FLOODING RESISTANCE AND ETHYLENE. III. THE ROLE OF ETHYLENE IN SHOOT ELONGATION OF RUMEX PLANTS IN RESPONSE TO FLOODING.

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In river forelands in the Netherlands several Rumex species occur. R. palustris is found in lower areas that are frequently flooded during the growing season, R. acetosa and R. thyrsiflorus occur on higher, seldomly inundated places such as dykes [1], while R. acetosella is restricted to dry sandy soils (e.g. slopes of terraces) that remain unflooded.

Figure 1. Kinetics of ethylene release of R. palustris in response to three flooding treatments, measured by the laser-driven photoacoustic detection system.

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R. palustris is resistant to prolonged periods of flooding. This resistance can be attributed to several adaptations. One of these is the ability to enhance elongation growth of rosette leaves during partial or total submergence. This phenomenon enables the plant to restore contact with the atmosphere. The elongation process is regulated by the gaseous hormone ethylene [2,4]. The ethylene physiology of R. palustris was compared with that of R. acetosella, which does not show any enhanced growth upon flooding.

The release of ethylene in both Rumex species was continuously measured for a week with a laser-driven photoacoustic detection system [3,5]. At the start of the experiment the plants just developed their fifth leaf. Control plants were kept drained throughout the experiment and treated plants were either waterlogged or totally submerged. A representative ethylene release pattern of R. palustris is shown in figure 1. In contrast to the control treatment both flooding treatments cause a substantial release of ethylene, but totally submerged plants have a somewhat lower ethylene production than waterlogged plants. The internal ethylene concentration of totally submerged plants is nevertheless much higher than that of waterlogged plants. This is caused by the fact that the release of ethylene into a water phase is very slow compared with air, resulting in an accumulation of the hormone in totally submerged plants. As a consequence, submerged plants show the highest shoot elongation rates. Preliminary results indicate that R. acetosella plants hardly produce ethylene. Therefore, high internal ethylene concentrations probably do not occur in this species.

Further investigations will focus on the internal concentration and the sensitivity towards this hormone in both Rumex species.