

## **Content of plastid pigments in leaves of seedling of indeterminant hybrids F1 of tomato (*Lycopersicum esculentum* Mill.) in conditions of glass-covered ground**

**Goal.** Compare the performance of six promising F1 Ukrainian breeding hybrids with regard to the content of chlorophyll and carotenoids in tomato plants and their productivity for a method of growing seedlings in soil under closed soil conditions. **Methods.** Laboratory, vegetative, measuring-weight, biochemical, mathematical-statistical. **Results** It has been established that the content of plastidic pigments in the leaves of plants of F1 tomato hybrids of Ukrainian selection changes in ontogenesis depending on their biological characteristics. **Conclusions** Influence of the method of growing seedlings in the soil on the content of plastid pigments (chlorophyll a, b and carotenoids k) in F1 tomato hybrids in a film greenhouse in solar heat. The highest figures were on the sheets of the Barmale F1 hybrid, the Yatran F1, the KDS-5 F1.

*Key words: chlorophyll, photosynthesis, leaf, hybrid, carotenoids*

One of the conditions for obtaining high yields of vegetable crops, in particular tomatoes, is in the closed ground, observing photosynthesis processes, on the basis of which the condition of plants can be assessed and timely corrections can be made to optimize the seedlings' cultivation regimes [1, 3, 4]. An important indicator of the efficiency of the use of light energy by plants is the quantitative and qualitative composition of plastidic pigments. An additional ultraviolet illumination contributes effectively to the accumulation of total green pigments, chlorophylls and carotenoids (14-36%). Thanks to its application during the growing of tomatoes the physiological state changes positively and the productivity of tomato plants increases [9, 12].

Tomato plants (*Lycopersicum esculentum* Mill.) - the Tarasenko and De Barato hybrid were grown under lamps with different spectral composition of radiation. The total content of chlorophyll and carotenoids in the leaves of tomatoes for growing under a lamp DRLF 400 was higher than under a DNT 400 lamp, which indicates a greater sensitivity of the pigmentation of tomato to radiation [16]. According to KS The tissue, the content of chlorophyll in the leaves, is positively influenced by frozen nutrition with liquid complex fertilizer, which contributes to the increase of soil fertility due to the growth of the number of Azotobacter and micromycetes. It has been established that improvement of nitrogen nutrition conditions for foliar application contributes to the increase of the content of pyrimin in leaves and fruit crops and the concentration of ascorbic acid and sugar in them [8, 13].

Chlorophylls and carotenoids [6-8, 10, 14] are the main pigments of the germinating complex of tomato, like other plants. The content of chlorophylls in plants varies from 0.7-1.1 g per 1 kg of green weight of plants, and the ratio of chlorophylls a and b is usually about 3: 1. The content of chlorophylls and their ratios depend on a number of factors - the level of illumination, temperature, balance of mineral and organic nutrition, the composition of the soil, concentration of certain chemical compounds and elements (for example, magnesium content) [1-8, 10]. Defeat plants viral infections significantly affects their content of chlorophylls a and b and carotenoids, which can be reduced by three times compared with healthy plants [3, 4, 6, 7].

During the study of the method of growing seedlings in the soil as a photosynthesis system of growing vegetative mass during the vegetation period, it was established that its growth for a certain period depends on the value of the average leaf area, the duration of the period and the net production of photosynthesis [1, 3, 10 ] With the aging of leaves, the whole plant decreases the intensity of photo-synthesis. In most annual plants, the intensity of photosynthesis increases in the process of ontogeny and reaches a maximum in the flowering phase. After flowering, the intensity of photosynthesis in the leaf is reduced [1, 3, 8, 10].

The purpose of the research is to compare the performance of 6 promising F1 Ukrainian breeding hybrids: KDS-5 F1 (K), Aenei F1, Barmale F1, Fred F1, Yatran F1, Rainbow F1 on the content of chlorophyll and carotenoids in the leaves of tomato plants with their productivity per se - there is growing of seedlings in the soil under conditions of closed soil.

