

Influence of presowing treatment with nano-composites upon photosynthetic apparatus of hybrid of corn

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The purpose. To study influence of newly synthesized nanocomposites (on the basis of saponite) on the content of green pigments and the square of leaf blade at plants of corn of hybrid Kharkovskii 340 MV. **Methods.** Laboratory, statistical. **Results.** It is shown that presowing treatment of seeds of corn by solutions of nanocomposites Saponite (H), Nb-Saponite (Cl), Nb-Saponite (Et) increases on the average the assimilatory surface of the square of leaf blade of plants for 20,4%. By results of spectrophotometric analysis they fixed growth of the sum of chlorophyll pigments (a + b) at plants which seeds were treated with nanocomposites Nb-Saponite (Cl) and Nb-Saponite (Et) in concentration of 300 mg/l on 41,2 and 40,6% in comparison with the control. **Conclusions.** It is determined that presowing treatment of seeds of hybrid of corn with nanocomposites promotes increase in the square of leaf blade and green pigments at plants.

Key words: assimilatory surface, leaf, photo-synthesis, chlorophyll pigment, corn, nano-com-po-sites, saponite.

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Topicality. Recently, in the field of plant growing, there is an increased interest in the use of nanoparticle based preparations. Nanomaterials in agriculture are used as biostimulants and microfertilizers, as they have several advantages over conventional means: they do not stratify under the influence of heat and light, provide full wetting of the surface of plants, are completely absorbed by plants, do not wash off with rain, the prepared working solution can be stored for years, while remaining active [1].

Analysis of recent research and publications. Nanoparticles affect biological objects at the cellular level, increasing the efficacy of biochemical processes in plants, as well as taking part in the formation of the microelement balance, that is, they are bioactive. Research by many scientists suggests that the use of nanoparticles in agricultural production for pre-sowing treatment of seed plants can improve the quality of the seed material, increase resistance to phytopathogens, increase yields and obtain environmentally friendly products [2, 3]. The process of photosynthesis in plants is one of the most important indicators of plant physiology. Experimental studies of many scientists have shown that the photosynthetic performance of plants depends on the area of the assimilation surface, the intensity of the passage of photosynthesis, the daily increment of vegetative mass, etc. [3]. The leaf area is considered one of the main indicators that best describes the state of crops in terms of their photosynthetic activity [4], it is established that the larger the area of the leaf surface, the faster the accumulation of organic matter by plant crops, which leads to an increase in yield per unit area of sowing [5].

The goal of the work. To investigate the effect of new synthesized nanocomposites based saponite on the content of green pigments and the area of the leaf blade in corn plants of the hybrid Kharkovskiy 340 MB.

Research methodology. The key objects were 3 types of new synthesized nanocomposites: 1) Saponite; 2) Nb-Sap (EtO); 3) Nb-Sap (Cl). The new created nanomaterials were provided within the

framework of NATO project NUKR.SFP 984481 by the Milan Institute of Molecular Technology (Italy). The influence of nanocomposites on the content of green pigments and the area of the leaf blade of maize hybrid Kharkivskiy 340 MB was studied.

The area of the puffer apparatus was determined by its length, width and coefficient of conversion, which for crops with a long leaf form is 0.67. In this case, the area is calculated with the following formula:

$$P = D \cdot Sh \cdot K,$$

where P - leaf area, cm²; K - conversion factor (0.67); D - leaf length, cm; W - leaf width, cm [6].

To determine the chlorophylls a and b fresh leaves of corn were finely cut with scissors and sampled a sample of 500 mg. The sample was placed in a porcelain mortar and triturated with 5 ml of solvent (96% C₂H₅OH) and quartz sand. Abstentions of filter films were obtained through a filter in a dry measuring flask, the filter was washed with solvent until the pigment was completely removed. The resulting extract was poured into a 50 ml flask and brought to a 96% C₂H₅OH label, mixed well and passed through the Unico 1205 spectrophotometer at appropriate wavelengths. The concentration of pigments was calculated by the equation:

$$C_{\text{хл. a}} = 13,70 D_{665} - 5,76 D_{649};$$

$$C_{\text{хл. b}} = 25,80 D_{649} - 7,60 D_{665};$$

$$C_{\text{хл. a + хл. b}} = 6,10 D_{665} + 20,04 D_{649},$$

where C_{хл. a}, C_{хл. b}, C_{хл. a + хл. b} – respectively, the concentration of chlorophytes a, b, their amounts, mg / l [7].

The content of pigments (A) in the plant material, mg / g of crude mass was calculated by the equation:

$$A = (C \cdot V) / (H \cdot 1000),$$

where C – is the concentration of pigments, V – is the volume of extract, ml (25 ml), H – is the weight gain of the plant material, g (0,2 g) [8].

