Silica distribution in various bamboo species and its effects on plant growth

Introduction

Bamboos are distributed throughout the world’s temperate, tropical and subtropical regions. They are widely used in industry, as fresh edible shoots, paper making, building and even in medicine. Bamboos also play multiple ecological functions such as soil and water conservation and erosion control. Bamboos have generally high silicon (Si) content. Silicon is known to have beneficial effects on plants and alleviate various stresses (salinity, metal toxicities...). Silicon concentration ranges from 0.3 to 4.1 % SiO₂ of dry matter (DM).

Objectives

1. Quantify the Si uptake and distribution among plant organs in various bamboo species.
2. Investigate the effects of Si on the plant growth.
3. Examine the Si deposition and localization in different organs: leaf and root.

Results

- Inventory of Si tissue content in several bamboo species growing at the Reunion Island (France, Indian Ocean)

Gigantocloa sp « Malay Dwarf » were grown for 6 months under optimal conditions in hydroponics. Bamboos were submitted to a wide range of Si supply: 0; 0.33; 0.75; 1.33; 1.5 mM Si.

- Effects and distribution of silicon in bamboo under controlled conditions

Gigantocloa sp « Malay Dwarf » were grown for 6 months under optimal conditions in hydroponics. All leaves and stems were counted in order to evaluate the development of each bamboo. Chlorophyll fluorescence measurements on leaves were recorded each week.

Conclusions

- The various species exhibit significant differences in their silicon accumulation.
- Silicon content of bamboo increases from roots, through the stem, to leaves.
- No effects on the concentration of nutrients in leaves and roots.
- No effects on the photosynthesis.
- No effects on the concentration of Si in nutrient solution.
- Si has no effect on growth on the whole concentration range tested.
- Roots have the lower Si content.
- Bamboos accumulate up to 24% Si in the leaves. The uptake is proportional to the supply of Si.

- The various species exhibit significant differences in their silicon accumulation.
- Silicon content of bamboo increases from roots, through the stem, to leaves. This distribution points out the major role of the transpiration in silicon accumulation and thus the importance of passive mechanisms for the transport of Si in bamboo.
- Si is accumulated mainly in epidermis in leaves and in endodermis in roots.
- Our results did not reveal any positive effect arising from Si supply even if the Si concentration in plant tissues increased markedly with the Si supply.

Litterature


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