Materials and methods of research. Experiments were conducted on the territory of the NDP "Fruit and Vegetable Garden" in a film greenhouse for "Methodology of the study in vegetable growing and melon" [2]. The area of the registration plot is 5 m<sup>2</sup>. The test is laid out in a 4-time repetition. Placement scheme of plants - 60 × 30 cm, number of plants per 1 m<sup>2</sup> - 5.5 pcs. The statistical processing of the data obtained was carried out according to the methods given by B.O. Vospehovy [5].

Ventilation - through the door and transom, located in the upper end of the greenhouse. In spite of the full opening of the greenhouse and shading of the grid, overheating may occur in the summer months. Watering - dripping, to each plant a dropper was placed on which the water passed to the root system. The advantage of this irrigation method is that the above-ground part of the plant was not moisturized, which prevented the disease from tomatoes to gray rot and other diseases [1, 8, 10].

The care of plants consisted in the removal of stepchildren with a systematic twisting of rovings around twine. Disinfection against hothouse whitewashing was carried out with the help of a veterinarian biopreparate and a yellow colored trap hanging with an entomologic glue; against aphids - biotrexil verticillin.

The content of photosynthetic pigments in the leaves of the studied tomato hybrids was determined in stages of organogenesis (budding, flowering, fruiting) according to the generally accepted method on OPTIZEN POP (South Korea) spectrophotometer. Extraction of the pigment was carried out with 100% acetone. The sheets of 6 indeterminate F1 medium-sized tomato hybrids that were grown in identical conditions were studied. The content of chlorophylls a and b in the leaves of hybrid plants was determined at different wavelengths (chlorophyll a - 662 nm, chlorophyll b-644, carotenoids k-440 and 644 nm) [2, 5, 11]. The concentration (C) of pigments was counted in mg per gram of crude mass of leaves using the formulas X.M. Fixing [11]:

$$C_a = 9,78 \cdot D_{662} - 0,99 \cdot D_{644};$$

$$C_b = 21,43 \cdot D_{644} - 4,65 \cdot D_{662};$$

$$C_a + C_b = 5,13 \cdot D_{662} + 20,44 \cdot D_{644};$$

$$C_k = 4,7 \cdot D_{440} - (1,38 \cdot D_{662} + 5,48 \cdot D_{644}),$$

where  $C_a$  is the concentration of CrA;  $C_b$  is the concentration of Chb b;  $C_k$  - concentration of carotenoids;  $D_{440}$  - optical density of the mixture at a wavelength of 440 nm;  $D_{662}$  is the optical density of the extract at a wavelength of 662 nm;  $D_{644}$  is the optical density of the extract at a wavelength of 644 nm. All experiments were carried out in 4-time repeat, the results obtained were statistically processed.

Correct selection and preparation of samples for analysis is essential for obtaining reliable data in physiological research. The correctness of their conduct depends on the accuracy of the determination of physiological parameters. By studying the processes occurring in the leaves, 1-2 leaves from the same tier are taken from each plant, when they are completely developed [2, 5, 11].

The seeds were sown directly into the soil of a film greenhouse at a temperature of 13-15°C. The soil is typical for the forest-steppe and Polissya - black ground, podzolic, low-humus, low nitrogen, medium phosphorus and potassium. To improve its structure, add 3-5 kg / m<sup>2</sup> of compost based on horse manure and sawdust. This increases the biological activity of the soil, which is especially important for soils that have been in constant use for many years.

Research results. Since the accumulation of chlorophylls in the leaves is determined, first of all, by their level of illumination, then the content of chlorophylls is greater in the leaves of tomato plants planted according to the optimal scheme. According to our research, the content of chlorophyll in the leaves of plants of F1 tomato hybrids gradually grew in phases of growth and development and reached its maximum in the fruiting phase, and at the end of fruiting declined (table).

The relatively low content of chlorophylls and carotenoids is found in the leaves of all F1 hybrids. The content of chlorophylls in the leaves, above all, indicates the specific adaptability of the plant to a certain intensity of light [4, 6, 12]. The low content of chlorophylls suggests that the representatives of these hybrids are luminous plants.

It has been established that the content of plastidic pigments in the leaves of plants of F1 hybrids of Ukrainian selection of tomato varies in ontogenesis depending on their biological characteristics. Thus, in the phase of budding chlorophyll a in the leaves was 0.82-1.36 mg / 100 g of crude mass, chlorophyll b - 0.34-0.57 mg / 100 g of crude mass.

