ANNOTATION

the dissertation of Alimbekova Nurgul Amanbayevna on the topic «Adaptation and cultivation technology of the olive tree (*Olea europaea L.*) in the conditions of South Kazakhstan» submitted for the degree of Doctor of Philosophy (PhD) in the specialty 6D080100 – «Agronomy»

1. Relevance of the research topic

In the Address to the People of the Republic of Kazakhstan, Kassym–Jomart Tokayev, President of the Republic of Kazakhstan, «Economic Orientation of a Fair Kazakhstan» dated September 1, 2023, the issues of reforming the agricultural sector, developing agroscience, and introducing innovative approaches were particularly emphasized. The Head of State gave a specific instruction: «It is necessary to develop agroscience and adapt it to the specific needs of agriculture. We need an agrotechnology hub that covers the entire stage of research work».

In addition, in this message, it is stated that «The time has come for a significant reform in agriculture. We need to increase the variety of crops. It is also necessary to plant more profitable crops. It is necessary to gradually reduce the area of agriculture that requires a lot of water and limit the cultivation of only one type of crop. It is important to provide farmers with local seeds. It is also necessary to develop new varieties and solve the problem of their cultivation».

The implementation of these strategic objectives is of particular scientific and practical importance. Research work on the introduction and acclimatization of the European olive tree (*Olea europaea L.*) in the southern regions of Kazakhstan is carried out. These studies are aimed at diversifying the country's agriculture, introducing ecologically and economically efficient crop varieties, as well as solving urgent problems in adapting to climate change.

The olive tree is a perennial crop that is drought–resistant, requires little water resources, and is not particularly picky about soil. These properties allow it to be considered a promising crop for cultivation in arid and semi–arid regions of southern Kazakhstan. In addition, the study of the agrobiological characteristics of the olive plant, the level of adaptation to local climatic conditions and agrotechnical requirements is one of the manifestations of the search for innovative solutions in agriculture. This study is fully consistent with the direction of strengthening the connection between agricultural science and production, forming the experience of introducing new crops using scientifically based approaches, and transforming agricultural research centers into agrotechnological hubs conducting experimental research. In addition, this work can increase the potential of rural areas and contribute to the creation of new jobs as a prerequisite for the development of domestic olive farming in the future.

Due to the need to diversify agriculture in Kazakhstan and introduce crops adapted to climate change, this dissertation work is relevant and scientifically novel, designed to study the possibilities of growing olive trees (*Olea europaea L.*) in the conditions of the Turkestan region.

In addition, the importance and effectiveness of our work are determined by the introduction of European olive trees to the southern regions of the Republic of Kazakhstan, their adaptation and propagation by cuttings and grafting, their adaptation to exotics in the field and the creation of microclimatic conditions in greenhouses, methods of planting, top dressing and qualitative implementation of the survey work.

2. The purpose of the dissertation research

To study the possibility of introducing and adapting the European olive tree (*Olea europaea L*.) for the first time in the fertile lands of southern Kazakhstan using a new intensive technology of growing. The introduction of olive trees into the structure of alternative horticulture in the southern regions is scientifically justified, and opens up the possibility of producing olive oil and replacing imports in Kazakhstan.

3. The main objectives of the research:

– For the first time in the southern regions of Kazakhstan, the use of a new intensive technology for growing European olive *(Olea europaea L*) trees;

– Study of the bioecological features of the Frantoio, Arbequina and Leccino varieties during the adaptation of European olive (Olea europaea L.);

– Conduct phenological monitoring of the growth and development of European olive (*Olea europaea L*.) trees in microclimatic conditions in order to create favorable conditions for the adaptation of European olive (*Olea europaea L.)* trees in greenhouse conditions;

– Conduct research on the effectiveness of top dressing, drip irrigation and maintenance of European olive (*Olea europaea L.)* trees and determine the optimal methods of top dressing and irrigation systems;

– Creation and improvement of infrastructure for mass propagation and adaptation of European olive *(Olea europaea L.)* trees in laboratory conditions using seeds, cuttings or calcium humate in a nutrient medium for rooting cuttings;

– Introduction of technology for the establishment of European olive (*Olea europaea L.)* trees in the southern regions of Kazakhstan.

4. Research methods

Using a new intensive technology for growing European olive (*Olea europaea L*.) tree varieties. Phenological monitoring of the growth and development of olive trees in greenhouse conditions.

The following observations, calculations and analyses were carried out in the experiment:

– depending on the stages of tree growth and development in the greenhouse, the soil moisture at a depth of 1 meter was determined every 10 cm before planting the tree, during the stages of germination, leafing, branching, flowering and pre–ripening.

– The amount and chemical composition of the humus layer of the 0–30 cm soil layer, mixed soil samples were taken from each variant of the experimental field and determined by the Tyurin and Machigin methods.

Tyurin method – Determination of the amount of humus by the Tyurin method:

This method is based on the oxidation of organic matter in the soil under the influence of potassium dichromate ($K_2Cr_2O_7$) and sulfuric acid (H_2SO_4). The excess amount of chromium (VI) ions released as a result of the reaction is titrated with a solution of Mora salt (iron (II) sulfate).

The determined amount of organic carbon was converted into humus according to the Van Bemmelen coefficient (1.724):

> Humus (%) = Organic carbon (%) × 1.724

The method is simple and highly accurate, suitable for determining the humus content of agricultural soils.

Machigin method – The amount of mobile phosphorus (P_2O_5) and potassium (K_2O) was determined by the Machigin method. In this method, soil samples are treated with an extractant consisting of a solution of ammonium carbonate $(NH_4)_2CO_3$ and ammonia (NH_4OH).

