УДК 630*181

4.1.1. Общее земледелие и растениеводство (биологические науки, сельскохозяйственные науки)

ХАРАКТЕРИСТИКА ОТДЕЛЬНЫХ БИОХИМИЧЕСКИХ ПОКАЗАТЕЛЕЙ АССИМИЛИРУЮЩИХ ОРГАНОВ ТОПОЛЯ БАЛЬЗАМИЧЕСКОГО (POPULUS BALSAMIFERA L.)

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Представлены результаты исследований биохимических показателей ассимилирующих органов тополя бальзамического (Populus balsamifera L.), произрастающего в условиях городской среды на трех опытных площадках: на территории городских лесов; на газонах, расположенных вдоль улично-дорожной сети; в сквере. Все три опытные площадки расположены в границах города Новосибирска. Установлено, что среднее значение суммы хлорофиллов в городских лесах на 13% ниже, чем в сквере и на 9% ниже, чем на озелененных территориях вдоль улично-дорожной сети. Среднее значение суммы флавоноидов в лесу на 10% выше, чем на двух других опытных площадках. Индекс азотного баланса в лесу на 30% ниже, чем в сквере и на 19% ниже, чем на улично-дорожной сети

Ключевые слова: ИНДЕКС АЗОТНОГО БАЛАНСА, АНТОЦИАНЫ, АССИМИЛИРУЮЩИЕ ОРГАНЫ, БИОХИМИЧЕСКИЕ ПОКАЗАТЕЛИ, ФЛАВОНИДЫ, ХЛОРОФИЛЛ

http://dx.doi.org/10.21515/1990-4665-199-030

UDC 630*181

4.1.1. General agriculture and crop production (biological sciences, agricultural sciences)

CHARACTERISTICS OF SELECTED BIOCHEMICAL INDICATORS OF ASSIMILATORY ORGANS OF BALSAMIC POPLAR (POPULUS BALSAMIFERA L.)

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The results of studies of the biochemical parameters of the assimilating organs of balsam poplar (Populus balsamifera L.) growing in an urban environment at three experimental sites are presented: in the territory of urban forests; on lawns located along the road network; in the park. All three experimental sites are located within the city of Novosibirsk. It was found that the average value of the amount of chlorophylls in urban forests is 13% lower than in a public garden and 9% lower than in green areas along the road network. The average value of the amount of flavonoids in the forest is 10% higher than at the other two experimental sites. The nitrogen balance index in the forest is 30% lower than in the park and 19% lower than in the road network

Keywords: NITROGEN BALANCE INDEX, ANTHOCYANANS, ASSIMILATOR ORGANS, BIOCHEMICAL INDICATORS, FLAVONOIDS, CHLOROPHYLL

Introduction

Balsam poplar (Populus balsamifera L.) is a promising tree crop, widely used in urban landscaping in the 50-70s post-war years. To date, mature plantings grow in areas with different conditions. In Novosibirsk, balsam poplar

was used to create forest crops in urban forests, in street landscaping and in decorative landscaping of public gardens.

To study the biochemical indicators of assimilating organs, three sample plots with different environmental conditions were selected in the following areas in Novosibirsk: the territory of urban forests in the Pervomaisky forestry area, landscaping of the road network of Petukhov Street, park named after. M.I. Kalinina.

The purpose of the study was a comparative assessment and establishment of differences in the state of the pigmentary complex under the influence of stress factors [1].

Study of biochemical parameters of assimilating organs balsam poplar (Populus balsamifera L.) was carried out usingportable flavonoid and chlorophyll meterDualex Scientific [4,5] in the 2023 growing season.

The physiological and biochemical characteristics of assimilating organs, which determine growth and reproductive processes that are sensitive to environmental changes, are used for early diagnosis of the condition of plants [2]. Flavonoids are indicators of plant nitrogen status. If plants do not experience a lack of nitrogen nutrition, they use basal metabolism to synthesize nitrogen-containing molecules, including chlorophylls, and when there is a lack of nitrogen, plants direct metabolism to increase the synthesis of flavonoids [3].

To objectively assess the results of the study, we additionally obtainedindicators of nitrate nitrogen in the soil layer of 0-20 and 20-40 cm on the same test plots.

Materials and research methods

Samples of assimilating organsbalsam poplar (Populus balsamifera L.) and soil samples were collected in Novosibirsk on three sample plots with different environmental conditions in the following areas: the territory of urban forests inPYervomaisky forestry area, landscaping of the road network of Petukhov Street, park named after. M.I. Kalinina.

The study of samples of assimilating organs of balsam poplar (Populus balsamifera L.) was carried out usingportable flavonoid and chlorophyll meterDualex Scientific in the laboratory of biotechnology and seed science of SibBS TSU.

Agrochemical testing of soil samples for nitrate nitrogen in soil layers of 0-20 cm and 20-40 cm (N-NO3), ppm was carried out in accordance with GOST 26951-86 soil. Determination of nitrates was carried out using the ionometric method. Ion-selective electrode Alice-121NO3 “Anion 4100” in the laboratory of phytodiagnostics and agrochemistry of the center of agricultural technology “Agrodoctor”, Novosibirsk.