The maximum accumulation of chlorophylls in leaves is determined in the flowering phase, chlorophyll a increases to 2.61-3.05 mg / 100 g of crude mass, chlorophyll b - 0.42-1.15 mg / 100 g of crude mass, probably connected with the efforts of growth processes.

Characteristic decrease of green pigments occurs in the fermented phase, chlorophyll a - up to 1.88-2.51 mg / 100 g of crude mass, chlorophyll b - 0.88-1.32 mg / 100 g of crude mass, which, It is true, due to depression as growth processes, and photosynthetic activity of plants.

Analyzing the table data, it is right to affirm that plants of the Barmal F1 hybrid, Fat Yatran F1 contains the highest amount of chlorophyll a and b, which exceeds the values of the control variant of KDS-5, the smallest recorded in the hybrid Rainbow F1.

The obtained results indicate that the amount of chlorophylls ( $\Sigma a + b$ ) in the conditions of film greenhouses for the method of growing seedlings in the soil during the entire period of vegetation changes. The lowest rates were in the budding phase (1.92-1.16 mg / 100 g of crude mass), the increase occurs in the flowering phase (4.44-3.29 mg / 100 g of crude mass), in the famine phase, the indices were average ( 3.84-2.75 mg / 100 g of crude mass). The analysis confirmed that in the F1 tomato hybrids, the pigment complex in the conditions of film greenhouses is unstable. Fluctuations were diverse.

From literary sources it is known that the correlation of chlorophylls a and b is one of the indicators of photosynthetic productivity of plants, and in the conditions of film greenhouses - a sign of their physiological state [9, 14].

The correlation of a / b chlorophyll content was calculated, which confirms the acquisition of characteristics of light-eagerness of plants. In the budding phase, these figures were 1.89-2.44, flowering - 2.15- 3.70, fruiting - 1.90-2.14. The analysis shows that the F1 hybrids of plants, even in film greenhouses, this characteristic varies over the course of the research.

At the same time, the reduction of the ratio chlorophylls a / b and an increase in the ratio of the content of chlorophylls and carotenoids in plants are similar to the reaction of plants to the influence of stress factors. However, it can not be unequivocally stated that in this case the classical reaction of plants to stress occurs, since the total content of pigments (chlorophylls and carotenoids) in leaflets of F1 tomato hybrids was higher than that of controls, whereas under the influence of stress the general the content of pigments decreases, primarily chlorophyll b.

In the process of photosynthesis, along with green, yellow pigments also participate. Carotenoids are mandatory components of pigment systems of all photosynthesis organisms, absorbing light as additional pigments, are part of the light complex assembly, transmitting the absorbing energy of chlorophyll.

The level of carotenoids in leaflets of F1 tomato hybrids has been shown to vary in ontogenesis. During the vegetation period, the pigment content was: in the phase of budding - 0,43-0,61 mg / 100 g of crude mass; flowering - 0,69-0,80; fruiting - 0,84-0,97 mg / 100 g of crude mass. The highest content of carotenoids in the Aenei F1 hybrids, Rainbow F1, exceeds the values of the control variant KDS-5 F1. The lowest figure was found in the Barmal F1 hybrids, Yatran F1.

The ratio between total chlorophyll content and carotenoids is 2.80-6.44 on average in the study, which characterizes them as rocks more adapted for a wide range of levels of illumination. The ratio of a / b and (a + b) / carotenoids is usually normal but is responsive to the effects of growing conditions: the a / b ratio decreases under adverse conditions, and the ratio of the content of chlorophylls and carotenoids increases. According to the literary data, the ratio of a / b in normally developed plants is 2.5-3 [3, 4, 8].

## Conclusions

In the leaves of tomato plants, the content of pigments (chlorophylls a, b and carotenoids k) and their ratios change in ontogenesis. Thus, the maximum accumulation in hybrids F1 occurs in the flowering phase, which is probably due to the power of their photosynthetic activity. The level of pigments in the leaves of F1 hybrids depends on the biological characteristics, as well as on the method of growing seedlings. For the

method of growing seedlings in the soil, the highest rates were in the leaves of the hybrid Barmaley F1, Yatran F1, KDS-5 F1.

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