Abstract

Crop irrigation over heavy metal polluted soil is a typical practice in underdeveloped nations, with several human health effects. The ability of rice husk biochar (BC) and *Trichoderma* in enhancing the nitrogen availability for growth and physiology of *A. esculentus* L. plants grown on soil contaminated with Ni was investigated. A biosorption trial using seven treatments such as T1 = control, T2 = Ni (100ppm) + *T.asp*, T3 = Ni (150ppm) + *T.asp*, T4 = Ni (200ppm) + *T.asp*, T5 = Ni (100ppm) + *T.asp* + Urea, T6 = Ni (150ppm) + *T.asp* + Urea, T7 = Ni (200ppm) + *T.asp* + Urea was first carried out to assess the heavy metal removal efficacy of *Trichoderma* Among all these treatments T5 showed maximum Ni removal efficiency (75%) and (85%) at day 5 and day 7 respectively. First study was followed by a pot experiment using Okra plant and 16 treatments such as T1 = control, T2 = *T.asp*, T3= Ni, T4 = BC, T5 = Urea, T6 = *T.asp* + Ni, T7 = *T.asp* + BC, T8 = *T.asp* + Urea, T9 = Ni + BC, T10 = Ni + Urea, T11 = BC + Urea, T12 = *T.asp* + Ni + BC, T13 = *T.asp* + Ni + BC, T14 = Ni + BC + Urea, T15 = Ni + BC + *T.asp* + Urea, T16 = *T.asp* + BC + Urea having three replicates for treatment. The results showed that application of BC, *T.asp* and urea positively impacted plant length and fresh weight under Ni stress. Similarly, after evaluating the results using a one way ANOVA and LSD, significant changes ($p \leq 0.001$) in plant APX, CAT, MDA & H_2O_2 were measured. Maximum decrease (88%) in root CAT, (50%) in fresh weight of plant and (36%) in leaf protein was observed under Ni toxicity. Under Ni stress, the synergistic impact of BC, *T.asp*, and urea raised root CAT by one-fold as compared to other treatments. T15 also showed a maximum decrease of 86% in leaf H_2O_2 and 83% in leaf MDA. Overall, the use of BC in combination with *T.asp*, and urea demonstrated the greatest effectiveness in combating Ni stress in soil and Okra plant compared to other treatments. The combination of BC, *T.asp* and urea was shown as the most effective treatment and can be utilized in underdeveloped countries to prevent the negative effects of Ni toxicity.