класових та етнічних розбіжностей в суспільстві на той час [4, p. XXIII].

Деякі їх західні колеги вважають, що реформи Мейдзі не принесли бажаних результатів і не довели до справжньої модернізації Японії. Вони також критикують реформаторів, за те, що вони більше уваги приділили створенню потужної армії й імперським амбіціям, а не розвитку економіки та освіти [4, p. XXV].

Підсумовуючи все вище зазначене, можна стверджувати, що не всі шари японського суспільства позитивно сприйняли реформи Мейдзі. Деякі групи населення вважали, що реформи призводять до втрати традиційних цінностей. Однак, були й прихильники реформ, які вважали їх необхідними для модернізації країни. Більшість японців традиційно прийняла «реформи зверху» і лише останнім часом у зв'язку з рецесією у японській економіці по відношенню до реформ Мейдзі побільшало скепсису.

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Nina Chernikova

THE MOST IMPORTANT SILICON FACTORS IN THE ADAPTATION PROCESS OF PLANT GROUPS TO ADVERSE ENVIRONMENTAL FACTORS

Silicon (Si) is one of the most common chemical elements of the Earth's crust, its content is about 28.8% of the dry mass, and varies from 50 to 400 grams per kilogram of soil. In nature, silicon can be in a solid, liquid or absorbed state, in particular in the form of silicon dioxide (SiO2), silica (SiO2•nH2O), polysilicic acid oligo salts (H2SiO3, H4SiO4). It is a part of clay minerals and silicates, in its pure form it is found in quartz, opal and other structures. Silicon (Si) is one of the most common chemical elements of the Earth's crust, its content is about 28.8% of the dry mass, and varies from 50 to 400 grams per kilogram of soil.

In nature, silicon can be in a solid, liquid or absorbed state, in particular in the form of silicon dioxide (SiO_2), silica ($SiO_2 \cdot nH_2O$), polysilicic acid oligo salts (H_2SiO_3, H_4SiO_4). It is a part of clay minerals and silicates, in its pure form it is found in quartz, opal and other structures.

The purpose of this study is to identify various factors of silicon on the adaptation process of plant communities to the environment.

Data from the literature on research, localization and the role of silicon in the growth and development of agricultural crops and wild plant species, carried out by cytological, physiological and molecular biological methods, are presented. It was found that silicon in a plant cell can exist in three forms: soluble, bound to high-molecular organic compounds, or in a pure amorphous or crystalline form. Silicon ions can bind to proteins, amino acids, polysaccharides, polyphenols, lipids and other substances.

The participation of silicon in the mechanisms of resistance and plasticity of plants to the action of many abiotic and biotic factors is shown. According to our research, it was found that the growth of plants in conditions of drought and soil salinity leads to the active absorption of silicon from the soil by the roots and an increase in its content in the leaves. This helps to reduce transpiration, preserve the plant's optimal water balance, increase photosynthesis, and activate the synthesis of stress proteins under adverse conditions.

Silicon also causes an increase in gene expression of enzymes involved in the synthesis of osmotically active substances and various secondary metabolites with protective properties. The participation of silicon in the processes of strengthening cell walls is of particular importance for the stability of plants. The polymerization of silicic acid in the apoplast leads to the formation of an amorphous silicon barrier that prevents the penetration of toxic ions of heavy metals and aluminum. The need to increase attention to the study of the role of this element in the adaptation of plants to adverse anthropogenic and climatic factors is emphasized.

In plants, silicon is contained in the form of silicic acid bound to organic compounds or in the form of siliceous inclusions (so-called phytoliths), different in size and shape, including in the form of crystals. All plants are divided into three classes based on their ability to absorb silicon by their roots: high-, medium, and low-accumulating silicon. Plants absorb Si through leaves and roots in the form of silicic acid [1].

Silicon is useful for the growth and development of plants, both under normal and stressful conditions. This review presents the results of studies of the structural, physiological, biochemical, and molecular mechanisms underlying Si-induced plant growth and reduction of the negative effects of dehydration, salinity, and other abiotic and biotic stresses. In the process of vegetative growth, the content of silicon in the plant changes [2].

According to our research on horsetail plants (Equisetum sylvaticum), in the aerial part of the plant, the total silicon content increased from 3.1 to 4.3%. From June to August, inclusive, the content of organically bound silicon decreased by 0.4%, the content of soluble silicon also decreased by almost half (from 30.2 to 11.2%), while the content of polymeric silicon increased threefold (from 11, 7 to 33.3%).

Silicon binds to both proteins and lipids, phospholipids and lignin – from 0.4 to 0.7% (in the leaves of Melissa officinalis and Polygonum patulum), with pectins – from 3.5 to 7.1% (from total silicon content). Most often, the content of silicon bound to organic substances is about 50% of the total content of silicon in the plant; for example, in horsetails and clover it is approximately 0.3–2.3% of the absolute dry mass, while the share of organic silicon varies from 47.5% (in clover) to 89.1% (in young leaves of wheatgrass – Elytrigia repens). In other species, the content of soluble silicon is also high and ranges from 3.3% (spicy horsetail) to 11.2% (horsetail) of the total silicon content. Polymeric forms of silicon make up from 6.0% (peanut) to 33.8% (horsetail).

So, the molecular mechanisms of increasing silicon's response of plants to damage by pathogens have been established. Silicon activates the genes of chalcone synthase, phenylalanine ammonium lyase, peroxidase, callose synthetase (β-1,3-glucanase) and chitinase. In this way, the mechanisms that ensure damage to pathogens and at the same time strengthen the cell walls of the host plant are activated. In addition to activating the phenipropanoid pathway, Si can affect plant resistance to pathogens by regulating genes involved in the hypersensitive response and jasmonic acid-dependent processes.

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Вадим Чичук,
Іван Лопатко

ІНТЕГРАЦІЯ НОВІТНІХ НАВЧАЛЬНИХ ПЛАТФОРМ У ПРОЦЕС ДИСТАНЦІЙНОГО ТА ЗМІШАНОГО НАВЧАННЯ

У сучасному світі, швидкі темпи технологічного розвитку невід'ємно перетворюють спосіб, яким ми здобуваємо освіту. Інтеграція новітніх навчальних платформ у процес дистанційного та змішаного навчання стає не лише актуальним, але й необхідним аспектом сучасної освітньої