Tolerance to Copper Stress in Elephantgrass (*Pennisetum purpureum*) under Soil Culture

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Key words: copper mine area; elephant grass (*Pennisetum purpureum*); copper resistance; critical concentration

Introduction Elephantgrass (EG, *Pennisetum purpureum* Schumach), is a high biomass yielding gramineous plant which originates from a tropical zone, and is commonly used as forage crop. Its nutritional value for animals has been well documented (Kabi et al.2005). Its potential biomass production is about 25 g m^{-2} d^{-1} and it has a potential biomass yield of 50-60 Mg hm^{-2} (20-25 tons/acre) over long periods (about 180d) with a linear growth rate (Wang et al 2002). Recently, EG has been considered as an important bioenergy crop (Prine et al 2007). In order to evaluate and empolder EG as a bioenergy resource in regions that are polluted with heavy metals, such as farmlands nearby or in copper mine tail areas, it is necessary to understand the ability of EG to resist or tolerate copper stress.

Materials and methods This copper contaminated soil cultivate experiment used EG which had about 2 tillers with approximately 7-8 leaves in total, it was carried out in pots and in a glass house (30℃±5℃). The yellow brown soil (15kg/pot) was mixed with different concentrations of $CuSO_4$ solution to match levels found in copper contaminated soils: 50, 100, 500, 1500, 3000 mg $CuSO_4 \cdot kg^{-1}$. In total 5 treatments with 5 replicates were used. N: P: K were supplied in 100: 80: 100 (mg • kg^{-1}) respectively. After a two month treatment period, the dynamic changes in plant height, number of leaves, number of tillers, biomass per plant, and chlorophyll concentration were measured. The critical concentration of Cu toxicity on growth of EG was definited based on the reduced extent being 10% in several tested characteristics of growth and physiology. All of data was analyzed by ANOVA using the software SPSS13.

Results and discussion The main results showed that root growth was found to decrease significantly ($P<0.05$) with increasing concentrations of Cu^{2+} during soil culture, even at the adding level of 100 mg $CuSO_4 \cdot kg^{-1}$. Also shoot growth was found to decrease significantly ($P<0.05$) with increasing concentration of Cu^{2+} since 500 mg • kg^{-1}. More specifically, the relative increase rate in plant height, the number of leaves, the number of tillers and relative growth rate in biomass decreased significantly ($P<0.05$) under the treatments of 500, 1500, 3000 mg • kg^{-1} in comparison to the control (50 mg • kg^{-1}). The chlorophyll concentration was not found to decrease significantly ($P<0.05$) until the concentration reached 3000 mg • kg^{-1}.

Conclusion The critical concentration of Cu toxicity on growth of EG was definited at around 154.67 mg • kg^{-1} by calculating $CuSO_4$ treated concentration when the entire growth index reduced extent being 10% of control.

References

Kabi F, Bareeba F B, Havrevoll Q, et al., 2005. Evaluation of protein degradation characteristics and metabolisable protein of elephant grass(*Pennisetum purpureum*) and locally available protein supplements. *Livestock Production Science*, 95, 143-153.

Wang D, Poss J A, Donovan T J, et al.2002. Biophysical properties and biomass production of elephant grass under saline conditions. *Journal of Arid Environments*, 52, 447-456.

Prine, G.M., Rockwood, D.L., Stricher, J.A., 2007. Report on the Biomess Production Symposium "Many Short Rotation Trees and Herbaceous Plants Available as Energy Crops in Lower South, USA", Nebrasga, USA. *http://www.nrbp.orgpapers023/*