Research results. It was investigated that pre-sowing seed treatment with aqueous solutions of nanocomposites based saponite increased the area of the leaf blade compared to control by an average of 20.4%. The largest increase in the area of the leafy corn plate was noted for the effect of nanocomposite Nb-Saponite (Et) at a concentration of 300 mg / l, this figure increased by 44.5%. By the influence of nanocomposites Saponite (H) and Nb-Saponite (Cl), this indicator averaged control over 2 and 25% respectively (Fig. 1).

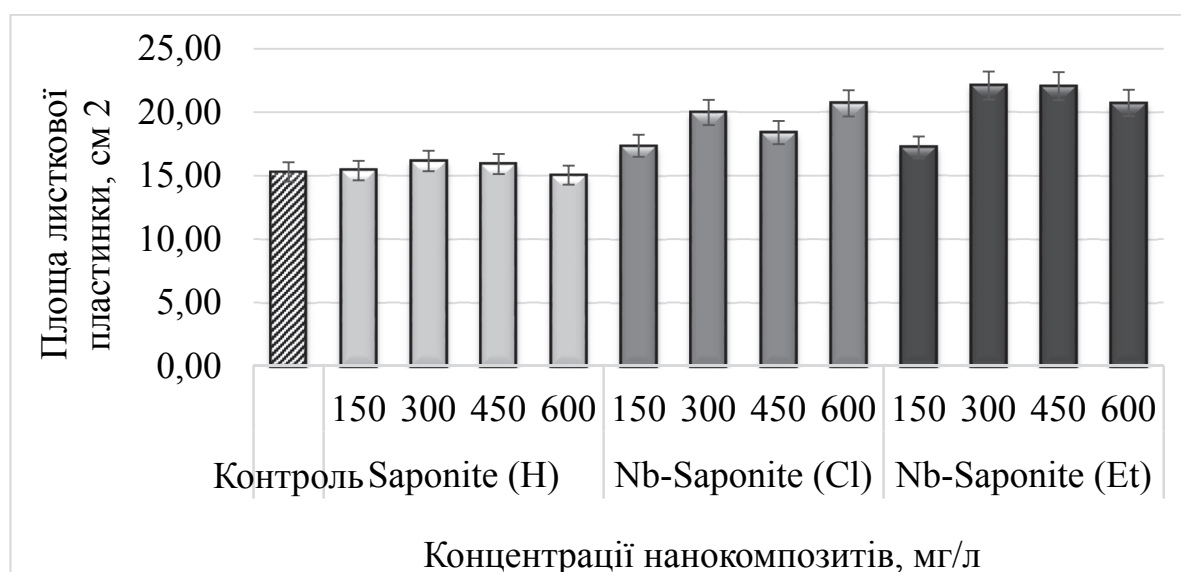


Fig. 1. Influence of nanocomposites on the area of the leaf surface of maize

Productivity of photosynthesis processes is closely related to chlorophyll leaves, which acts as a sensitizer, that is, a substance that absorbs light. Chlorophylls *a* and *b* are important photosynthetic pigments of higher plants, which are Mg-containing porphyrins, the main part of which is included in the light-harvesting complexes, provides absorption and transmission of light energy to the reaction centers in which photosynthetic reactions occur [9]. With the participation of pigments, the energy of the quantum of light is transformed into macroscopes, which are further used to synthesize organic compounds in the plant [10].

According to the results of the spectrophotometric analysis, it was found that the content of chlorophyll *a* and plants of the 340 MW corn honey of Kharkivskiy in the phase of 3 leaves of seed, which was pre-treated with nanocomposites, increased by 21.8% in comparison with the control. A similar pattern was found for chlorophyll *b* and the number of chlorophylls in plant leaves increased by 4.3% over control.

For the pretreatment of maize seeds with Saponite (H) Nb-Saponite (Cl) and Nb-Saponite (Et) nanocomposites, the content of chlorophylls *a* and *b* increased in average by 15.5 and 2%, 28.9 and 13% respectively, and by 26, 7 and 4.3% respectively. The highest chlorophyll content *a* was observed in the leaves of the maize hybrid, the seeds of which were treated with solutions of nanocomposites Nb - Saponite (Et) and Nb - Saponite (Cl) at a concentration of 300 mg / l which was 2.03 and 2.11 mg / g mass of crude substance, whereas in the control variant this indicator was 1.42 mg / g. The high content of chlorophyll *b* was observed due to nanocomposites based on saponite Nb - Saponite (Et) in concentrations of 300 mg / L and Nb - Saponite (Cl) at a concentration of 600 mg / l and amounted to 0.29 mg/g and 0.29 mg / g, while in the control it was 0.23 mg / g (Table 1.).

