ACTA BIOL. SZEGED. 35. PP. 237—239 (1989)

SHORT COMMUNICATION

AMINO ACIDS AS SOURCES OF NITROGEN FOR THE GROWTH OF SOME HYDROPONICALLY CULTURED PLANTS

A. PÉCSVÁRADI

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

(Received: September 1, 1989)

Most of the amino acids are readily taken up by roots as water soluble compounds, and may act as N source, or the release of carbon skeleton can provide energy or building structures for different pathways of the metabolism.

Young seedlings of three plant species (wheat, rice and cucumber) were hydroponically cultured (facilities and methods were according to ZSOLDOS, 1984) to compare their ability to grow on nitrogen-free or single amino acid as nitrogen source containing growth solutions, and to demonstrate the effects of such feeding.

In N-free growth conditions there are some general, rapidly developing signs of N deficiency of plants. These N deficiency symptoms are the elongation of the root system and the slower growth of the shoot (MARSCHNER, 1986).

Application of four amino acids (L-Arginine, Glycine, L-Glutamine, L-Tryptophane) in concentration of 2 mM, respectively, could partially compensate these effects, but in each case the amino acid addition alone was not enough to support the normal growth.

Table 1. shows the results. Each amino acid exerted an unique effect on the growth. With exception of L-Tryptophane, which had a hormonal effect as auxin precursor, the amino acids resulted in a shorter root system (but different morphological appearance) and a shoot-growth similar to the control, grown on complete medium. From the data listed in Table 1. turned out, that the effects of

Table 1. The effect of nitrogen supply on length of roots and shoots of 10 days old seedlings of cucumber (*Cucumis sativus* L. cv. Budai csemege) and wheat (*Triticum aestivum* L. cv. GK Szeged). Plants were cultured in N-free (—N) and in 2 mM L-Arginine (+ARG), Glycine (+GLY), L-Glutamine (+GLN), L-Tryptophane (+TRP) containing medium. The control had 4 mM KNO_3 content (S<12.4).

Plant		Length in Control %				
		—N	+ARG	+GLY	+GLN	+TRP
Cucumber	Root	165.1	30.2	59.4	34.4	9.1
	Shoot	73.5	112.6	95.8	96.3	88.9
Wheat	Root	143.8	77.8	50.1	80.6	55.6
	Shoot	96.8	100.0	90.1	88.7	91.9

amino acids were not simply determined by their chemical properties, but there were characteristic variances due to biological differences between the monocotyledonous wheat and the dicotyledonous cucumber. Only one amino acid, glycine have been chosen for further experiments.

Results of the next step of the investigations are reported in the Fig. 1. Since in some cases a slight inhibition of shoot-growth have also appeared, wide range of amino acid concentration have been tested, but in condition of normal nitrate-N supply.

Comparison of growth-curves of two monocots, rice and wheat, revealed some differences concerning the effect of glycine, which might affect the regulation of N-assimilation. The curves of root-growth are almost identical, reflect higher sensitivity of wheat, but similar way of action. In interval of 0.01—5.0 mM glycine concentration the curves of shoot-growth show an opposite picture. In case of rice these amounts of glycine promoted the shoot-growth, but shoot-length of wheat decreased from the concentration of glycine higher than 0.01 mM. Effect of glycine in concentration higher than 5.0 mM seems toxic.

These opposite results on rice and wheat fit into the earlier experiences (MINOTTI, 1969; SHEN, 1969, 1976) showing differences between regulation of N-assimilation of these two species, and give indirect evidence of glycine action. Effect of glycine on uptake of ^{15}N labelled N sources (NO_3^-, NH_4^+) and $K^+(^{86}Rb)$, $H_2{}^{32}PO_4^-$ have been tested, the promising results are being evaluated.

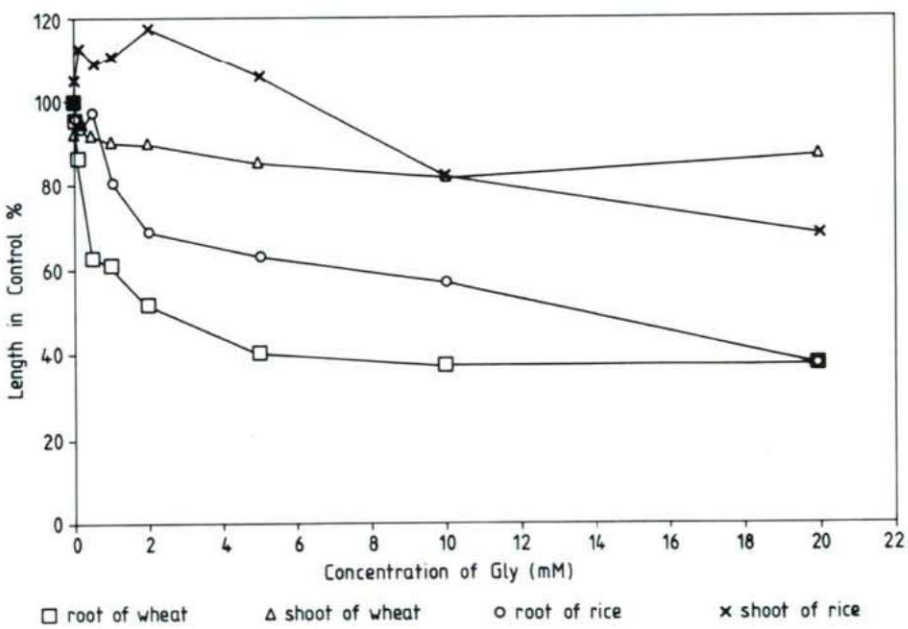

Fig. 1. The effect of glycine content (added to 4 mM KNO_3 containing medium) on length of roots and shoots of 10 days old seedlings of wheat (*Triticum aestivum* L. cv. GK Szeged) and rice (*Oryza sativa* L. cv. Oryzella). Points are 0.00, 0.01, 0.1, 0.5, 1.0, 2.0, 5.0, 10.0, 20.0 mM glycine ($S<9.6$).

References

MARSCHNER, H. (1986): Mineral Nutrition of Higher Plants. — Academic Press, pp. 430—434.

MINOTTI, P. L., WILLIAMS, D. C. and JACKSON, W. A. (1969): The influence of ammonium on nitrate reduction of wheat seedlings. — Planta *86*, 267—271.

SHEN, T. C. (1969): Induction of nitrate reductase and preferential assimilation of ammonium in germinating rice seedlings. — Plant Physiol. *44*, 1650—1655.

SHEN, T. C., FUNKHOUSER, E. A. and GUERRERO, M. G. (1976): NADH- and NAD(P)H-nitrate reductases in rice seedlings. — Plant Physiol. *58*, 292—294.

ZSOLDOS, F., SÁGI, F., VASHEGYI, Á. and LOMNICZI, H. (1984): Nutrient deficiency and its effects on ion uptake, transpiration and dry-matter production by wheat. In: Proceedings of the sixth international congress on soilless culture. Lunteren. The Netherlands. pp. 801—808.