those of Bashan et al. (1986), who showed that heat-killed azospirilla lose their adsorption ability, which indicates that active bacterial metabolism is needed for bacterial attachment to roots. *E. coli* K12 did not have a significant growth-promoting effect on wheat seedlings. The inoculation-induced enhancement of mitotic activity in root meristem cells is probably the main cause for the increase in the morphological parameters, although our results may indicate that the change in PAI content in root meristems is a parameter that characterizes the effectiveness of plant interactions with the soil microflora.

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Growth activation testing of wheat cultivars for aluminum toxiticy.

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Table 1. Increase of the vegetative part (cm) of the spring wheat cultivar Lada with the addition of Al (3 mg/L) into soil and solution.

Variant	Days-after-germination			
	6	8	10	12
Control	1.09± 0.35	1.76 ± 0.84	2.43 ± 0.81	3.16 ± 0.79
$AlCl_3$	1.63 ± 0.50	3.49 ± 1.45	4.67 ± 1.25	5.52 ± 1.29

Table 2. Increase in the leaf area (cm^2) of spring wheat cultivars with the addition of Al (0.72 mg/10 g soil) into soil and solution.

Variant	Cultivar		
	Voronezhskaya 14	Omskaya 24	Kerba
Control	51.98 ± 6.81	38.71 ± 7.65	38.18± 3.87
$AlCl_3$	68.16 ±14.84	45.07 ± 6 06	42.62 ± 3.78

The toxic influence of Al ions on plants is real and urgent in breeding Al-resistant cutlivars. Al-tolerance investigations have been conducted in solutions with 10, 30, 50, and 200 μM Al all over the world. Growth and changes in plants processes were researched in the investigations. At the genomic level, some cultivars have tolerance genes to Al ions, but the toxic effects of such ions appears in root shortening and chromosome aberrations.

At the same time, we discovered that Al ions cause root shortening as often as not and sometimes cause forcing of the vegetative part of wheat germ. Leaf length and area in several cultivars increase considerably Al (Tables 1 and 2). The length of the Lada seedlings in the Al variant increased by 74.74% over the control by the 12th growth day. Leaf area also increased in cultivars Voronezhskaya by 31.1 %, Omskaya 24 by 16.4%, and Kerba by 11.6% over the control. Stimulation of leaf growth could be caused by early sensitivity to Al toxicity.

The Al solution stimulated leaf growth but to different degrees among the three cultivars tested (Fig.1). The greatest

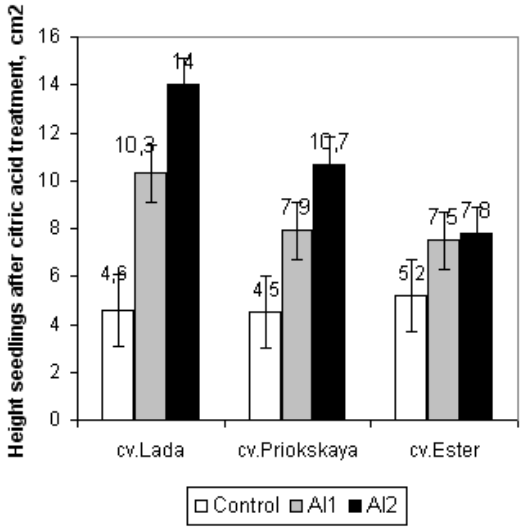

Fig. 1. Area of assimilating leaf surface (cm^2) of the spring wheat cultivars Lada, Priokskaya, and Ester atfter a preplanting seed treatment with citric area.

increase was in the leaf area of the cultivar Lada, which was 2.0% times the control. The leaf area of the cultivar Priokskaya increased 1.06% over the control and the cultivar Ester increased by 47.0%. The relationship between stimulation of leaf growth and plant productivity in Al-weak soils is the capability of greater productivity. We suggest that there is a possible adaptation mechanism of wheat cultivars that are able to initiate early growth because of Al in soils.

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Effect of bacterial lipopolysaccharide on the morphogenetic potential of wheat callus cells in vitro.

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The major problem when cultivating plants *in vitro* is ensuring that the cells preserve their morphogenetic potential. Plant-associated methylobacteria stimulate plant growth and morphogenesis *in vitro* (Kalyaeva et al. 2001). Volkogon et al. (2006) also found that the nitrogen-fixing bacteria *Azospirillum* promote potato growth in an *in vitro* culture. However, inoculation of plants with whole bacterial cells in a *in vitro* culture is fraught with methodology-related difficulties. In view of this, a problem is using bacterial cell components that are responsible for plant–bacterial interaction, and not a bacterial suspension, to treat explants. The outer-membrane lipopolysaccharide (LPS) of the nitrogen-fixing bacteria *Azospirillum* is an active cell component that not only determines bacterial contact interactions with the roots of plants but also is involved in processes inducing plant responses to these interactions (Matora et al. 1995; Evseeva et al. 2009). Our work examined the influence of LPS on the morphogenetic parameters of cultivation of somatic wheat calli differing in the *Rht-B1c* gene.

Immature embryos of two near-isogenic wheat lines (genetic background of cultivar Saratovskaya 29) differing in the *Rht-B1c* gene were placed on Linsmaier–Skoog medium, an experimental nutrient medium for callus initiation, that contained LPS at 1, 2.5, 10, and 100 μg/mL. The resulting morphogenic calli were transferred to a regeneration medium with the same LPS content. The standard medium did not contain LPS. The morphological characteristics of the calli were assessed on day 30 of culturing by using two parameters: yield of morphogenic calli and their content of proliferative antigen of initials (PAI), a molecular marker for wheat meristematic cells (Evseeva et al. 2002).

Callus formation in the wheat lines was high (close to 100%) in all treatments. The addition of 10 μg/ml of LPS to the nutrient medium had a positive effect on morphogenic callus formation in the line with the *Rht-B1c* gene. The yield of morphogenic calli in this line increased almost twofold. LPS at 10 μg/ml also increased the content of PAI in the callus cells of all genotypes studied. Compared with the tall sister line and the original cultivar, the line with *Rht-B1c* showed a significant difference. In other treatments, we did not record any significant effect of LPS on the morphogenetic activity of the calli. Similarly, no substantial differences in the 'mass of morphogenic calli' parameter were found between the standard and experimental nutrient–medium versions. Overall, this study confirmed the previously found positive effect of the *Rht-B1c* gene on all stages of *in vitro* tissue culture compared with the *Rht-B1a* allele (Tkachenko and Lobachev 2008). In most cases, the influence of genotype was greater than the effect of introducing LPS into the nutrient medium.

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