EFFICIENCY OF COMPLEX FORMATION BETWEEN ALUMINIUM AND MORIN OR LUMOGALLION IN THE PRESENCE OF ORGANIC LIGANDS

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Morin has often been used to stain and localise Aluminium in plant tissues. But formation of the morin-Al complex is strongly influenced by the binding stage of Al. As Eticha et al. (2005) pointed out morin is not able to stain Al, which is bound to cell-wall pectin. Lian et al. (2003) assumed also that the morin-Al complex is weak in comparison with other ligands such as oxalate. With regard to these findings it is possible that morin is able to stain only inorganic Al (Al^{3+}; $Al(OH)_2^{+}$; $Al(OH)^{2+}$). In order to use Al-morin complex formation to localise Al in plant tissue it is important to specify the limitations of the dyes with respect to organic ligands of Al. Assessment of the constraints underlying Al-dye complex formation is especially important in case of Al accumulating plant species as tea, hydrangea and buckwheat, where Al is supposed to be bound to organic ligands. Aim of this study is therefore to estimate stability constants of morin- and lumogallion-Al complexes and to evaluate the possibility to use the limitations to predict the binding forms of Al in different regions of the root tip by using different dyes or by simultaneous staining.
Under optimized conditions of dye concentration for sensitivity and maximum fluorescence intensity, the Al concentration was varied to achieve a linear response between complex formation and fluorescence development. With these settings the dye, Al and different organic ligands as oxalate and citrate, with different metal-ligand ratios, were incubated. It was found that the dyes were able to stain Al which is associated with weak ligands as oxalate at a 1:1 ratio Al-ligand ratio, but not stronger Al-organic ligand complexes such as citrate in a 1:3 Al-ligand ration. These results suggest that it is possible to predict the binding form of Al in Al accumulators. First results showing the localisation of Al in longitudinal sections of root tips in Al accumulator plants and the predictions on the organic ligands will be presented.

References:

Eticha D., Staß A., Horst W. J. 2005. Localisation of aluminium in the maize root apex: can morin detect cell wall-bound aluminium? J. Exp. Bot. 56, 1351-1357.

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