

BIOECOLOGICAL FEATURES OF POTATO (*SOLANUM TUBEROSUM* L.) VARIETIES UNDER LOCAL GROWING CONDITIONS

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Abstract

Potato (*Solanum tuberosum* L.) is one of the most important food crops worldwide due to its high nutritional value and wide adaptability. This study examines the bioecological characteristics of potato varieties, focusing on their adaptability to local soil and climatic conditions, resistance to diseases, and yield potential. The relevance of the research is associated with the growing demand for locally adapted and high-yielding potato varieties, as well as the need to reduce dependence on imported seed material. The results of the study highlight the importance of selecting potato varieties that are well adapted to regional environmental conditions, which ensures stable yields and improves the efficiency of local seed production. The findings may be used in breeding programs and in the development of sustainable potato cultivation practices.

Keywords: Potato varieties, bioecological characteristics, adaptability, yield, soil and climatic conditions, seed production.

Introduction

Potato tubers are rich in carbohydrates, vitamins, and antioxidants essential for the human body and occupy an important place in the daily diet. In many countries around the world, potato products account for nearly 30% of the daily food ration of the population. Therefore, special attention is paid to the development of potato cultivation in agriculture and to obtaining high and quality yields [1].

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In our country as well, a number of measures have been implemented to fully meet the population's demand for potatoes. In this regard, large volumes of seed potatoes are imported annually from foreign countries. However, several problems arise, including the adaptation of imported seed potatoes to the republic's climatic conditions, the risk of introducing quarantine diseases and pests, and high foreign currency expenditures.

Therefore, one of the most urgent tasks today is the development of high-yielding, disease-resistant potato varieties adapted to local soil and climatic conditions, as well as the scientifically based organization of local seed production within the republic.

At present, in many leading research centers around the world, special attention is being paid to the selection, development, and cultivation of agricultural crop varieties adapted to specific soil and climatic conditions, particularly in relation to food security issues. In this context, the development of potato cultivation as a crop of high nutritional importance, as well as the achievement of high and high-quality yields, is given particular emphasis. Studies have shown that the content and balance of mineral elements play a significant role in determining the quality characteristics of potato tubers.

In order to obtain high-quality potato production, principles for the development and selection of promising and high-yielding varieties, the sanitation of planting material, and the technologies for producing seed material in open fields and protected environments have been established. Currently, scientific research is being conducted to increase the propagation of high-yielding potato varieties, ensure adequate supply of seed material to farms, and further improve the efficiency of potato production.

In this regard, one of the key objectives is to determine the relative indicators of nutrient elements based on the study of the physiological and biochemical characteristics of potatoes during cultivation. Potatoes belong to the group of tuber-bearing crops and are perennial plants by nature; however, under cultivation they are grown as annual crops, since their entire life cycle as a cultivated plant is completed within one year. Potatoes are usually propagated vegetatively, while botanical seeds are used in breeding practices for the development of new varieties.

Potato belongs to the Solanaceae family and is classified under the genus *Solanum*. According to Professor L.Ye. Gorbatenko, this genus includes more than 211 wild, semi-wild, and cultivated species, of which only *Solanum tuberosum* L. is widely cultivated. Many other species possess valuable biological and agronomic traits and are extensively used as initial genetic material in breeding programs [3].

The potato plant has a vine-like growth habit and consists of stems and leaves. Each plant forms 3–5 or more stems. The number of stems is a varietal trait and depends on the weight of the seed tuber and the number of sprouted buds it contains. Potato stems may be erect or prostrate, with varying degrees of branching. In cross section, the stem is round and often 3–4 angled. Plants grown from botanical seeds form a single stem.

Potato varieties are characterized by differences in stem number, angularity, height, branching intensity, and coloration. Based on stem number, varieties may be classified as having few or many stems, with three or multiple angles, and as non-branching, weakly, moderately, or strongly branching.

Leaves of plants emerging from tubers or seeds are compound, with entire margins. A potato leaf consists of a petiole, rachis, a terminal leaflet, 3–7 pairs of lateral leaflets, and intermediate leaflet segments between them. The size, shape, number, arrangement, and color of the terminal and lateral leaflets are considered important varietal characteristics. Leaflets may be large, medium, or small, and their shapes include oval, elongated, ovate, and various intermediate forms. The shape of the base of the terminal leaflet—cordate, cuneate, or intermediate—is also regarded as a varietal trait [4].

