

H2

ALUMINUM TOXICITY AND PHOSPHORUS UPTAKE IN CORN. I. NITROGEN SUPPLIED AS NITRATE

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An association between the tolerance to the Al toxicity and the P absorption capacity of plants was described by Foy & Brown (Soil Sci. Soc. Am. Proc. 28: 27, 1964). The source of N, on the other hand, affects both the Al toxicity (Cunha Filho, XIII Reun. Bras. Milho e Sorgo, p. 113, 1980) and the P absorption (Miller, Plant Root and Its Environment, p. 646, 1974).

Two corn lines considered tolerant to the Al toxicity (CMS 153 and CMS 297) and one line considered sensitive (CMS 244) were grown, from the 5th to the 24th day after germination, in a nutritive solution containing nitrate as the N source, and having an initial pH of 4.6. The additional Al 0.22 mM to the nutritive solution greatly decreased inorganic P (Pi), lipids bound P (Pl), nucleic acids bound P (Pa), proteins bound P (Pp) and total P (Pt) concentrations in the upper part of the plants. These results are in agreement with those from a previous experiment (Cunha Filho, Arq. Biol. Tecnol. 23: 243, 1980). The CMS 297 line showed Pi, Pl, Pa and Pt concentrations lower than the CMS 153 and CMS 244 lines in the nutritive solution without Al. When Al was added to the nutritive solution the decrease in these concentrations was significantly lower in the CMS 297 line, and therefore it showed significantly higher Pi and Pt concentrations than the CMS 244 line, and higher Pa concentration than both the two other lines.

The method used in the selection of the tolerant and sensitive lines in regard to the Al toxicity was mainly based on the dry matter production by the plants, and according to Santos & Baligar (XIII Reun. Bras. Milho e Sorgo, p. 24, 1980), such a procedure might lead to a mistake with a 30% probability. Moreover, further observations have suggested that the CMS 297 is a more tolerant line than the CMS 153 one. These facts help explain the differences obtained between two tolerant lines, and to emphasize the importance of finding other parameters to increase the accuracy of the selection process. The results in this experiment suggest the desirability of correlating studies between Pa concentration and Al toxicity tolerance in plants.

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H3

ALUMINUM TOXICITY AND PHOSPHORUS UPTAKE IN CORN. II. NITROGEN SUPPLIED AS AMMONIUM

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There is evidence that tolerance to the Al toxicity is associated with P absorption capacity of plants (Foy & Brown, Soil Sci. Soc. Am. Proc. 28: 27, 1964). The N source, however, affects both the Al toxicity (Cunha Filho, XIII Reun. Bras. Milho e Sorgo, p. 113, 1980) and the P absorption (Miller, Plant Root and Its Environment, p. 646, 1974).

Two corn lines considered tolerant to the Al toxicity (CMS 153 and CMS 297) and two considered sensitive (CMS 244 and CMS 408) were grown, from the 10th to the 23th day after germination, in a nutritive solution containing ammonium as the N source, and whose pH was corrected to the initial value of 4.6 every other day. The additional Al 0.22 mM to the nutritive solution did not alter the inorganic P (Pi), lipids bound P (Pl), nucleic acids bound P (Pa), proteins P (Pp) and total P (Pt) concentrations in the upper part of the plants. A second experiment was conducted with the following modifications: The considered sensitive CMS 408 line was substituted for the CMS 407 line; the lines were grown in the nutritive solution from the 5th to the 24th day after germination; and no correction was made in the nutritive solution pH. In these new conditions the Al caused the following alterations: The CMS 297 and CMS 408 lines increased P concentrations for each parameter; the CMS 153 line increased Pp concentration; and the CMS 244 line decreased Pi and Pt concentrations. The tolerant lines could not be distinguished from the sensitive lines for any of these alterations if the procedure used for classifying the lines in regard to Al toxicity is acceptable (see previous summary). Nevertheless, when Al was beneficial to rice the Al-tolerant cultivars showed greater growth stimulus than the Al-sensitive ones (Howeler & Cadavid, Agron. J. 68: 551, 1976). If a similar association proves to be true for the corn lines and P concentrations the CMS 297 and CMS 408 lines might be classified as Al-tolerant, and the CMS 153 and CMS 244 as Al-sensitive.

The results suggest that further research should be carried out to determine the mechanism involved in the cases where Al favors or impairs P uptake, and if these responses by plants are correlated to the characteristics of Al tolerance or sensitiveness.

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