INFLUENCE OF LUMINOUS FLUX INTENSITY ON TOMATO PRODUCTIVITY AND QUALITY AT VARIOUS LEVELS OF MINERAL NUTRITION IN REGULATED AGROECOSYSTEM

O. R. Udalova, E. N. Volkova, G. V. Mirskaya, G. G. Panova

Agrophysical Research Institute (AFI),
14, Grazhdanskiy pr., St.-Petersburg, Russia, 195220,
E-mail: udal59@inbox.ru

Tomatoes are a leading crop in modern greenhouse production. Most gross tomato yields are produced in greenhouses equipped with climate control systems, artificial lighting, and nutrient supply. Multidimensional optimization of light, air, and root conditions, considering the biological needs of tomatoes at different stages of growth and development, remains an unresolved and pressing issue aimed at ensuring stable development, high yields, and high-quality plant products. The objective of this study was to evaluate the response of tomato plants to light intensity at varying levels of mineral nutrition in a controlled agroecosystem, based on integral indicators of yield and fruit quality. The study was conducted at the agrobiological testing ground of the Agrophysical Research Institute under intensive light conditions. It was established that growing tomatoes at a luminous flux intensity of 120 W m^{-2} PAR contributed to a significant or trend decrease in plant height (by 9–17%), an increase in the area, leaf weight and vegetative above-ground mass (by 2–16%), as well as the weight of one fruit (by 40%), the weight of fruits per plant and the yield per m^2 (by 109–140%) of one tier of the vegetation lighting system (VLS) in all the studied variants with different concentrations of the nutrient solution compared to those at an irradiance of 60 W m^{-2} PAR. The most significant values of the specified indicators were established in the variants with the maximum level of mineral nutrition in the generative phase of plant development under both irradiation conditions. Moreover, the plant irradiation factor had a more significant effect on the height, the assessed indicators of tomato plant productivity, the quality of its fruits, and the mineral nutrition level factor - on the area, mass-metric characteristics of leaves, and the vegetative above-ground part. Higher dry matter content (by 14–20%) was found in tomato fruits across all nutrient solution concentration variants at an irradiance of 120 Wm^{-2} PAR. Nitrate content in fruits grown at a lower irradiance of 60 Wm^{-2} PAR was 43–54% higher than in fruits grown at 120 Wm^{-2} PAR; however, in all studied variants, it was significantly below the MAC. The obtained results demonstrate the importance of preliminary selection of the nutrient solution composition and the feeding regime of tomato plants at different stages of development in light culture.

Keywords: intensive artificial-light culture, tomato, plant irradiation, mineral nutrition level, stages of development, vegetative, generative, productivity, fruit quality.