

Evaluation of Response of the Forest Is in the Pine Underbrush on the Introduction of Zinc Nitrate in a Field Experiment

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Heavy metals (HM) belong to the most common and phytotoxic environmental pollutants that trigger changes in forest condition and productivity in large areas. Despite sufficient research, regularities of specific TM dose impacts on forest plant and stand condition are still understudied. To address this goal field experiments were established in 15 year old pine plantations with the following manual soil applications of zinc nitrate salt ($Zn(NO_3)_2 \cdot 6H_2O$) loads: control – 0g/m², 7, 30, 90, 150, 225 and 300 g/m² in 40 m² plots. For the first time in a controlled pollution rate field experiment data on pine wood impacts to various zinc loads was found. Excessive Zn intake by tree organism resulted in pine needle chrome deficiency that could be triggered by breakdown of synthesis and photodisruption of chlorophyll and carotenoids. A year after $Zn(NO_3)_2$ application needle chlorosis was observed at 150-225-300 g/m² in 13%, 47% and 94% of tress respectively while 225 and 300 g/m² zinc loads reduced needle length and mass sufficiently. 2 years after zinc applications pine stand condition index began to deteriorate from 30 g/m² load and reduced at 90 – 150 g/m² to CI=1,7 (low poor condition), at 225 and 300 g/m² to CI=3.45 (severely poor condition) and CI = 4.0 (decline condition). Stand condition decline was due to various condition trees redistribution while shift intensity from more healthy trees to poorer ones and mortality development intensity raised with metal load growth. By experiment end at Zn 225-300 g/m² loads 50-70% of stand were declining or dead trees so in fact it broke down. Zinc load increase resulted in reduction of axial shoot linear growth, over all observation years variation accuracy to the control remained sufficient at maximum 225 and 300 g/m² zinc loads.