INTERDISCIPLINARY STUDY OF THE INFLUENCE OF RADIOACTIVE ELEMENTS AND SUBSTANCES ON PLANTS

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ABSTRACT

In the seventh grade of the secondary school, according to the course of physics, about the atom and the structure of its nucleus, based on some experiments, only initial information is given, and in the ninth grade this information is expanded. In particular, information is given on the properties of isotopes and natural, artificial radioactivity in connection with the structure of the atomic nucleus. The influence of α, β, γ rays and some isotopes encountered in this topic can be described in connection with biology. In this article, we will familiarize ourselves with the influence of radioactive rays on the cultivation and development of plants, the development of plants using iconic atoms and isotopes, as well as with processes occurring in a given period in plant cells.

INTRODUCTION, LITERATURE REVIEW AND DISCUSSION

Depending on the power and significance of the energy, in the collision of α, β, γ rays with plants, additional biological processes can occur in their bodies, growing and development is intensified, or vice versa, they can be destroyed. Usually, the transition of these rays into the medium is quantitatively classified based on the ionization energy of the molecules.

Under normal conditions, a unit dose of gamma (x-ray) rays is accepted (temperature - 0 ° C, pressure - 760 mm Hg) in 1 cm3 of air 2.08 · 109 dose of rays forming paired ions, equal to one x-ray (p). The set of ion charges in such an amount in 1 cm3 of air is equal to 1 GCE.

When irradiated with this x-ray dose, the energy absorbed in 1 gram of a plant cell in relation to 1 cm3 of air is 770 times more, because the tissue density is so higher than the density of air. The energy absorbed by 1 gram of plant tissue when 1 dose of X-ray is emitted is approximately 85 erg. The dose is also characterized by power. Dose rate is the dose received by a living organism per unit of time. It is measured:

$$\frac{\text{р}}{\text{сек}}, \frac{p}{\text{мин}}, \frac{p}{\text{час}}.$$

Mixing natural radioactive substances with soil in certain doses affects the cultivation of agricultural plants. If the flour of oil shale containing radium and uranium is mixed with soil, then small doses of natural radioactive substances contribute to the improvement of plant development and increase their productivity.

The influence of ionizing radiation contributes to the formation of large amounts of water in living organisms. The formed ions lead to chemical reactions in living organisms. Alpha rays have the strongest ionizing effect on living organisms. They affect 10 to 20 times more than x-rays, gamma and beta rays. In water, an alpha particle ionizes one third of the molecules found.

The strong effect of gamma rays on an object is carried out in two ways: a) the strong action of the source in a short period of time; b) the weak effect of the source for a long period of time. In terms of energy, both of these techniques are identical. However, their biological effects are not the same. For example, strong intense radiation of potatoes in comparison with small doses several times delay the development of its sprouts. Because as a result of strong ionization, the beam slows down the speed of action of nutrient molecules. Ionizing rays not only enhance the development and growth of organisms, but also lead to "mutations," that is, the formation of new forms.

Purely chemical factors can affect the "radiosensitivity" of living organisms. For example, as the amount of oxygen increases, the "radiosensitivity" of living organisms increases. An increase in the amount of water has the same effect. With decreasing temperature, the "radiosensitivity" decreases.

The purpose of radiation of seeds and plants is to change their hereditary properties in favor of man. Among them, there are such properties as early maturity, endurance in adverse conditions (even in cold weather), resistance to various diseases, harmful insects and others.

Different plants favorably perceive different doses of radiation. This is reflected not only in seeds, but also in large plants. The radiation efficiency depends on the type of plant, its physiological state and environmental conditions during radiation.

Various sources can be used to emit seeds and plants. One of them is the device of radioactive cobalt. It is often called "cobalt guns", they have different activities. With the help of cobalt guns it is possible to form the currently widely applicable gamma field. In this case, the source is set in the middle of one or another field sown with seeds. Since the farther from the source, the lower the intensity of the effective radiation.

In recent years, when conducting experiments on nuclear reactions with natural and artificial radioactive substances, the existence of atoms was discovered whose chemical properties are the same and the amount of mass of the same element is different. In the nucleus of these atoms, the number of protons is the same, and the amount of mass (atomic mass) is different. Similar atoms are called isotopes of these elements. Some of them, being in an artificial radioactive state (possess a radioactive property), emit as a result and turn into other elements. For example, in the reaction ${}_6C^{14} \rightarrow 7^{n15} +$, the radioactive carbon is radiated and turns into a nitrogen isotope, in which the electron is released at a high speed.

Elements or isotopes emitted by themselves are called "sign atoms". Currently, natural stable concentrated isotopes, as well as preparations of artificially produced radioactive isotopes, are used as sign atoms. The method of sign atoms plays an important role in photosynthesis, providing plants with mineral nutrients, as well as in the study of biological processes.

In biological testing, radioactive and heavy isotopes are widely used, for example: 7^{n15}, 15^{p33}, 16^{s35}.

In order to learn the development of plant nutrition by superphosphate fertilizer, the following composition should be prescribed: 15^{p32} radioactive phosphorus and 16^{S32} sulfur. After a day, you can determine the presence of radioactive elements in the plant and calculate their amount in certain parts of it. Most of these elements will be on the leaflet, where the phenomenon of

photosynthesis occurs. When this radioactive plant was dried by the same distance and time, the studied photographic plates and control plants were revealed.

