

**GROWTH, DEVELOPMENT, AND YIELD OF SWISS CHARD AND SPINACH
CULTIVARS UNDER UNHEATED GREENHOUSE CONDITIONS****Ibrohimov Bahodir Akmal o'g'li**Research Institute of Vegetable, Melon Crops and Potatoes,
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Doctoral student**Abstract**

The article presents the results of studies on the cultivation of various cultivars of Swiss chard and spinach under unheated greenhouse conditions in the Tashkent region. Particular attention was paid to their phenological development, morphological traits, and yield performance. The experimental results revealed that several cultivars demonstrated earlier maturity, higher biomass accumulation, and superior total yield compared with the control variants.

Keywords: Swiss chard, spinach, unheated greenhouse, phenology, yield.

Introduction

In recent years, the importance of unheated, resource-efficient greenhouses has increased significantly in ensuring a stable supply of vitamin-rich leafy vegetable products for the population. Swiss chard and spinach are relatively underutilized vegetable crops; however, they are characterized by high biological and nutritional value. Improving cultivation technologies for these crops under local climatic conditions remains a relevant and pressing task. The adaptation of Swiss chard and spinach to unheated greenhouse environments offers considerable potential for expanding the assortment of leafy vegetables while reducing energy inputs and production costs.

Materials and Methods

The research was conducted during 2024–2026 in unheated greenhouses of the Research Institute of Vegetable, Melon Crops and Potato Growing. Eight cultivars of Swiss chard (Izumrud – control, Bright Lights, Baraze, Mira, Vulkan, Aliy, Krasniy, and Fayr Fresh F1) and five cultivars of spinach (Nafis – control, Hosildor, Hosildor-1, Viktoriya, and Rostoviskiy)

were evaluated. Phenological observations were carried out throughout the growing period, and plant biomass and total yield were determined using standard field and statistical methods.

Results and Discussion

The results of the conducted experiments demonstrated that the growth, development, and yield performance of Swiss chard and spinach cultivars under unheated greenhouse conditions were directly related to their biological characteristics and adaptability to environmental factors. According to phenological observations, the Swiss chard cultivars Baraze, Mira, Vulkan, and Aliy, as well as the spinach cultivars Hosildor and Hosildor-1, emerged 1–2 days earlier than the control cultivars Izumrud and Nafis. This indicates a higher tolerance of these cultivars to low temperature and limited light conditions typical of unheated greenhouses.

Differences among cultivars were also observed at subsequent stages of plant development. In particular, the promising cultivars reached the 3–4 true-leaf stage 1–5 days earlier than the control variants. This feature reflects a higher level of physiological activity and more efficient formation of photosynthetic capacity, which is essential for early biomass accumulation and stable growth under suboptimal environmental conditions.

Analysis of biometric parameters showed significant variation in average plant mass among the studied cultivars. The average mass per plant was 240 g for the Swiss chard control cultivar Izumrud and 260 g for the spinach control cultivar Nafis. In contrast, the Swiss chard cultivars Baraze, Mira, Vulkan, and Aliy exceeded the control by 8.3–33.3%, while the spinach cultivars Hosildor and Hosildor-1 showed an increase of 14–30%. The increase in plant mass can be explained by the expansion of leaf surface area and the formation of a denser leaf rosette, which enhances photosynthetic efficiency and dry matter accumulation.

Significant differences among cultivars were also recorded in terms of total yield. Experimental results indicated that yield in Swiss chard cultivars exceeded the control by 18.2–34.0%, while in spinach cultivars the increase ranged from 7.5 to 14.5%. These findings confirm that proper cultivar selection is one of the key factors for achieving high and stable yields under unheated greenhouse conditions.

Overall, the obtained results suggest that several Swiss chard and spinach cultivars are highly adapted to unheated greenhouse environments. Their practical implementation enables the production of early, high-quality, and environmentally safe leafy vegetable products based on resource-efficient cultivation technologies.

Conclusion

Under unheated greenhouse conditions, certain Swiss chard and spinach cultivars were distinguished by high yield potential and early maturity. The introduction of these cultivars into production can significantly contribute to the supply of early and high-quality leafy vegetables for the population while maintaining resource-efficient and sustainable production systems.

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