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FUNGAL DISEASES TOLERANCE STUDIES OF POTATO GENOTYPES

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ИССЛЕДОВАНИЯ УСТОЙЧИВОСТИ ГЕНОТИПОВ КАРТОФЕЛЯ К ГРИБНЫМ БОЛЕЗНЯМ

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Abstract. The article is devoted to the study of fungal diseases tolerance of potato samples and discusses the major potato diseases worldwide: late blight, early blight and powdery scab. During the research, the effects of fungal diseases on the quantitative and qualitative characteristics of the plant, some physiological parameters, and pest characteristics were studied. In the studied varieties, the dynamics of specific leaf mass and biomorphological indicators increase in during ontogenesis depend not only on the developmental phase and genotypic characteristics of the plants, but also on the state of diseases infected. The article states that the highest overall incidence was against late blight, with relative resistance to powdery scab, this is due to the nature of the pathogens. During the study, it was determined as a result of biomorphological indicators in the selected samples introduced from selection centers and local potato genotypes for their resistance to late blight, early blight and powdery scab of that the plants were 43-63 cm tall and quantity of stem were 1-3. The difference between the specific leaf mass of the control and experimental variants in the varieties taken during the study was comparable across the study years and development phases. Complex control measures based on high agricultural technology methods are more effective in reducing the risk of potato diseases and preventing their development. Studies have shown that the main methods of protecting potatoes from diseases are the cultivation of resistant varieties, optimal planting dates, and the use of mineral fertilizers and chemical plant protection products.

Аннотация. Статья посвящена изучению устойчивости образцов картофеля к грибным болезням и рассмотрены основные болезни картофеля в мире: фитофтороз, альтернариоз и порошистая парша. В ходе исследований изучалось влияние грибных болезней на количественные и качественные характеристики растения, некоторые физиологические показатели и особенности вредителей. У изучаемых сортов динамика прироста удельной массы листьев и биоморфологических показателей в онтогенезе зависит не только от фазы развития и генотипических особенностей растений, но и от степени поражения болезнями. В статье указано, что наибольшая общая заболеваемость была против фитофтороза, при относительной устойчивости к порошистой парше, это обусловлено природой возбудителей. В ходе исследований установлено, что в результате биоморфологических показателей у отобранных образцов, интродуцированных из селекционных центров, и местных генотипов картофеля по устойчивости к фитофторозу, альтернариозу и порошистой парше растения имели высоту 43-63 см и количество стеблей 1-3. Разница между удельной массой листьев контрольных и опытных вариантов у сортов, взятых в ходе исследований, была сопоставимой по годам исследований и фазам развития. Комплексные меры борьбы, основанные на приемах высокой агротехнологии, более эффективны для снижения риска

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возникновения болезней картофеля и предупреждения их развития. Исследования показали, что основными методами защиты картофеля от болезней являются возделывание устойчивых сортов, оптимальные сроки посадки, применение минеральных удобрений и химических средств защиты растений.

Keywords: potato, fungal diseases, selection, resistant varieties.

Ключевые слова: картофель, грибковые заболевания, селекция, устойчивые сорта.

Potato (*Solanum tuberosum*) is the third most important crop for human consumption in the world, after rice and wheat. Increasing the production and improving the quality of agricultural products, including potato, plays a key role in ensuring the food security of the country's population. Potato is among the high-income crops globally and can contribute to poverty reduction in developing regions. The need to increase agricultural efficiency and intensify agricultural production makes the selection of new disease-resistant varieties of exceptional importance. Since potatoes are one of the most important food sources, the main goal of breeding work with this plant is to create new varieties with high yield potential and adaptive characteristics adapted to the ecological conditions of a particular climatic zone [1].

One of the most important problems in the cultivation of potato plants is their susceptibility to diseases [7]. The effect of pathogens on plants depends on the physiological characteristics of the plant and the conditions that arise after exposure to the pathogen. Of particular importance in the agricultural sector is the cultivation of high-quality seeds to obtain high-quality yields of agricultural crop varieties through the introduction of innovative technologies [3, 4].

The process of photosynthesis plays a key role in the formation of biological products of plants. This process depends on the genotype of the plant, cultivation conditions, and the resistance of the plant to diseases. Resistant genotypes can protect themselves from the effects of stress by maintaining high photosynthetic activity.