Flowering in potatoes varies depending on the variety. Some varieties (e.g., *Falenskiy*) shed their buds and do not flower, while others flower but do not produce fruit due to sterile pollen. Only certain varieties with fertile flowers (such as *Kufri*, *Djoti*, *Picasso*, *Sahro-32a*) exhibit good fruit-setting ability [5].

Potato is a self-pollinating plant. Its fruit is a berry, bilocular, containing many seeds, and is yellow-green in color. The seeds are small, flat, and yellow, with a 1000-seed weight of approximately 0.5 g.

The tuber is a modified (metamorphosed) stem, formed as a result of nutrient accumulation at the tip of a white underground stem (stolon) that develops

from lateral buds of the subterranean stem. Depending on the variety, stolons may be short or long.

Although eyes are arranged spirally over the entire surface of the tuber, they are more numerous in the apical part and fewer in the basal part. Each eye consists of a bud scar (remnant of a reduced leaf) and the eye cavity itself. Each eye contains three buds, which can develop into stems. Eyes located in the apical part of the tuber sprout earlier, exhibiting apical dominance.

Potato varieties are described based on tuber traits such as color, shape, skin characteristics, number and depth of eyes, and flesh color. Tuber color may be white, yellowish, red, purple, blue-purple, while shapes include round, oval, elongated, ovate, round-oval, and elongated-oval forms [6].

The shape of potato tubers depends not only on the variety but also on the growing location and environmental conditions. The tuber skin may be smooth or netted, while the flesh is characterized by white, yellow, or creamy-white colors. The number of eyes on the tuber, whether few or many, is also considered a varietal trait. In addition, depending on the length of stolons, tubers may be arranged compactly or dispersed within the nest, which serves as an important varietal characteristic determining suitability for mechanized harvesting.

Biological Characteristics of Potato Varieties. The ecological plasticity of a variety is defined as its biological ability to adapt to environmental conditions. According to Melnikova (2007), the higher the ecological plasticity of a variety, the smaller the variation in the complex of its breeding-valuable traits under different growing conditions compared to other studied varieties. Kostin (2009) proposed the use of an ecological plasticity coefficient to characterize the adaptability of varieties to specific environmental conditions, emphasizing that ecological plasticity is determined by varietal diversity and biomorphological variability. Sergeyeva (2015) noted that when studying the yield characteristics of varieties, it is possible to obtain information on the genotypic response to changing environmental conditions [7].

In Uzbekistan, potato breeding programs are conducted in nine major directions, aiming to develop varieties with the following characteristics: early-, medium-early-, and medium-maturing varieties with a growing period of 70–90 days; yields of 25–40 t/ha; marketable yield exceeding 90%;

resistance to viral diseases and ecological degeneration; suitability for both generative and vegetative propagation; germination rates above 75% when freshly harvested tubers are planted in summer; an average of at least 2.5 stems per plant; marketable yield not less than 18 t/ha; high quality and long storage ability; and suitability of seed tubers for cut planting [8].

For the hot climatic conditions of Uzbekistan, varieties with a short biological dormancy period capable of producing two harvests per year are considered promising. However, in mountain and foothill regions, it is not possible to obtain a second summer crop using freshly harvested tubers. Therefore, for foothill areas, varieties with a long biological dormancy period of 30–34 weeks are considered suitable. Such varieties do not sprout prematurely after being stored in pits during autumn and winter and remain dormant until they are removed in spring. These varieties can be used for spring consumption or as seed material.

Approximately 60% of Uzbekistan's soils are affected by salinity to varying degrees, and 16.0% of agricultural crop production is carried out under such conditions. Under the conditions of Mirzachul, potato yields do not exceed 11.0–12.0 t/ha. Although certain technological elements for potato cultivation under the saline soils and extremely hot climate of Mirzachul have been developed, there is currently a need to establish a new system of agrotechnical measures for regionally adapted varieties.

Conclusion

In conclusion, one of the main approaches to increasing potato yield and expanding production in the Republic is the proper selection of varieties. When selecting potato varieties for cultivation based on their valuable agronomic and biological traits - such as yield potential, early maturity, tuber storability, resistance to diseases and pests, consumer quality, starch and protein content, as well as tuber taste and shape—it becomes possible to achieve high and stable yields of superior quality.

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