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THE GROWTH CHARACTERISTICTS OF SWEET CHESTNUT (*CASTANEA SATIVA MILL.*) UNDER DIFFERENT MINERAL NUTRIENT CONDITIONS

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The article presents the results of experimental researches of the growth characteristics of chestnut plants under different mineral nutrition conditions. It has been determined that the deficit of mineral nutrition stipulates increasing of water consumption on transpiration and causes negative influence on the growth and development of chestnut plants.

Mineral nutrition is an important factor that determines processes of growth and development of woody plants [6, 8]. Mineral nutrients act as a catalyst in the conditions of biochemical reactions, regulate osmotic processes, serve as components of the buffer systems and regulators of membrane permeability plants [3, 10]. By creating a sustainable supply of woody plants it is possible to direct physiological processes towards increasing of organic matter synthesis [4, 5]. The presence and correlation of mineral nutrients in the soil determines the further functioning of plants [1, 2].

The literary analysis shows that woody plants in the initial period of their development require another balance of nutrients differ of grass [9].

Materials and Methods. Vegetation experiments from study the processes of growth and development chestnut plants at different levels of mineral nutrients conducted in containers with volume 8 liters, which were filled with pure quartz sand.

Experiments were performed on a base of a mixture the composition of which was developed at the Institute of Plant Physiology and Genetics NAS of Ukraine with regard to the requirements of seedlings of tree species [8]. The composition of mixture ($N_1R_1K_1$) were (mg / kg sand): NH_4NO_3 – 0,200, $MnSO_4$ – 0,002, KH_2PO_4 – 0,375, H_3BO_3 – 0,002, $MgSO_4$ – 0,060, $ZnSO_4$ – 0,001, $CaCO_3$ – 0,250, F_2C_{l6} – tracks. During the research used variants of binary content ($N_2P_2K_2$), half-dose of NPK ($N_{0,5}P_{0,5}K_{0,5}$) and $P_2N_1K_1$ of mineral nutrition.

Nutrients brought when stuffing vegetation vessels. The dose of each of the major elements was 150 mg / kg of sand (normal). In each of vessels grown 3 plants. Soil moisture maintained at 60% of the total water capacity (TWC). During the vegetative experiment, the reaction medium was varied in the range of pH 5,8-6,6, which is optimal for chestnut plant.

The transpiration coefficient of plant leaves was determined by the ratio of the amount of water used for irrigation, to the mass of dry matter. For this purpose, each plant before planting in vessels weighed in the balance VLAO – 100 to within 0,001 g. The amount of water which was used for watering plants, also was weighed. For each variant of the experiment used 15 plants (3 in a five-repetition). The basic version of mixtures provisionally marked $R_1N_1K_1$ with relevant quantitative changes in other embodiments experiments.

Discussion and Results. The choice of this mixture related to the fact that it, unlike the mixture of Helrihelya are included increased need for planting of trees of phosphorus supply and mediocre – nitrogen and potassium. Advantage in an environment of phosphorus under nitrogen and potassium consist in providing intensive initial growth of seedlings, leads to the creation of mycorrhizal roots and intensification of beneficial microorganisms rhizosphere [8]. In addition, in the mixture are absent chloride ions, taken into account changes in the mutual reactions and introduced necessary plant micronutrients for seedlings. The results of analysis after 30 days of cultivation allowed securing the distinctions in the accumulation of organic matter and water consumption through transpiration in plant leaves chestnut (Table 1).

Double reducing the major mineral nutrients were not significantly alter the water consumption through transpiration ($t_{0,05}$ = 1,02), but the increasing of plant mass decreased in 1.48 times, which led to growth of transpiration coefficient in 1.63 times. Doubling norms N and K with P, compared with a control option

Table 2

Water consumption on transpiration, dry matter and transpiration coefficient of chestnut plants at different levels of root-feeding

Variant	Water consumption for transpiration (g / vessel)	$t_{0,05}$	Increment of plant mass (g abs. dry. m. on vessel)	$t_{0,05}$	Transpira-tion coefficient	$t_{0,05}$
$P_1N_1K_1$	23945 ± 2599	–	52,0 ± 5,0	–	485 ± 46	–
$P_{0,5}N_{0,5}K_{0,5}$	25118 ± 1499	1,02	35,0 ± 3,0	2,93	794 ± 72	5,08
$P_2N_2K_2$	27785 ± 2094	0,85	49,0 ± 4,0	0,47	587 ± 51	1,49
$P_2N_1K_1$	35989 ± 3223	6,82	95,3 ± 8,6	4,36	391 ± 41	1,53

caused significant changes in the ratio of main nutrients, but significant differences in the growth of our organic matter was not detected ($t_{0,05}$ = 0,47).

