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FUNGAL INFECTIONS' IMPACT ON HYBRID PEACHES IN SOUTHERN RUSSIA'S CLIMATE

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Abstract

The aim of this study was to investigate the impact of fungal infections on hybrid peach varieties in the climate of Southern Russia, with a focus on the ecological zone of Chechnya. The research aimed to assess the degree of damage to hybrid peach varieties caused by infectious diseases, as well as their influence on the morphological features of trees and fruit formation. The study utilized a combination of field observations, laboratory analyses, and statistical methods to gather data on the resistance of peach varieties to fungal infections and their adaptability to the cultivation area. The findings revealed that economically valuable traits of peach varieties exhibited varying degrees of resistance to infectious diseases and demonstrated different levels of adaptation to the local growing conditions. Through careful analysis, it was determined that certain hybrid peach varieties showed higher levels of resistance to fungal infections, while also displaying favorable characteristics for cultivation in the region. These results provide valuable insights for peach growers in Southern Russia, informing their selection of varieties and cultivation practices to mitigate the impact of fungal infections and optimize fruit production.

Keywords: Adaptation, diseases, peach, resistance, variety

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1. Introduction

A peach is a tree with beautiful pink flowers that gives sweet, juicy and healthy fruits. This crop grows well in warm regions, as it hardly tolerates severe frosts. Of all stone fruits, the peach is considered the most capricious fruit crop in need of continuous care (Komar-Dark, 2022a, 2022c; Makarov, 2019). Peach culture is considered the most sensitive of all the inhabitants of the garden because it reacts painfully to climatic changes: temperature changes, exposure to sunlight, increased humidity, drought and soil acidity. Unfavorable weather conditions in the cultivation area, as well as irregular or improper care of this plant, lead not only to a reduction in yield, but also to a decrease in its immunity. Together, this leads to a loss or decrease in the ability to resist pathogens of various infections and insect pest attacks (Komar-Dark, 2021, 2022b). Resistance to diseases and pests is characterized by a degree of productivity. Thus, the use of modern selection methods in the selection of improved peach varieties, allows you to create new varieties immune to various diseases, with high consumer quality of fruits (Belousova & Karpukhin, 2021; Kvitko et al., 2022).

2. Problem Statement

The study focuses on the critical examination of the influence of infectious diseases on globally selected cultivated peach varieties. This research holds significance for the advancement of orchards employing intensive technologies, necessitating highly productive peach varieties. The economic value of fruit crops is intricately tied to their resistance against diseases and pests. Therefore, within the ecological zone of Southern Russia, notably in Chechnya, a comprehensive investigation was conducted to evaluate the extent of damage incurred by hybrid peach varieties due to infectious diseases. Additionally, the study explores how these diseases impact the morphological characteristics of trees and influence the process of fruit formation. Understanding the dynamic interaction between infectious diseases and economically valuable traits of peach varieties is vital for optimizing cultivation practices in the region.

3. Research Questions

The research presented in this paper prompts a number of follow-up inquiries:

i. What are the most important properties of fruit crops required for the development of gardens with intensive technologies?

ii. How does the resistance of peach varieties to infectious diseases affect their economic value?

iii. What are the morphological features of trees and fruit formation affected by infectious diseases in hybrid peach varieties?

iv. How do economically valuable traits of peach varieties vary in their resistance to infectious diseases and adaptability to cultivation areas?

v. What are the characteristics of the studied peach varieties in terms of their resistance to infectious diseases and adaptability to the area of cultivation?

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4. Purpose of the Study

The primary objective of this research is to comprehensively investigate and analyze three globally selected peach varieties—Redhaven, Favorite Morettini, and White Swan. The study is driven by several interconnected tasks aimed at advancing our understanding of these varieties and optimizing their utilization in the specific context of the Chechen Republic.

One of the pivotal tasks is the meticulous examination of disease and pest resistance exhibited by Redhaven, Favorite Morettini, and White Swan. Through systematic assessment and in-depth analysis, the research seeks to unravel the varietal characteristics contributing to their resilience against prevalent diseases and pests affecting fruit crops. This knowledge is paramount for sustainable cultivation practices and forms a foundational aspect of the study (Verzilin, 2021).

The selection of these particular peach varieties is not arbitrary; hence, the research endeavors to justify this choice based on their demonstrated resistance to major diseases and pests. The rationale for this selection is crucial for integrating these varieties into the technological processes of intensive gardening within the Chechen Republic. Understanding the unique environmental conditions and challenges in the region is imperative for optimizing cultivation practices, resource management, and pest control strategies (Smykov & Richter, 2021).

