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Research of the potassium maintenance in leaves of triticale seedlings in the presence of aluminum toxicity by means of ion-selective electrodes.

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Reaction of wheat and triticale plants to aluminum ions in a soil solution has been observed at very low aluminum concentrations. Some plants are able to grow in acclimation to aluminum toxicity, but is the growth of such plants accompanied by increased soil ion absorption, in particular potassium? Research of potassium movement in vegetation by ardent photometrics is expensive and labor-consuming and, because, of it its use is limited.

A fast and complete use of potassium ions in plant biomass by means of ionometry has been developed. The essence of the method consisted of the allocation of potassium from plants in two steps: first, the cut sheet within an hour per a solution of $CaCl_2$ (0.01 M, potassium of the apoplast), and second, after boiling the fabric sheet within 3 min in the same solution. After each stage, potassium ions were measured using a potash electrode (ELIT-031) on a Ekoniks EXPERT 001. This device allows to defining potassium maintenance in mg/L, and also to construct a model of dependence EMF from the concentration of potassium, on a preliminary constructed scale in a range of concentrations. After boiling, data of potassium level in the leaves was obtained. The triticale cultivar Legalo, after the addition of aluminun ions in the soil, was studied for the reaction of plants with the following scheme: control (0 mg/Al), Al4 ($AlCl_3$/100 g soil), K10 (KCl/100 g soil), and K10+Al4 (4 мg Al + 10 мg soil K/100 g). After 14 days, the plants were measured for maintenance of potassium before (potassium of apoplast) and after (general potassium) boiling.

The presence of aluminun ions in the soil sharply reduces apoplast potassium, whereas dependent simplast potassium fluctuates slightly (Fig. 1). The addition of potash salts to the soil does not activate potassium accumulation in the leaves of triticale seedlings. With the simultaneous addition to the soil of potash and aluminum salts, a decrease in the maintenance of potassium in the simplast is observed, which essentially stops the absorption of potassium by means of potash pumps and a strengthening of potassium in apoplast. The mechanism for the decrease in absorption of water and nutrients is the presence of aluminum ions, because aluminum toxicity has a negative influence on root metabolism. In the apoplast, the raised maintenance of potassium is observed. Potassium exit from the intercellular space is observed.

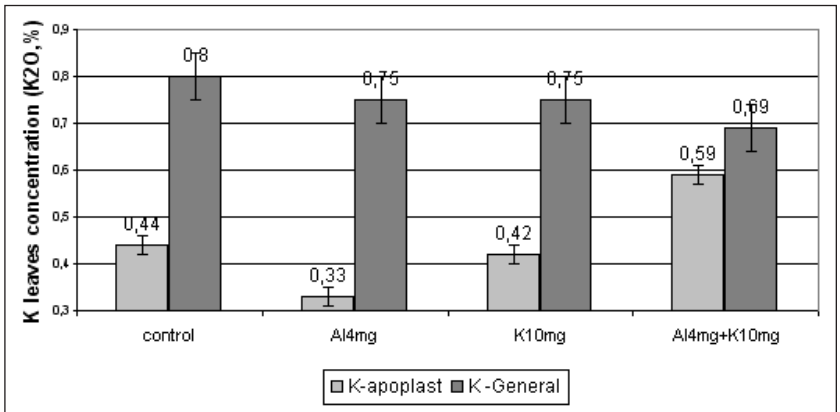

Fig 1. The potassium maintenance (K_2O, %) in seedlings leaves of the triticale cultivar Legalo.

Aluminum has an essential impact on seedling growth in triticale. Aluminum ions activate adaptable seedling growth; the dry weight increased 86%, whereas from potash salt use it was more than 57.6%, and from a potassium application in the presence of aluminum more than 56.4%. Potassium lowers the activation of growth in Legalo triticale. Growth did not caused a raised absorption of potassium ions. The absorption of potassium is dependent on metabolism by roots in the presence of aluminum ions (Poukhalskaya et al. 2008). Earlier, we observed similar growth activation of wheat plants in the presence of aluminum (Poukhalskaya et al. 2006).

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Influence of exogenous phytohormones on the functional activity of apical meristematic cells in wheat seedlings.

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The functioning of plant apical meristems is controlled by the hormonal regulatory system, which operates at all stages of plant ontogenesis. A topical problem is the identification and further study of molecular markers involved in the perception of a hormonal signal and its transmission to the plant cell genome.

Our preliminary work has found that the meristematic cells of the wheat apex are characterized by the presence of a marker protein called the proliferative antigen of initials (PAI), whose content in root and stem meristematic cells correlates with their mitotic index (i.e., it defines the extent of activity of these cells (Evseeva et al. 2009). The suggestion has been made that PAI is associated with the perception of an auxin or cytokinin signal and its transmission to the cell genome. Our aim was to examine the influenceof exogenous auxins and cytokinins on the functional activity of meristematic cells in the seedllings of wheat cultivar Saratovskaya 29.

The root system of 5-day-old seedlings was treated with solutions of indole-3-acetic acid (IAA; 1 and 0.1 mg/L) and 6-benzilaminopurine (6 BAP; 1 and 0.1 mg/L). The activity of meristematic cells was assessed by the results of determination of the cells mitotic index and by comparative immunochemical estimates of PAI content in these cells.

IAA at 1.0 and 0.1 mg/L enhanced the mitotic activity of the root meristematic cells 2- and 2.5-fold, respectively. The PAI content of the apical meristems changed insignificantly. In turn, in response to 6-BAP at 0.1 mg/L, cellular mitotic activity increased 2-fold and PAI content increased 1.2-fold. These results suggest that PAI involved in the perception of signals from gormones of the cytokinin series and their transmission to the plant cell genome.

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The programmed cell death in winter wheat suspension culture at low temperatures.

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Programmed cell death (PCD) is the genetically controlled process of the organized destruction of superfluous or defective cells (Krishnamurthy et al. 2000; Kingston-Smith et al. 2008). The mechanisms of PCD are well known in animals, whereas many features of this process in plants are needed to investigate. PCD in plants plays a crucial role in real-