INDEXES OF THE INDUCTION OF CHLOROPHYL FLUORESCENCE IN PLANTS OF LUPINUS LUTEUS AFFECTED BY CARBONATE CHLOROSIS AT THE TRETMANT OF COLLOIDAL SOLUTIONS OF Zn AND Fe.

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The results of study about the effect of colloidal solutions of Fe and Zn, on the photosynthetic activity of plants Lupinus Luteus by the determination of the chlorophyll fluorescence intensity. It was shown the change in fluorescence of the main parameters in healthy plants and affected by carbonate chlorosis. When impressed carbonate plant chlorosis the efficiency of photosystem II was decreased. Processing plants by the colloidal solutions of metals iron and zinc improved the work of the photosynthetic apparatus.

Colloidal solution, induction fluorescence, carbonate chlorosis.

For rapid diagnosis of extreme environmental factors on plants developed different methods to the corresponding instrumental support. One of them is a method based on the detection of fluorescence of chlorophyll, which provides information about the activity of the photosynthetic apparatus, and the latter, in turn, reflects the general state of the plant [11]. It consists in assessing individual performance fluorescence of chlorophyll, which occurs when light-intensity light it adapted to the dark leaves of the plant. Light energy absorbed by molecules of chlorophyll in the leaves can be used for one of three processes: generation of photochemical reactions, energy dissipation as heat or radiation as fluorescence. These three processes are pro-competitive, so changing the effectiveness of one of them leads to variation of parameters for the other two. Thus, determining the characteristics parameters fluorescence of chlorophyll or detailed specifications Kautsky curve gives information about changes photochemical reaction flow efficiency [4]. Nonmonotonic character of the curve associated with the kinetic features of the primary processes of photosynthesis, the state of light-collecting complex reaction center, acceptor and donor of photosystem II part: of electron-transport-foot chain combination of dark and light phases of photosynthesis and alternative processes consumption of energy quanta, whose intensity is about efficiency of photosystem [8].

But for the effective use of this method should learn more depending on changes in fluorescence parameters and state photo-synthetic apparatus for plants of various

factors. Now this phenomenon is already being used in scientific practice in the study of effects on the body of plants such factors as temperature, drought, mineral nutrition, herbicides, and in the case of choosing the optimal technology for growing plants, environmental pollution monitoring, assessment virus and fungus-term infections and in other cases [2,10]. In addition, the method of determination of IFH monitors the state of plants in real time, which is especially important in the study of mechanisms of influence on plant new drugs and new technologies, which include nanotechnology. Relevant questions remain efficient and environmentally friendly products containing minerals in a biologically available form for use in an environment where there are functional diseases that are caused by unavailability of micronutrients. In this connection, studied the possibility of using metal colloids for the improvement of plants grown on calcareous soils and salinity conditions, when there is a violation of mineral nutrition. Carbonate chlorosis is a functional disease that occurs in plants in soils with a high content of calcium carbonate. Chlorosis appears in yellowing of leaves, which is an external sign of a sharp decrease in chlorophyll content. Carbonate chlorosis occupies a special place among the various types of chlorosis, because it is widespread in large areas of gardens and vineyards, located on calcareous soils. It is known that calcareous soils occupy 30% of the earth's surface [7]. During the chemical, physiological and agrochemical research it was found that a significant concentration of calcium carbonate in the soil lowers the solubility and availability to plants of iron and some other batteries. At this time, we can assume that the point of view of carbonate chlorosis as "Iron" is common [3,6]. These properties calcareous soils create a kind of balance of power plants macro and micronutrients especially characterized insufficient intake of certain metals, which mainly belong to the first transition group. Imbalance of power plants in calcareous soils, refers primarily to metals such as iron, manganese, cobalt, copper, zinc. With a lack of any of these elements in plants appear different disease.

The aim of research was to study the efficiency of colloidal solutions of Fe and/or Zn for the prevention and treatment of chlorosis carbonate with an analysis of changes in the photosynthetic apparatus of plants by fluorescence of chlorophyll.

Materials and methods research. In experiments conducted test cultures were yellow lupine plants, varieties " Kyyivs′kyy ranniy" grown on normal (black soil, sand in the ratio 2: 1) and carbonate (black soil: sand 2: 1 containing 30% calcium carbonate) soils. Plants treated with foliar 14 days of growth. The treatment was carried colloidal solutions of iron and/or zinc. Assessment of the state of the photosynthetic apparatus of plants was performed at 28 and 36 days. Accounting mass aboveground plant parts and root mass that processed spent aged 69 days (6 weeks after a single treatment). Control plants were grown in normal soil, which contained no calcium carbonate. And in the case study of the influence of colloidal solutions as additional controls were plants, which sprayed with distilled water and grown in both soils.

State of the photosynthetic apparatus was determined by assessing the intensity of IFH using a portable fluorimeter "Floratest" developed at the Glushkov Institute of Cybernetic of NAS of Ukraine [9]. Measurements conducted on the leaves middle-tier mode 10 s, ie detected rapid phase of chlorophyll fluorescence. For adaptation to darkness leaves were kept under these conditions for at least 3 minutes. Measurements performed in triple repetition.

On the curve of chlorophyll fluorescence were recorded following indicators and parameters [1,2]: Fo is the level of fluorescence that is emitted complexes of photosystem II reaction centers open in which the acceptor Qa is oxidized state; Fm is the intensity of fluorescence of chlorophyll in the "closed" reaction centers of photosystem II when all Qa restored and can not accept electrons from the reaction centers. Also used for the analysis of parameters: Fv = (Fm-Fo) is the value of the variable fluorescence, which caused part of the light energy, which is the primary reactions of photosynthesis utilized in open reaction centers; Fv/Fm is the measure used indicator of potential photosynthetic activity of the leaf and the value of which depends on the efficiency of photosystem II photochemical reactions. Statistical analysis of data was performed using the program MS Excel. The reliability of the difference between the variants was assessed by Student's criterion for significance level at $P < 0.05$.

So lesions carbonate plant chlorosis causes undesired their photosynthetic apparatus, as evidenced by an increase in the level of background fluorescence and

maximum reduction of weight and aerial parts and roots. Processing plants colloidal solutions of metals shows a positive effect and increases the vegetative mass of plants. Changes in the photosynthetic apparatus, which are determined by colloidal solutions of metals, pointing to enhance photosynthetic function in plants affected by carbonate chlorosis.

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