Furthermore, the study delves into the adaptability of Redhaven, Favorite Morettini, and White Swan to the specific climatic, soil, and environmental conditions prevalent in the Chechen Republic. This assessment aims to identify any unique challenges or advantages associated with the local context, facilitating the proposal of tailored cultivation approaches to enhance adaptability (Smykov et al., 2020).

A holistic perspective is essential, considering the broader implications of these varieties on sustainable agriculture practices in the region. The research evaluates their potential contributions to resource efficiency, environmental impact, and socio-economic aspects, thereby providing valuable insights for promoting sustainable peach cultivation practices in the Chechen Republic.

In essence, this research aspires to contribute significantly to the knowledge base surrounding these peach varieties, offering practical recommendations for their cultivation, and fostering sustainable agricultural practices in the specific context of the Chechen Republic.

5. Research Methods

The research focused on the examination of three globally selected peach varieties: Redhaven, Favorite Morettini, and White Swan. The methodology employed followed established practices for studying fruit, berry, and nut crops. The assessment incorporated various parameters, with a particular emphasis on the resistance of the peach varieties to diseases, a crucial factor influencing overall crop health and yield.

The study applied a well-established method for testing peach varieties, considering the susceptibility of plants to diseases throughout the growing season. This comprehensive approach involved the scrutiny of shoots, leaves, flowers, fruits, and roots of peach plants, as these components are susceptible to numerous diseases and pests, often leading to substantial yield losses (Smykov & Mesyats, 2020).

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The methodological framework acknowledges the significance of timely protection against various pests and pathogens during the care of peach plants. The growing season exposes peach varieties to a range of diseases, and effective management strategies are essential to mitigate potential losses. The research considered the diverse array of challenges, emphasizing the need for protection against diseases and pests to ensure optimal crop health and yield.

Peach diseases were categorized into infectious and non-infectious types, with the latter resulting from mechanical, chemical, or thermal injuries, as well as mass attacks by insect pests. The preventive measures included the use of contact fungicides, a common practice for the protection of fruit plants. One prevalent disease studied was the curly leaves disease, characterized by the formation of green bubbles on the leaves, oozing gum from the buds, subsequent drying of affected areas, and the premature death of buds before fruit formation (Efremova & Ryabushkin , 2020).

The visual representation in Figure 1 illustrates the impact of a fungal disease, curly leaves, on peach leaves, emphasizing the importance of understanding and addressing such diseases in the cultivation of peach varieties.

In essence, the research methodology integrated established practices in fruit crop studies, with a specific focus on disease resistance to provide valuable insights into the health, productivity, and adaptability of Redhaven, Favorite Morettini, and White Swan peach varieties in the context of the Chechen Republic.

Figure 1. Curly leaves

Moniliosis. Infection with moniliosis is mainly affected by all fruit crops and peaches, in this case no exception. Spores of the fungus penetrate into leaves and shoots, during pollination by bees. A characteristic sign of the disease is scorching or the so—called monial burn. It is recommended to cut out the affected areas of the plant, and then treat the plant with fungicide preparations. Moniliosis also affects fruits, which immediately begin to rot (Prikhodko et al., 2021; Trishevskaya et al., 2021). Figure 2 shows the manifestation of the disease in the form of fruit rot.

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Figure 2. Moniliosis

Kleasterosporiosis. Along with other fungal diseases, stone crops are characterized by another disease – klasterosporiosis or hole spotting. Infection of plants with klasterosporiosis is possible twice a year - in spring and autumn, when optimal temperatures coincide, contributing to the development and spread of mycelium (+4-6). This disease also affects the leaves, covers them with bright spots, after which the inner part of the leaves crumbles, forming holes on them, framed with red stripes. Figure 3 the characteristic signs of klasterosporiosis or perforated leaf spotting are expressed.

Figure 3. Clusterosporiosis or hole spotting

6. Findings

The findings of the research revealed crucial insights into the resistance of the studied peach varieties – Redhaven, Favorite Morettini, and White Swan – to major diseases and pests. The assessment

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considered various morphological features of the trees and fruit formation, shedding light on the economic value of these peach varieties in the conditions of the Chechen Republic.

Among the notable findings, the study identified variations in the resistance of the selected peach varieties to infectious diseases. Each variety exhibited distinct levels of adaptability to the cultivation area, emphasizing the importance of selecting varieties based on their disease resistance and performance in specific environmental conditions.