The negative impact of diseases on plant leaves is a limiting physiological factor that prevents potato cultivation in many countries of the world. The growth and development of potatoes, the collection of tuber yields largely depend on their physiological characteristics. This dependence is more pronounced in potatoes than in other plant species. Narrowing of the leaf surface and the destruction of photosynthetic pigments reduce photosynthetic activity, inhibit the onset of stolon growth and tuber formation [2, 9].

One of the main goals of the research was to study the morphophysiological dimensions and yield components of potato genotypes during the vegetation period, which allows for the selection of high-yielding and disease-resistant genotypes.

The expansion of potato cultivation areas in farms due to the transition to a market economy requires the creation of competitive, productive varieties. Therefore, it is important to obtain specimens that are resistant to diseases and provide stable yields [8].

Material and methodology

The main purpose of the research is to study the effects of fungal diseases and pest characteristics on local and introduced potato samples, to evaluate local and introduced potato genotypes for durability, to select resistant and tolerant genotypes, to study the effect of diseases on physiological parameters and productivity in local and foreign varieties .

Samples with a high relative water content of leaves have many advantages during the vegetation period. Thus, water is considered the main chemical component of cells. It plays the role

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of a medium for most biochemical reactions. In environments with a low water content, metabolism weakens. When there is a lack of water, photosynthesis weakens rapidly, while respiration, on the contrary, becomes more intense. Weakening of photosynthesis and strengthening of the respiratory process ultimately leads to a decrease in yield [6].

Literature data shows that as a result of the effects of potato diseases, the photosynthesis process weakens, chlorophyll and other pigments are destroyed, the assimilation surface area of plants decreases, the permeability of stomata decreases, the rate of transpiration and the intensity of respiration increase, which negatively affects the formation of carbohydrates, the development of the root system, and the formation of crops.

To date, there is numerous and contradictory information in the literature regarding the issue of correlative relationships between potato traits.

The main fungal diseases of potatoes in Azerbaijan include late blight, early blight, powdery scab and etc. The causative agent of late blight is Phytophthora Infestans, early blight is caused by Alternaria Solani and powdery scab by the Spongospora subterranean [5].

Results

During the year of research, phenological observations were carried out over the samples, determined specific density of leaves, the area of the leaf surface.The results of the phenological observations and analyzes of 2018 are given in the chart 1, 2, 3. (I variant treated with drug, II infected with phytophthorosis, III with alternariosis and IV with powdery scab).

Potato is among the crops severely affected by pathogens. Symptoms of infection often include yellowing of infected leaves, the appearance of pigmentation determined by structural and functional damage, and changes in leaf cell homeostasis. Therefore, plant biomorphological indicators are a valuable feature in the assessment of potato yield.

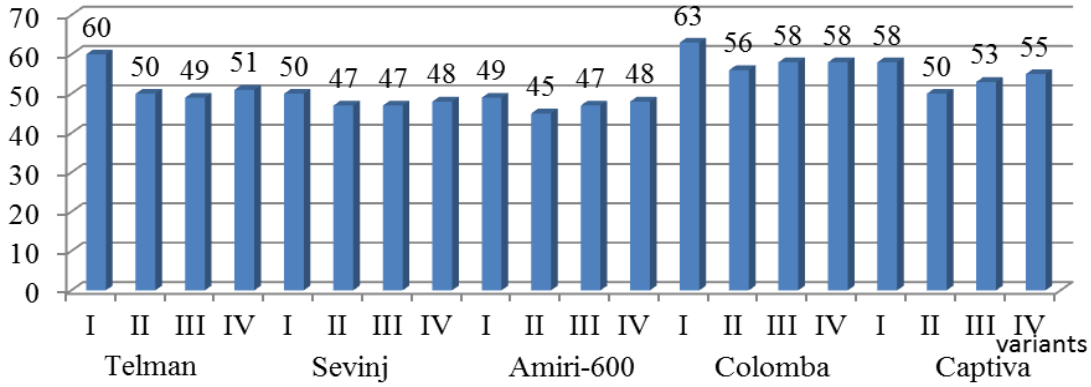

Figure 1. Plant height of potato samples, cm

One of the main indicators of economic importance for potato plants are plant height, quantity of stems. Phenological observation of potato samples were carried out during the flowering phase.

One of the main morpho-physiological characteristics related to the activity of the photosynthetic apparatus of plants is the specific surface density of the leaf, which is an indicator of the ratio of a unit leaf area to dry mass. Through the specific mass of the leaf, plants form their architectonics in order to use photosynthetically active rays more efficiently. Although the specific leaf mass is a genetic characteristic, this characteristic can change under the influence of external factors.

