

Pinus contorta and flooding tolerance

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In der vorliegenden Studie wurde die Überflutungstoleranz von *Pinus contorta* untersucht. Während der experimentellen Überflutung wurde das Sproßwachstum und die Sterblichkeitsrate von verschiedenen Provenienzen bestimmt. Außerdem wurden bei diesen Provenienzen die Wurzel-/Sproßfrischgewichtsverhältnisse bestimmt. Diese Untersuchungen zeigen, daß die Drehkiefer eine überflutungstolerante Art ist und daß innerhalb dieser Art eine Variabilität bezüglich der Überflutungstoleranz besteht.

In the course of flooding experiments it had been shown that shoot growth measurements allow a distinction of flood tolerant and intolerant tree species (CRAWFORD 1972). Using one year-old seedlings of *Pinus contorta* and *P. sylvestris*, the effects of a 4-month period of flooding on the subsequent shoot growth during a 1-month recovery period and a reflooding period of 2-month are investigated. It was found that the stress induced reduction of the shoot growth is significantly higher when plants of *P. sylvestris* instead of *P. contorta* are tested. In addition it was observed that the shoot growth of *P. contorta* is also reduced through flooding. In other words, inundated soil conditions are even a strain for the flood tolerant species *P. contorta*.

Now that *Pinus contorta* has been classified as a flood tolerant species, it is of interest to examine different provenances of this species. For this purpose pot-grown trees of 6 provenances were flooded. After one year a distinction of those provenances in three groups was possible through shoot growth measurements. First, some provenances reduced by half their shoot growth through the continuous flooding stress. Secondly, the trees of one provenance, however, grew equally well whether or not they had been flooded or kept under unflooded conditions. Thirdly, the trees of one provenance grew best under unflooded conditions but reduced growth drastically during flooding.

A comparison of the shoot growth rates with the mortality rates of those provenances, however, showed no correlation. This finding is in contrast to earlier observations when different species had been examined (VESTER 1974). That is to say, changes in the shoot growth are not a sufficient evidence when the flooding tolerance of different ecotypes of a single species is to be investigated.

However, the prediction of the flooding tolerance of an ecotype of *P. contorta* renders possible when the root/shoot ratios of unflooded trees is determined. A juxtaposition of shoot growth data and mortality rates during a flooding experiment and the root/shoot ratios of unflooded trees reveals a correlation with all provenances. Thus the root/shoot ratio of 6 year-old trees is the basis of the flooding tolerance test of different provenances of *P. contorta*.

An increase in the natural tendency of a variety to produce roots is accompanied by an increased tolerance of flooding. Regarding the root/shoot ratio, less than 0.5, the mortality of the trees is increased in soils which are waterlogged; at ca. 0.75, experimental flooding seems only to decrease the shoot growth; at ca. 1.0 the result are low growth rates in both flooded and control plants (VESTER 1978). Thus, where there is a higher root/shoot ratio there seems to be a better capability to withstand flooding than in other varieties.

Summary

The lodgepole pine (*Pinus contorta*), native to the western North America, is also cultivated in Europe (e.g. Ireland, Scotland and Schleswig-Holstein). In this present study the flooding tolerance of *P. contorta* is examined by means of shoot growth data and mortality rates during experimental flooding as well as the root/shoot ratios of unflooded trees. This is done not only to elucidate whether *P. contorta* is a flooding tolerant species, but also whether there are varieties of different flooding tolerance within this species or not.

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