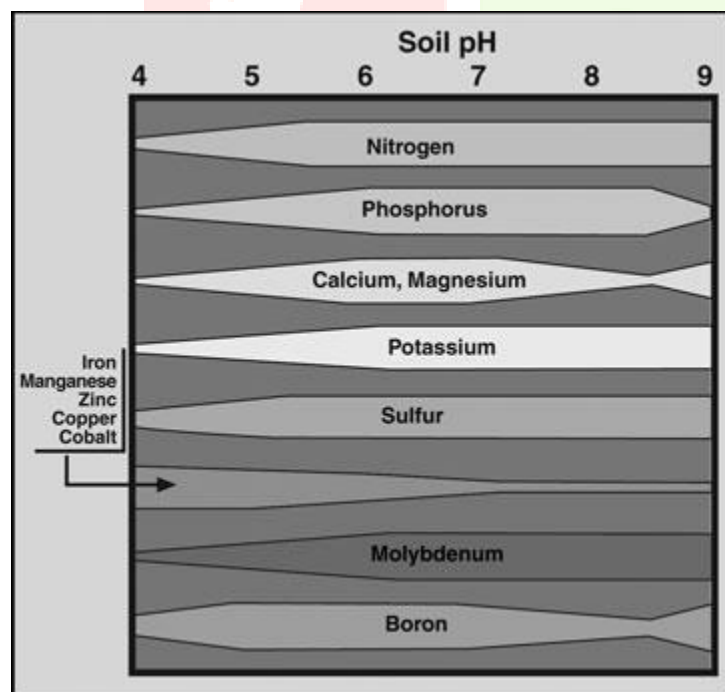
Discussion



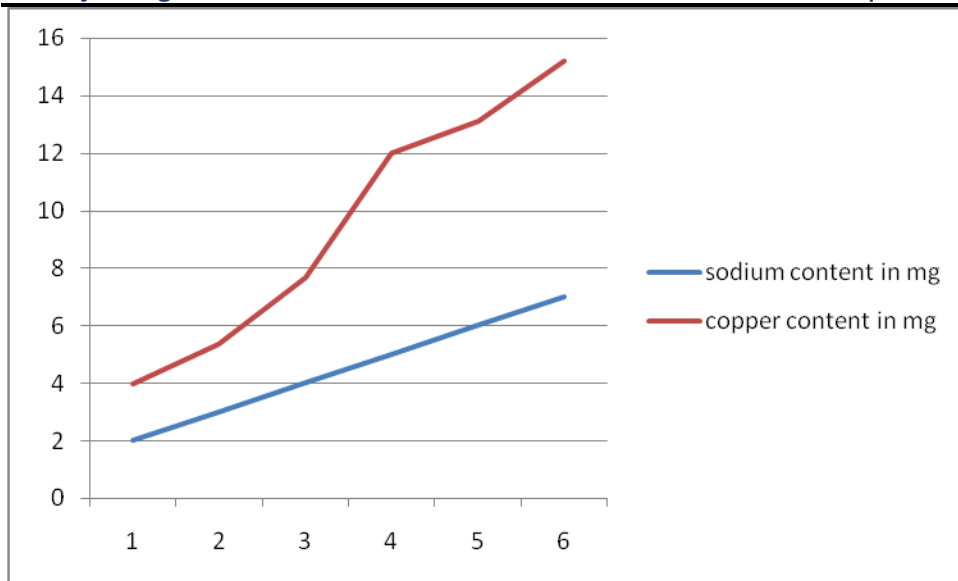
Graph1 -showing decrease in copper toxicity in plants of Khetri by increasing fertiliser concentration

However, excessive sodium concentration in soil of drought region of Khetri , Rajasthan, increases the copper toxicity due to more stress in soil which is usually dry and naturally there is no provision of water (graph-2).

Fig. Soil pH affects nutrient availability to plants. The width of the band indicates the relative availability of each plant nutrient at various pH levels.



Graph-2: At high sodium concentrations the toxicity of copper increases in plants



Results

Among different plant species in Khetri, Jhunjhunu, Rajasthan, only few plant species got germinated at 300 mg Cu kg⁻¹. The growth parameters were significantly reduced under high Cu stress (from 25 to 100 mg Cu kg⁻¹) in and drought conditions, also the sodium content increased in this drought region.[13,14] The chlorophyll content found decreased in copper toxic regions of mine sites, but the supply of NPK fertilizers could increase chlorophyll content. Significantly, high Cu accumulation was found in roots and shoots of drought plants in Khetri and few were only tolerant due to external provision of water and minerals. [15,16]

Conclusions

Copper is an essential microelement, for plants is nutritive for plant growth but under stress conditions as in Khetri, Jhunjhunu its high prevalence in soil causes copper phytotoxicity.[17,18] We can reduce this by providing fertilizers externally and water containing minerals. The copper tolerance increases in plants and plants survive more in comparison to common conditions of drought. [19,20]

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