Experiments with the use of the radioactive phosphorus isotope (15^{p32}) showed that if phosphate fertilizers, for example, secondary superphosphate fertilizer are introduced into the soil, then the plant receives 48-68 percent of the phosphorus from the phosphorus fertilizer, and receives a small part from the soil. Using radioactive phosphorus in the fields of Central Asia in the process of growing cotton, the efficiency of fertilizer supply is checked by various mechanization techniques. Then, with the help of iconic atoms, it was proved that the movement of the received substance in the root is observed not only in the wooden part, but also in the outer layer.

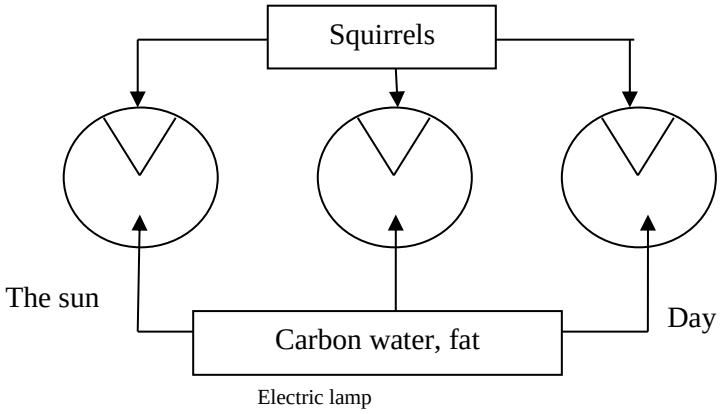
The tests showed that the movement 15^{p32} is unstable in its wooden and external parts.
Using radioactive carbon ($_6C^{14}$), it was found that a new function of the root system is formed by absorbing carbon dioxide from the soil from the soil and transferring it to the leaves and other parts of the plants.

Depending on the coefficient of elasticity and viscosity of the external fluid, organic acids moving through the root and carrying carboxylic acids from the soil rise to the upper part of the plant, penetrate the region of the unripe green fruit, the point of the sprout and leaf blades, and here it contributes to the process of photosynthesis, forming proteins in carbonated waters and high-calorie nutrients, again assumes its original state. In special cases, usually the movement of sucrose, glucose, fructose, hexophosphoric ether, a mixture of organic acids and aluminoacids by race from sugar beets, pumpkin, cotton and other plants was found.

Prior to the application of the method of sign atoms, it was believed that photosynthesis is formed by the synthesis of carbon dioxide by carbonic waters, that is, as a result of exposure to light. As the method of symbolic atoms has shown, after the extinction of light, this gas may still form for some time. During this darkness, oxygen is not released. This shows the heterogeneity of the classification of oxygen evolution and the process of carbon dioxide development.

Another important piece of news is the formation of proteins during photosynthesis. Under the influence of light, a plant synthesizes fuel (carbon water) and then it is consumed in the process of synthesis of complex organic molecules and the like proteins. During photosynthesis, amino acids are also formed along with carbonic waters, which are the bricks of complex protein molecules.

The influence of the spectra in the event of photosynthesis is determined by the use of symbolic atoms. This can be understood on the basis of the following experience: three identical plants are illuminated by sunlight, an ordinary light bulb, and a fluorescent lamp. These three plants absorb the same amount of radioactive gas. During the experiment in these three plants, the radioactive value was the same.



1-рисунок

Therefore, the amount of carbon consumed was also the same. When checking the radioactivity of fat, protein and carbon water in plants, it was found that under the influence of sunlight a large amount of protein substances was accumulated, while fats and carbon water were accumulated under the influence of a light bulb. Exposure to the daylight was similar to sunlight. Due to the fact that in daytime lamps there are a lot of airy color spectra, like the sun's rays, proteins quickly accumulate in plants under the influence of its rays, and since there are a lot of red rays in electric bulbs, a lot of carbonated water and fats accumulate. The results of the experiment are reflected in the scheme (1-figure).

If gamma rays are used as a radioactive source, then when they penetrate through the soil, some of them are absorbed. The degree of absorption of rays depends on their energy, as well as on the density and volume of the emitted material. The density of wet soil is expressed by the “skeletal" density of dry soil and the density of the water contained in it. If the density of the soil skeleton is assumed to be unchanged, then the number of gamma rays absorbed by the soil will also remain unchanged. Therefore, the degree of absorption of gamma rays in moist soil will be high. This technique will help measure the moisture content of a particular soil layer, which in turn will contribute to the continuous monitoring of soil moisture. The absorption of gamma rays (in the presence of a monochromatic stack) by atoms of water and soil substances obeys the following exponential law:

$$I = I_o e^{-\mu h};$$

here: I_o - the intensity of gamma rays in the outer layer; I - h the intensity of the gamma rays penetrating through the substance into the depths; μ - is the absorption coefficient of a given substance; h - is the density of the obtained substance in cm

This method makes it possible to measure soil moisture in stationary conditions up to 3 m and deeper.

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