ORIGINAL ARTICLE

INTERNATIONAL JOURNAL OF ARTIFICIAL INTELLIGENCE

ISSN: 2692-515-x, Impact Factor: 9.23
American Academic publishers, volume 6, issue 05,2026

Journal: https://www.academicpublishers.org/journals/index.php/ijai

UDC: 634.31:631.52:631.544

SCIENTIFIC AND PRACTICAL BASIS FOR PREPARING AN EXPERIMENTAL AREA FOR THE SELECTION AND GENETIC EVALUATION OF CITRUS MANDARIN (CITRUS RETICULATA BLANCO) HYBRIDS UNDER PROTECTED CULTIVATION CONDITIONS

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https://doi.org/10.5281/zenodo.20072916

Abstract. This article discusses the scientific and practical basis for preparing an experimental area for the selection and genetic evaluation of citrus mandarin (Citrus reticulata Blanco) hybrids under protected cultivation conditions. The study analyzes the sanitary cleaning of the greenhouse area, preparation of a nutrient-rich substrate, establishment of a drainage layer, inspection of the drip irrigation system, and control of temperature, humidity, ventilation, and lighting conditions. The uniformity of experimental conditions is substantiated as a key requirement for the objective evaluation of the genetic potential of genotypes and the selection of promising initial breeding materials.

Keywords: citrus, mandarin, Citrus reticulata, hybrid, genotype, selection, inheritance, variability, protected cultivation, substrate, microclimate, drip irrigation.

Introduction

Mandarin (Citrus reticulata Blanco) occupies an important place in global fruit production due to its high nutritional value, richness in vitamins, pleasant taste, and strong market demand. The growing demand for citrus products makes it an urgent task to develop productive varieties that are well adapted to local conditions, have high fruit quality, and show resistance to diseases and pests. According to USDA FAS data, in the 2025/2026 season, global production of mandarins and tangerines intended for fresh consumption is forecast at approximately 38.4 million tons, with China recorded as the leading producer with 27.1 million tons [1].

In Uzbekistan, a significant share of the demand for mandarin products is met through imports. According to national statistics, in January-November 2025, mandarins worth 256.4 million US dollars were imported into Uzbekistan from 62 countries [2]. This situation indicates the need to strengthen local breeding work, conduct in-depth studies of introduced and locally adapted genotypes, and scientifically evaluate mandarin hybrids under protected cultivation conditions.

The study of inheritance and variability of economically valuable traits in mandarin hybrids is an important stage in the creation of initial breeding material. Most citrus species have a complex genetic origin associated with natural hybridization, apomixis, and vegetative propagation. Modern studies emphasize that hybridization and apomixis in mandarin-type citrus play an important role in the formation of diversity [3]. Therefore, the uniformity of experimental conditions is a decisive factor in ensuring the reliability of genotype evaluation.

Materials and Methods

The research is planned to be conducted under protected cultivation conditions, namely in a greenhouse experimental area assigned to the Department of Genetics, Breeding and Seed Production of Agricultural Crops at Tashkent State Agrarian University. Mandarin genotypes, hybrid forms, and standard varieties will be studied as research objects. According to the

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dissertation plan, phenological observations, biometric measurements, morphological characterization, agrobiological evaluation, and statistical analysis methods will be used.

In March, before conducting the experiment, the greenhouse area was prepared in accordance with agrotechnical requirements. First, the area was cleared of plant residues, dried branches, weeds, and mechanical waste. This measure was carried out to reduce sources of diseases and pests, improve the sanitary condition of the experimental area, and create favorable conditions for the healthy growth of genotypes [7].

For each mandarin genotype, a nutrient-rich, light, air- and water-permeable substrate was prepared. The substrate consisted of fertile soil, decomposed organic matter, sand, and other lightening components. Since the root system of citrus plants is sensitive to excessive moisture, a drainage layer was established in containers or pots to ensure the removal of excess water. Before the experiment, the drip irrigation system, irrigation rate, moisture distribution, temperature, relative humidity, ventilation, and lighting conditions were checked.

All genotypes were planned to be maintained under the same nutrition, irrigation, temperature, humidity, and care conditions. Variants and replications were arranged according to the experimental scheme, and each genotype was labeled with its name, variant number, and replication indicators. This approach serves to distinguish the effect of genotype from the influence of external environmental factors in selection and genetic evaluation.

Results and Discussion

Under protected cultivation conditions, proper preparation of the experimental area is one of the initial but decisive stages in the study of mandarin hybrids. Since mandarin is a perennial subtropical plant, its root system, vegetative growth, flowering, and fruit formation are directly related to the physicochemical properties of the substrate, moisture regime, temperature, and lighting conditions. Therefore, preparation of the experimental area should not be regarded merely as a routine agrotechnical process, but as a methodological requirement that ensures the accuracy of further scientific observations.

Sanitary cleaning of the area reduces the pressure of pathogens and pests in the protected environment. In greenhouses, air exchange is limited, while humidity and temperature remain relatively stable, which may create favorable conditions for the development of fungal diseases. Therefore, preventive cleaning, removal of excess plant residues, and maintenance of optimal moisture levels are important for the healthy development of genotypes.

The preparation of a substrate with a uniform composition makes it possible to evaluate the root system development of the studied genotypes under equal conditions. Normal root development is directly associated with nutrient uptake, formation of vegetative mass, tolerance to stress factors, and subsequent yield indicators. If differences in substrate, irrigation, or fertilization occur among experimental variants, the observed variability may be explained more by environmental effects than by genetic characteristics.

Inspection of the drip irrigation system and equalization of the irrigation rate also increase the reliability of the results. Mandarin plants are sensitive both to moisture deficiency and to excessive water accumulation. Uneven moisture distribution may cause differences in leaf development, growth rate, flowering, and fruit formation. Therefore, the experiment ensured that the irrigation system functioned uniformly across all variants.

Microclimatic factors -- temperature, relative humidity, lighting, and ventilation -- directly influence the phenological phases of mandarin plants. By controlling these parameters, it is possible to compare the growth rate, leaf formation, onset of flowering, fruit set, and general physiological condition of genotypes. In modern citrus breeding, along with morphological evaluation, the use of molecular markers is important for determining genetic diversity. Studies

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based on SSR and other markers have shown that it is possible to identify the genetic relationships among citrus genotypes and determine valuable sources for breeding [4, 5].

Thus, the standardization of experimental conditions creates a methodological basis for the objective evaluation of inheritance and variability in mandarin hybrids. Such an approach has scientific and practical significance for identifying promising genotypes, recommending them as initial breeding material, and developing new mandarin varieties adapted to local conditions in the future.

Conclusion

Under protected cultivation conditions, preparing the experimental area in accordance with agrotechnical requirements is a key factor in increasing the reliability of selection and genetic evaluation of citrus mandarin (Citrus reticulata Blanco) hybrids. Clearing the area of plant residues and weeds, properly organizing the substrate and drainage system, checking the irrigation system, and controlling microclimatic parameters contribute to the healthy development of genotypes.

Maintaining all genotypes under the same nutrition, irrigation, temperature, and humidity conditions makes it possible to objectively evaluate phenological, biometric, and economically valuable traits in hybrids. As a result, a scientific basis is formed for accurately determining inheritance and variability, selecting promising initial breeding materials, and creating new mandarin varieties adapted to local conditions.

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