

MASTER THESIS

“Silicon – Reducing light stress in tropical trees?”

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Elite Graduate Program “Global Change Ecology”

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Can Silicon alleviate high light stress in tropical tree seedlings?

Elina Rittelmann is studying M.Sc. Global Change Ecology at the University of Bayreuth. For her Master thesis under the supervision of Prof. Dr. Bettina Engelbrecht she had the opportunity to conduct research at the Smithsonian Tropical Research Institute in Panama for three months. There she analysed if the nutrient silicon can alleviate high light stress in tropical tree seedlings through conducting a greenhouse experiment.

Too much light can harm plants

Everyone knows that plants need sufficient light to grow well. But too much of it can actually be harmful. When the amount of light energy received by plants exceeds the amount they require for photosynthesis, the excess light energy can damage the photosystems, resulting in photoinhibition. In tropical forests little light gets through to the forest understory and thus seedlings of tropical trees are adapted to growing in very low light conditions. But tree fall gaps and other disturbances, for example the cutting down of larger trees, can lead to a sudden and strong increase in light. The stress induced by this – high light stress – is one of many abiotic stresses that plants can face. It is one of the challenges that tree seedlings e.g. in reforestation programs need to overcome in order to grow into mature trees.

Silicon – an important nutrient in stress situations

Silicon is not classified as an essential plant nutrient, but it has been shown to be highly beneficial, especially under stress conditions. The role of Silicon in plants is very complex and an active area of research. Most research on Silicon is done on grasses with a large focus on crops, in some of which Si has already been shown to reduce high light stress. But little is known about the role of Silicon in alleviating abiotic stresses in natural systems.

This master thesis contributes to improving the understanding of the ecological role of Silicon in tropical forests by analysing its effect on high light stress in tropical tree seedlings. For this a greenhouse experiment was set up, in which half of the plants were grown in soil with Silicon fertilizer. All seeds were germinated and seedlings developed in a shade house under very low light conditions. After several months of growth the seedlings were transferred into full sunlight, to induce high light stress. The level of stress was quantified through measuring chlorophyll fluorescence, which can be used as an indicator for high light stress. Additionally leaf development and color changes were monitored throughout the experiment. If Silicon does reduce high light stress in tropical tree seedlings it is expected, that the plants grown under high Silicon concentration will exhibit less severe stress symptoms than plants grown without Silicon addition. The response of plants is expected to vary by species, as there are Silicon accumulating and Silicon excluding species used in the experiment.

For conducting the experiment Elina Rittelmann spend 3 months at the Smithsonian Tropical Research Institute in Gamboa, Panama. Besides being able to study in a renowned research institution and networking with international scientists, she also got to experience the beauty of the very diverse and fascinating surrounding rainforest during her time there.



Tree seedlings after transfer into the full sunlight. Each block contains one replicate of each species and treatment (low/high Silicon availability). The sensor on the front table is measuring the light intensity in the greenhouse regularly.

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