Research results and discussion

The results of studies of biochemical parameters of the assimilating organs of balsam poplar (Populus balsamifera L.) and agrochemical testing of soil samples for nitrate nitrogen in soil layers of 0-20 cm and 20-40 cm have the following values:

Measurement data for the following biochemical parameters: sum of chlorophylls, sum of epidermal polyphenols, nitrogen balance index (NBI - Nitrogen Balance Index) are given in Table 1.

Table 1

The value of biochemical parameters in balsam poplar in Novosibirsk.

An object	Sum of chlorophylls a+b, µg/cm2	Total flavonoids, µg/cm2	Nitrogen Balance Index (NBI)
Urban forests	29.0 ± 0.7	1.54 ± 0.04	19.5 ± 0.7
Square named after M.I. Kalinina	32.7 ± 0.7	1.38 ± 0.04	25.2 ± 1.1
Petukhova street	31.7 ± 0.5	1.39 ± 0.03	23.2 ± 0.5

It was found that the average value of the amount of chlorophylls in urban

forests is 13% lower than in a public garden and 9% lower than in green areas along the road network. The average value of the amount of flavonoids in the forest is 10% higher than at the other two experimental sites. The nitrogen balance index in the forest is 30% lower than in the park and 19% lower than in the road network. Thus, it can be noted that there is a lack of nitrogen nutrition in balsam poplar (Populus balsamifera L.) crops located in the urban forests of the Pervomaisky forestry area in Novosibirsk. The best biochemical indicators are characteristic of the plantings in the park named after. M.I. Kalinina. The biochemical indicators of the plantings on Petukhova Street occupy average values, despite the least favorable, from an environmental point of view, arrangement of plants.

Data from agrochemical testing of soil samples are given in Table 2.

Table 2

The value of nitrate nitrogen in the soil layer 0-20 and 20-40 cm in Novosibirsk

An object	N-NO3 (0-20), ppm	D*, %	N-NO3 (20-40), ppm	D*, %	d**,%
Urban forests	1.4	20.0	1.2	20.0	0.6
Square named after M.I. Kalinina	23.5	15.0	7.1		
Petukhova street	6.2	20.0	5.9		

* - permissible relative deviations with a two-sided confidence level P = 0.95 from the arithmetic mean of the test results;

** - actual relative deviation from the arithmetic mean of test results.

Agrochemical testing of soil samples for nitrate nitrogen showed the

highest values of nitrate nitrogen for the park named after. M.I. Kalinin (23.5 ppm in layer 0-20) and the lowest values for urban forests (1.2 ppm in layer 20-40) (Table 2). The content of nitrate nitrogen in the soil layer 0-20 cm in urban forests is 16 times lower than in a similar layer in the park named after. M.I. Kalinin and 4 times lower than on the street. Petukhova. The value of the indicator for the layer of 20-40 cm in urban forests is 5 times lower than in a similar layer in the park named after. M.I. Kalinin and 4 times lower than on the street. Petukhova.

Thus, summary values of the studied biochemical parameters and agrochemical tests of soil samples for nitrate nitrogen shows that forest crops of balsam poplar in urban forests grow under conditions of nitrate nitrogen deficiency in soil layers of 0-20 and 20-40 cm, which determines the lowest of the three experimental plots for the sum of chlorophylls a + b and the nitrogen balance index with the highest amount of flavonoids.

For green spaces along the street. Petukhov and in the park named after. M.I. Kalinin is characterized by similar values of the sum of chlorophylls a+b, the sum of flavonoids and the nitrogen balance index, with a significant difference in the nitrate nitrogen parameters. Thus, a fourfold difference in nitrate nitrogen indicators in a soil layer of 0-20 cm and a 1.5-fold difference in this indicator for a soil layer of 20-40 cm gives a 3% deviation in the sum of chlorophylls a+b and an 8% deviation in the nitrogen balance index, and the deviation in the sum flavonoids are less than 1%.

Conclusions

Studies of biochemical parameters of assimilating organs have been carried out balsam poplar (Populus balsamifera L.), growing in three different urban environments in Novosibirsk. Differences in the state of the pigment complex under the influence of stress factors have been established. A comparative assessment of the biochemical parameters of the assimilating organs of the balsam poplar Populus balsamifera L. was carried out.

It was found that the average value of the amount of chlorophylls in urban forests is 13% lower than in a public garden and 9% lower than in green areas along the road network. The average value of the amount of flavonoids in the forest is 10% higher than at the other two experimental sites. The nitrogen balance index in the forest is 30% lower than in the park and 19% lower than in the road network.

Forest crops of balsam poplar in the urban forests of Novosibirsk grow under conditions of nitrate nitrogen deficiency in soil layers of 0-20 and 20-40 cm, which determines the lowest of the three experimental sites indices of the sum of chlorophylls a + b and the nitrogen balance index with the highest index of the sum of flavonoids .

For green spaces along the street. Petukhov and in the park named after. M.I. Kalinin is characterized by similar values of the sum of chlorophylls a+b, the sum of flavonoids and the nitrogen balance index, with a significant difference in the nitrate nitrogen parameters. Thus, a fourfold difference in nitrate nitrogen indicators in a soil layer of 0-20 cm and a 1.5-fold difference in this indicator for a soil layer of 20-40 cm gives a 3% deviation in the sum of chlorophylls a+b and an 8% deviation in the nitrogen balance index, and the deviation in the sum flavonoids are less than 1%.

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