ITEMS FROM KAZAKHSTAN

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Influence of arsenic on the content of some macroelements in the roots and shoots of spring wheat.

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This study examined the effect of arsenic on the distribution of nitrogen, phosphorous, and potassium in plant roots and shoots. Seeds of the spring wheat cultivar Omskaya-17 were germinated and then transferred to Knop's solution. In the experimental variants, arsenic was adding to the incubation solution as the salt Na_3AsO_3 in concentrations 12.5 and 25 mg/L. Based on previous experiments, concentrations of arsenic from 25 to 100 mg/l are toxic to the growth of wheat seedlings. The contents of organic and inorganic nitrogen, phosphorous, and potassium in organs of 11-day-old seedlings were determined by the standard methods in dry material (Pleshkov 1976).

An increase in the arsenic concentration to 25 mg/l in the growing solution corresponded with a higher content of mineral nitrogen in the roots and shoots of wheat plants. In the control seedlings, inorganic nitrogen was 29% of the general nitrogen, whereas this index increased to 43% with 25 mg As/l. On the other hand, the level of organic nitrogen in seedlings was reduced. The decrease of organic nitrogen caused by arsenic was observed in the shoots, from 20.5% (12.5 mg As/l) to 46.1% (25 mg As/l), whereas in the roots, no significant change was observed. Based on this data, it appears that the arsenic delayed the transport of nitrogen to shoots and stopped the synthesis of organic substances with nitrogen in wheat seedlings.

The control plants contained more potassium than ones grown on the solution with arsenic (Table 1). Potassium concentration especially decreased under higher levels of arsenic, 50% in the roots and 75 % in the shoots. A potassium deficiency in seedlings was noted in the presence of arsenic. The concentration of phosphorous in wheat shoots also decreased. The reduction was 17% with 12.5 mg As/l and 19% with 25 mg As/l. Changes were insignificant in the roots. The reduction in phosphorous was 3-4%. These results showed that arsenic inhibited the transport of phosphorous from roots to above ground organs but did not influence on the absorption of phosphorous by roots.

Arsenic suppressed the transport of nitrogen, potassium, and phosphorous from root to shoot, the uptake of potassium, and the inclusion of nitrogen into organic synthesis in wheat seedlings. The toxic effect of arsenic upon the plants could be related with the difficulty of transport of general nutritional elements to metabolically active areas.

Table 1. The content of macroelements in the roots and shoots of wheat seedlings (mg/g dry matter) under arsenic in the substrate.

	Control		12.5 mg As/l		25 mg As/l	
	shoots	roots	shoots	roots	shoots	roots
organic nitrogen	39.0 ±1.5	16.0±1.2	31.0±1.4	17.0±1.3	21.0±1.2	18.0±0.1
inorganic nitrogen	9.0±0.9	13.0±1.2	9.0±0.8	10.0 ±1.3	16.0±0.8	12.0±0.3
phosphorous	6.9±0.2	6.4±0.2	5.7±0.3	6.2±0.2	5.6±0.1	6.0±0.3
potassium	0.27±0.03	0.04±0.01	0.12±0.02	0.02 ±0.01	0.09±0,02	0.02±0.01

Reference.
Pleshkov BP. 1976. Practice of biochemistry of plants. Moscow, Kolos, pp. 8-9.