ACTA BIOL. SZEGED. 36. PP. 95 – 97 (1990)

**Short Communication**

# EFFECTS OF pH AND NITRITE ON POTASSIUM AND PHOSPHATE UPTAKE AND GROWTH OF RICE SEEDLINGS

F. ZSOLDOS and Á. VASHEGYI

*Department of Plant Physiology, József Attila University, H-6701 Szeged, P.O.B. 654, Hungary*

(Received: July 1, 1990)

In most soils $NO_2^-$ is usually negligible, but certain environmental (stress) conditions, e.g. waterlogging, some soil-applied herbicides, heavy metals, high pH, may lead to an accumulation of $NO_2^-$ in the soil solution to concentrations which are toxic to plant roots (HAYNES and SHERLOCK, 1986; MARSCHNER, 1986). This prompted us to study the effects of factors influencing the toxicity of $NO_2^-$ in rice seedlings.

The investigations were carried out on rice seedlings (*Oryza sativa* L. cv. Dunghan shali) grown in nutrient solution in the presence or absence of $NO_2^-$. The composition of nutrient solution was as follows: $NaNO_2$ from 0.01 to 5.0 mM, $KH_2PO_4$ 1.0 mM, $Na_2HPO_4$ 0.5 mM, $CaCl_2$ 0.5 mM, $MgSO_4$ 0.5 mM and micro nutrients as described earlier (ZSOLDOS et al., 1986). Ion uptake was followed via tracer techniques under controlled conditions. All experiments were carried out with three parallel samples (20 seedlings in each group) and the data given below are averages. The main results are as follows.

Even at a concentration of 0.1 mM, $NaNO_2$ inhibited $K^+$ and $H_2PO_4^-$ uptake and growth of seedlings (Figs 1. and 2.). The inhibitory effect of $NO_2^-$ differed considerably between the nutrients and was also different for the roots and shoots. The toxic effect of $NO_2^-$ was strongly influenced by the $H^+$ ion concentration of the outer medium. A decrease of the pH in the external solution led to an increased inhibitory effect of $NO_2^-$ on both the ion uptake and the growth of seedlings. It is noteworthy that the root hairs are unusually sensitive to $NO_2^-$ treatments.

The results obtained suggest that the lower the pH in the root environment, the higher the uptake of $NO_2^-$ by the roots, resulting in an inhibition even at low concentrations of $NO_2^-$ which are otherwise non-toxic to the roots of seedlings.

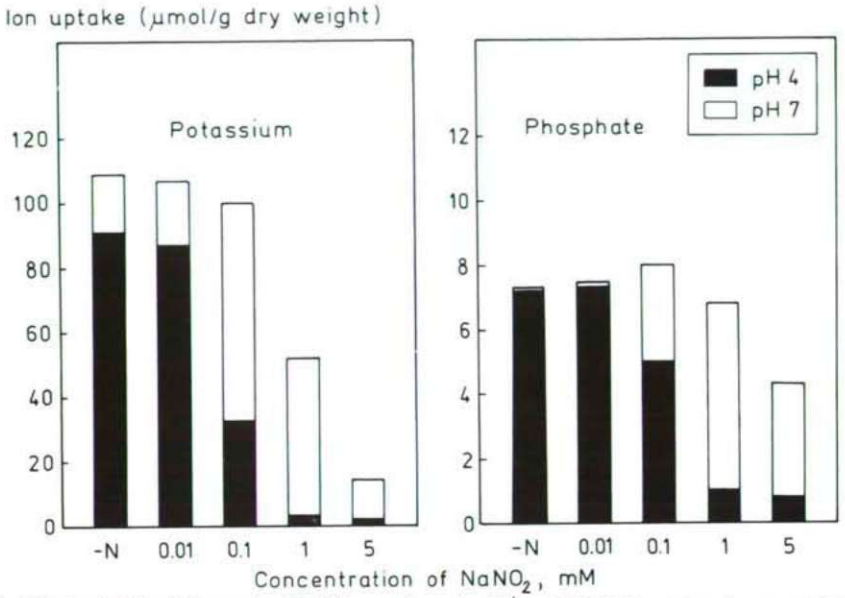


Fig. 1. Effects of pH and increasing $NaNO_2$ supply on the $K^+$ and $H_2PO_4^-$ uptake of roots of 7-day-old rice seedlings grown in 0.5 mM $CaSO_4$ solution in the absence of $NaNO_2$. Uptake solution: 1 mM $K(^{86}Rb)Cl$ + 0.5 mM $CaCl_2$ + $NaNO_2$ or 0.5 mM $KH_2{}^{32}PO_4$ + 0.5 mM $CaCl_2$ + $NaNO_2$. Uptake time: 1 h. Each value is the mean of 3 replicates. SE did not exceed ±8%.

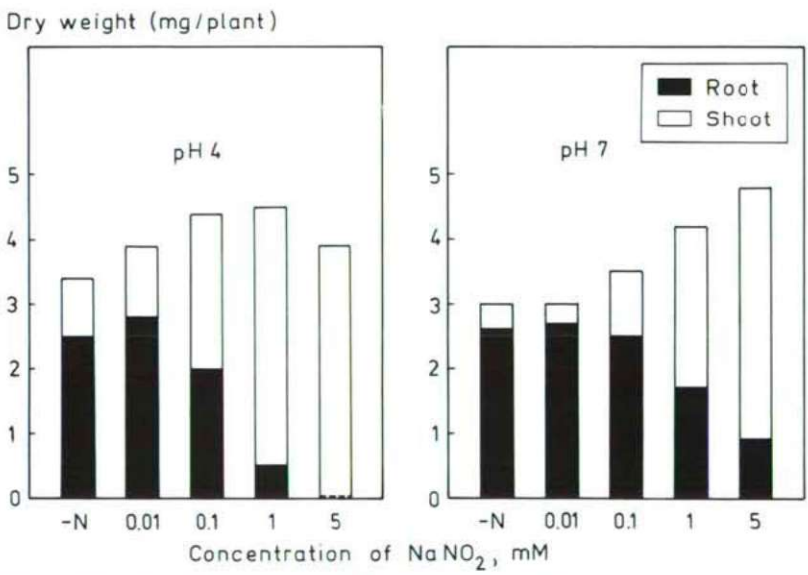


Fig. 2. Effects of increasing $NaNO_2$ supply on dry weight of 7-day-old rice seedlings grown in nutrient solution. Otherwise as in Fig. 1.

## References

HAYNES, R.J. and SHERLOCK, R.R. (1986): Gaseous losses of nitrogen. – In: Mineral Nitrogen in the Plant-Soil System (ed.: R.J. HAYNES). Acad. Press New York, pp. 242-302.

MARSCHNER, H. (1986): Mineral Nutrition of Higher Plants. – Acad. Press, New York, pp. 477-542.

ZSOLDOS, F., HAUNOLD, E. and VASHEGYI, Á. (1986): The effects of phosphate supply on uptake of potassium ions, 2,4-D and atrazine by wheat and maize. – Physiol. Plant. *68*, 154-158.