Influence of nanocomposites on the content of chlorophylls in leaves the maize hybrid Kharkivskiy 340 MB

Options	Concentration, mg / l	Chlorophyll content, mg/g mass of crude substance	
		C a	C b
Control	-	1,42 ± 0,07	0,23 ± 0,01
Saponite (H)	150	1,91 ± 0,08	0,27 ± 0,01
	300	1,63 ± 0,06	0,23 ± 0,02
	450	1,64 ± 0,07	0,24 ± 0,01
	600	1,38 ± 0,06	0,20 ± 0,01
Nb-Saponite (Cl)	150	1,52 ± 0,07	0,23 ± 0,03
	300	2,11 ± 0,07	0,22 ± 0,01
	450	1,72 ± 0,11	0,28 ± 0,02
	600	1,96 ± 0,07	0,29 ± 0,02
Nb-Saponite (Et)	150	1,52 ± 0,06	0,21 ± 0,01
	300	2,03 ± 0,08	0,29 ± 0,03
	450	1,79 ± 0,10	0,25 ± 0,01
	600	1,86 ± 0,05	0,22 ± 0,01

Notes: C a - concentration of chlorophyll *a* (mg / g mass of crude substance); C b - concentration of chlorophyll *b* (mg / g mass of crude substance).

An increase in the amount of chlorophylls (*a* + *b*) in plant variants, the seeds of which were pretreated with nanocomposites Nb-Saponite (Cl) and Nb-Saponite (Et) at a concentration of 300 mg / l, was higher than 41.2 and 40 , 6% respectively (Fig. 2).

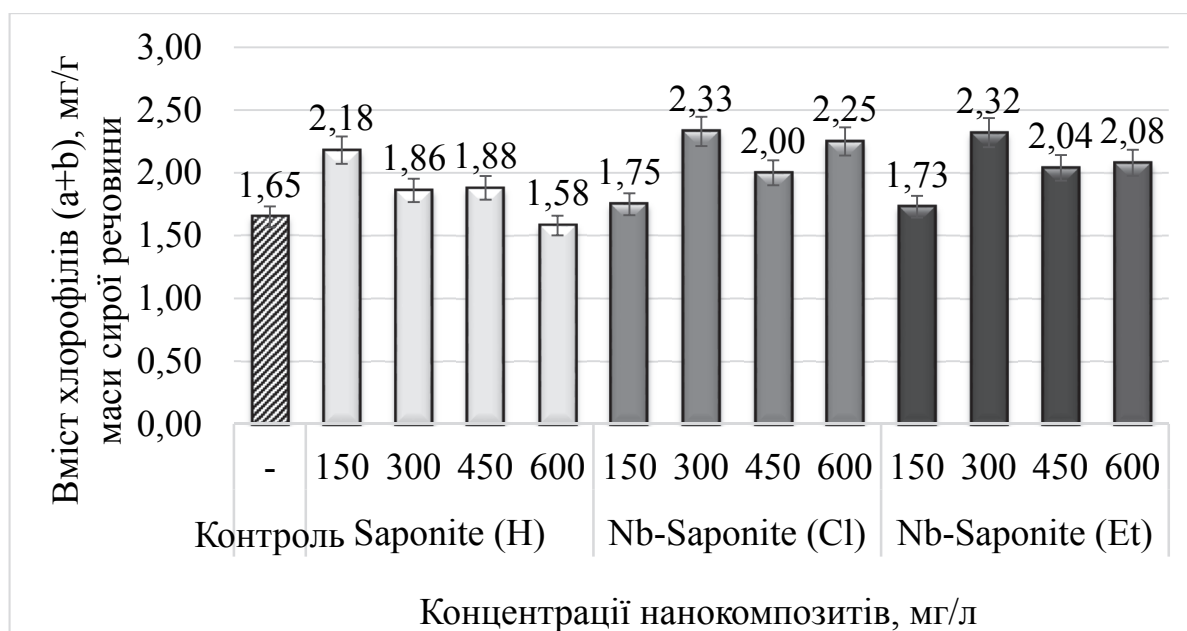


Fig. 2. Influence of nanocomposites on accumulation of chlorophylls in leaves of maize hybrid Kharkivskiy 340 MB

Conclusions Early sowing of maize seeds by solutions of nanocomposites Saponite (H), Nb-Saponite (Cl), Nb-Saponite (Et) causes an increase in the assimilation surface of the maize hybrid Kharkov 340 MB. The area of the leafy plant plate under the influence of nanocomposites increases by an average of 20.4%. The most intensive growth of the area of the leafy corn plate was noted for the influence of nanocomposite Nb-Saponite (Et) at a concentration of 300 mg / l, this figure increased by 44.5%.

According to the results of the spectrophotometric analysis, the growth of the sum of chlorophylls (a + b) in plants whose seeds have been pretreated with Nb-Saponite (Cl) and Nb-Saponite (Et) nanocomposites at a concentration of 300 mg/l by 41.2 and 40.6% according to control.

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