The optimal results of transpiration coefficient inherent to the variant of experiment with doubled P contenting in the mixture of mineral elements. In this variant of the experiment, given the growing water consumption on transpiration (1,5 times) was observed increasing of wet weight plants in 1,82 times.

Thus, the optimal conditions for feeding of annual sweet chestnut seedlings causes maximum accumulation of dry matter.

We found that using half the norm of fertilizers leads to decreasing in the average height of sweet chestnut seedlings to 25,2% and in diameter – 16%. (Table 2). The maximum average of chestnut seedlings height values obtained by using doubled the phosphorus with the rate of nitrogen and potassium, which had a positive impact on the growth of seedlings in height, diameter and weight of aerial

parts of plants (in 2.55 times) in compared with half of the norm. The data obtained shown that the deficit of major mineral nutrients has led to a significant (in 1,88 times) reduction in aboveground mass of plants.

Table 2

Influence of nutrient supply on the growth of sweet chestnut

Variant	Seedling height, cm	$t_{0,05}$	Stem diameter, mm	$t_{0,05}$
$P_1N_1K_1$	72,6 ± 1,5	–	8,7 ± 0,4	–
$P_2N_1K_1$	84,5 ± 2,5	4,10	8,9 ± 0,4	0,36
$P_{0,5}N_{0,5}K_{0,5}$	58,0 ± 1,8	6,22	7,5 ± 0,2	2,70

A characteristic feature of this experiments is a significant increasing (1,10) the ratio of the mass roots stems under conditions of growth with mineral deficiency. This ratio was close to the 1 (0.98) under optimal conditions of mineral nutrition. In our opinion, such changes in the ratio of the mass of the root system and aerial parts, associated with the violation of phytohormones and energy status and also a specific manifestation of the adaptive plant responses to stress, which aims at preferential root growth by above-ground parts.

Conclusions.

Thus, we can make conclusions that deficit of mineral nutrients in the soil causes an increasing of water unproductive expenses through transpiration, the violation of the receipt and distribution of chemical elements in chestnut plant organs, which reduces their growth and development.

Reference List

1. Алексеев А. М. Влияние минерального питания на водный режим растений / А. М. Алексеев, Н. А. Гусев. – М.: Изд-во АН СССР, 1957. – 224 с.

2. Кабата-Пендиас А. Микроэлементы в почвах и растениях / А. Кабата-Пендиас, С. Пендиас. – М.: Мир, 1989. – 439с.

3. Камов В. П. Биохимия. / В. П. Камов, В.Н. Шведова. – М., 2004. – 640 с.

4. Крамер П. Физиология древесных растений: [науч. пособ.] / П. Крамер, Т. Козловский. – М.: Гослесбумиздат, 1963. – 627 с.

5. Люттге У., Передвижение веществ в растениях / У. Люттге, Н. Хигинботам. – М.: Мир, 1984. – 408 с.

6. Маркарова Е. Н. Физиология корневого питания растений / Е. Н. Маркарова. – М.: Изд-во МГУ, 1989. – 103 с.

7. Полевой В. В. Физиология растений: [науч. пособ.] / В. В. Полевой. – М.: Высш. шк., 1989. – 464 с.

8. Слухай С. И. Физиология питания растений / С. И. Слухай. – К.: Урожай, 1964. – 314 с.

9. Церлинг В. В. Диагностика питания сельскохозяйственных культур: справочник / В. В. Церлинг. – М.: Агропромиздат, 1990. – 235 с.

10. Юрин В. М. Регуляция ионного транспорта через мембраны растительных клеток / В. М. Юрин, А. И. Соколик, А. А. Кудряшов. – Минск: Наука и техника, 1991. – 271 с.