The economic value of the studied peach varieties was assessed through an analysis of their resistance to infectious diseases and adaptability to the Chechen Republic's cultivation area. The research aimed to justify the selection of peach varieties for integration into the technological processes of intensive gardening, considering the unique conditions of the region.

The findings contribute valuable information for horticulturists, farmers, and researchers involved in peach cultivation in the south of Russia, particularly in the ecological zone of Chechnya. The variations in disease resistance and adaptability highlighted in the study can inform decision-making processes related to variety selection and cultivation practices, ultimately enhancing the sustainability and productivity of peach orchards in the region.

In conclusion, the research findings provide a nuanced understanding of the performance of Redhaven, Favorite Morettini, and White Swan peach varieties in the specific ecological and climatic conditions of the Chechen Republic. The insights gained from this study have implications for the development of strategies to promote disease-resistant and economically valuable peach cultivation in the region.

Unfavorable weather conditions, which contributed to temperature changes, air humidity,contribute to the spread of infectious diseases –curly leaves, moniliosis and perforated spotting (clusterosporiosis). The susceptibility of the studied peach varieties to fungal infections, in the Chechen Republic, a field assessment of the resistance of varieties to leaf curliness, moniliosis and hole spotting (clusterosporiosis) was carried out. The prevailing climatic conditions and biological data in the region determined the degree of harmfulness of diseases (Mamalova, 2023).

Table 1. Shows the degree of damage to the leaves of peach varieties by the main diseases (scale from 0 to 5 points)

Variety	Curly leaves	Moniliosis	Clusterosporiosis
Redhaven	3.5	2.0	2.0
Favorite Morettini	2,0	2.5	2.5
The White Swan	2.5	3.5	3.5

From table 1, it can be seen that the development of moniliosis and clusterosporiosis was recorded in the range from 2.0 to 3.5 points (Mamalova, 2023). The greatest lesion was found in peach varieties more susceptible to these diseases: Redhaven-curly 3.5 points and White Swan, in which infection with moniliosis and clusterosporiosis was also 3.5 points each. The introduced Redhaven peach variety showed good resistance equal to 2.0 points to diseases such as moniliosis and clusterosporiosis (Mamalova, 2023). The variety of domestic selection White Swan turned out to be slightly less resistant to these diseases and the lesion level was 3.5 points each, when resistance to the disease of curly leaves was at a

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fairly good level and showed 2.5 points. The cultured peach variety of foreign selection, Morettini's Favorite, turned out to be less susceptible to these diseases: leaf curl-2.0 points, moniliosis and clusterosporiosis 2.5 points each, which indicates its economically valuable signs. Like many fruit trees, all the peach varieties studied are prone to fungal infections. The resistance of the varieties to these diseases corresponded to the average and above average levels (Mamalova, 2023). The disease spread by spores and droplets. The ideal conditions for the disease are a rainy, prolonged spring. In this regard, it is recommended to carry out timely preventive work in order to preserve garden plantings and yields. If the cultivation technology is broken, and the humidity is increased, then problems arise constantly. Pests also cause great damage to trees and fruits. In order to obtain high-quality products with a complex of economically valuable signs, it is necessary to develop new methods of protection to combat viral and bacterial infections (Asayeva et al., 2019; Mamalova, 2023; Mirzaitova et al., 2020; Mitrofanova et al., 2021).

7. Conclusion

In conclusion, the conducted research has provided valuable insights into the characteristics of cultivated peach varieties of world selection in the specific ecological and climatic conditions of the Chechen Republic. The findings indicate that these varieties exhibit good resistance to the studied diseases, contributing to their economically valuable traits.

The favorable temperate continental climate of Chechnya has been identified as a conducive factor for the successful cultivation of peach fruit culture, particularly when accompanied by timely irrigation practices, which are crucial for the implementation of intensive cultivation technologies.

Based on the research outcomes, agricultural producers in the Chechen Republic are recommended to consider stable hybrid varieties of peaches from world selection, specifically Redhaven, Favorite Morettini, and White Swan. These varieties have demonstrated positive characteristics and are deemed suitable for cultivation not only in Chechnya but also in various regions with warm, temperate climates, including the North Caucasus, Crimea, the Republic of Adygea, and Stavropol.

The introduction of these recommended varieties can contribute to the renewal and expansion of industrial peach orchards, offering sustainable options for fruit cultivation. This information is valuable for agricultural decision-makers, horticulturists, and researchers involved in peach cultivation, providing practical guidance for enhancing peach production in the region and beyond. Overall, the research findings contribute to the promotion of economically viable and resilient peach cultivation practices in the specific agro-ecological context of the Chechen Republic.

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