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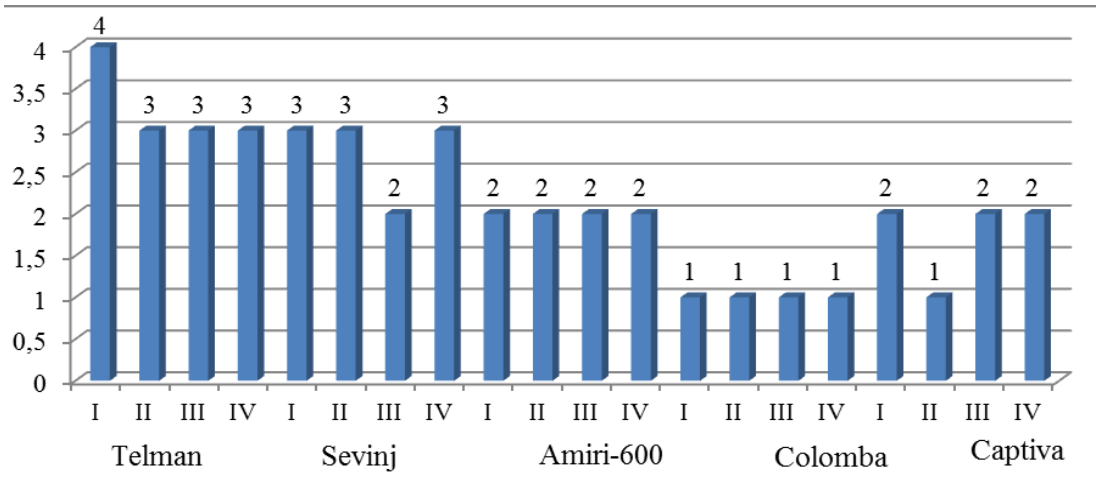

Figure 2. Quantity of stems of potato samples

The value of specific leaf mass is affected by factors other than diseases, such as the amount of photosynthetically active rays falling on the plant, the structure of the plantation, the water supply of the plant, the application of mineral fertilizers, the development stage of the plant, the location in the plantation, and other factors.

As can be seen from the results of the study, early blight disease occupied an intermediate position compared to late blight and powdery scab.

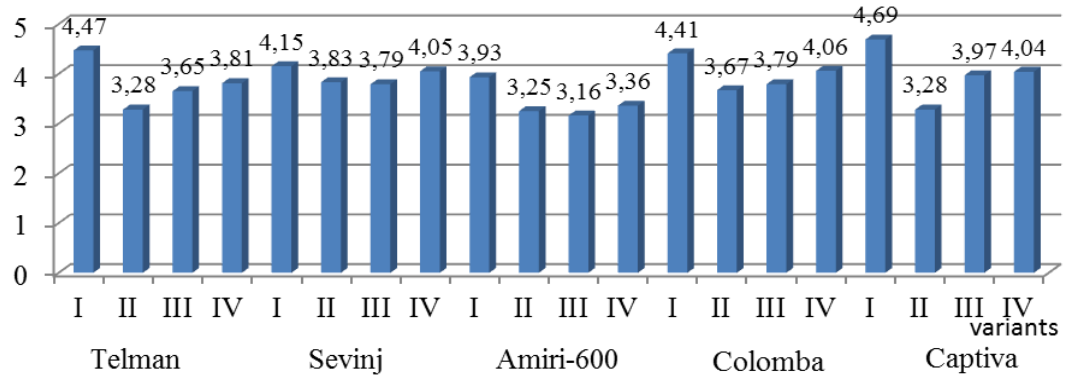

Figure 3. Specific density of leaves, (mg/cm^2)

In temperate regions, soil or plant residues are believed to harbor the late blight pathogen between seasons. The fungus also survives in infected tubers left in the soil from the previous season. To this end, in-depth interviews with farmers, breeders and other experts are essential for making decisions about the potato sector and late blight control. Both increased stakeholder cooperation and the availability of resistant varieties that meet market requirements can improve disease management [10].

Conclusion

As can be seen from the charts, in the studied potato samples, the disease had a negative effect on all the signs of the plant. Measures to combat late blight, early blight and powdery scab should be planned and preventive. To protect potato tubers from various pathogens and pests, as well as to obtain a crop with high quality indicators and yield, it is necessary to eliminate poor-quality seed material and prevent violations of harvesting technology and storage conditions.

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