In the solution after extraction:

Phosphorus was determined by the molybdenum blue formation method (colorimetry), Potassium was determined by the flame photometry method (or atomic absorption method).

Machigin method – allows you to determine the exact amount of macroelements available to plants and is aimed at scientifically substantiating the fertilizer application system.

– the density of the soil layer was determined using the Kachinsky method during the leafing stage of seedlings and before harvesting.

Kachinsky method – To determine the mechanical composition of the soil, 10 g of air–dried soil was weighed. The sample was placed in a porcelain dish, 100 ml of distilled water and 10 ml of 10% hydrochloric acid (HCl) were added to it, and the carbonates were precipitated until complete dissolution. Then 10 ml of 10% sodium pyrophosphate ($Na_4P_2O_7$) solution was added and mixed with a glass rod. The mixture was left for 16–18 hours.

Then the resulting suspension was poured into a graduated cylinder and made up to 1 liter with distilled water. The cylinder was tightly closed and shaken vigorously for 1 minute. At specified time intervals (30 seconds, 2 minutes, 5 minutes, 2 hours, 6 hours and 8 hours), 10 ml of suspension was pipetted from the upper layer, poured into porcelain dishes, dried at 105 °C and weighed.

Based on these results, the percentage of clay (diameter < 0.01 mm), silt (0.01–0.05 mm) and sand (0.05–1 mm) fractions was calculated.

The mechanical composition of the soil was determined by the Kaczynski sedimentation method. This method is based on the separation of the size of soil particles (sand, silt, clay) according to their sedimentation rate in water.

5. The main principles proposed for protection:

– For the first time in the south of Kazakhstan, the use of a new intensive technology for growing European olive trees has increased productivity and improved agrotechnical methods;

– Bioecological features of (*Olea europaea L.)* Leccino, Frantoio and Arbequina varieties, their ability to adapt to regional soil and climatic conditions;

– Control of microclimatic factors affecting the growth and development of European olive trees in greenhouse conditions and creation of favorable conditions for their growth and development;

– Identification of optimal ways to increase productivity by studying the effectiveness of fertilizing, drip irrigation and maintenance of European olive trees;

– Creation of the necessary infrastructure for rooting and adaptation of seeds, cuttings or cuttings using calcium humate in a nutrient medium for mass propagation of European olive trees in laboratory conditions.

6. Description of the main results of the study:

1. The use of intensive technologies, in particular, drip irrigation, humic and humate fertilizers, contributed to the increase in the growth of stems and leaves of olive trees, as well as fruiting. In particular, the use of 20–20–20 NPK mineral fertilizer with humate improved plant development indicators.

2. During our studies, phenological observations revealed that the growing season of all varieties varies between 177–194 days, and they are divided into medium–early (Frantoio) and medium–term (Arbequina, Leccino) groups according to their ripening dates. Such features allow for effective planning of the production period of varieties. It was also found that the introduction of drip irrigation and agrotechnical measures increases the viability of seedlings and increases their resistance to climatic stress factors.

3. The effect of the fertilizers used in the study (biohumus, calcium humate, potassium humate, nitroammophos) on the growth of olive trees was evaluated. The results showed that the growth of olive seedlings in the variants where biohumus was used was significantly higher than in the control variants. The biometric indicators of the Frantoio, Arbequina and Leccino varieties varied significantly depending on the type of fertilizer, which proves the effectiveness of organic and humate fertilizers.

4. The data obtained as a result of studying the effectiveness of top dressing, drip irrigation and maintenance of European olive trees (*Olea europaea L.*) showed that the methods of vegetative propagation of olive trees are effective.

The results of the study indicate the high efficiency of using biostimulants in the vegetative propagation of olive trees, which plays an important role in the development of olive production. The data obtained will serve as a basis for improving the cultivation technologies of olive trees, effective selection of varieties and optimization of agronomic measures in the future.

5. The research addressed the issues of improving the infrastructure for mass propagation and adaptation of European olive tree (*Olea europaea L.)* in laboratory conditions using seeds, cuttings and calcium humate.

6. Based on the results obtained, work was carried out to introduce the technology of European olive tree (*Olea europaea L.*) into production in the study areas of southern Kazakhstan.

7. Justification of the novelty and significance of the results obtained

For the first time in Kazakhstan, the ability of olive trees to adapt to the soil and climatic conditions of the southern regions was studied in a comprehensive

manner (taking into account agrotechnics, irrigation regime, microclimate and soil composition).

In the village of Badam, Ordabasy district, the phenological development stages of various varieties of olive trees were studied, and their resistance to spring frosts and summer drought was determined.

For the first time, planting schemes and agrotechnical care systems for olive cultivation (fertilizer rates, irrigation regime, pest control, etc.) were developed and tested, adapted to the conditions of the region.

Olive varieties effective for cultivation in the conditions of southern Kazakhstan were identified according to the quality indicators and productivity of their fruits.

8. Compliance with development direction or government programs

The dissertation work was carried out in 2019–2024 under the grant funding of JSC «Science Fund» on the topic «Organization of European olive tree cultivation and processing production" (No. 0227–17–GK). Registration number and date of the contract: No. 462, November 24, 2017. Grantee – LLP «Olives».

9. The contribution of the doctoral student to the preparation of each publication

The main results of the dissertation work were published in 8 scientific works, 3 articles – in scientific publications recommended by the Committee for Quality Assurance in the Field of Education and Science of the Republic of Kazakhstan, 5 articles – in the proceedings of international scientific and practical conferences, 1 article was published in the scientific journal Eurasian Journal of Soil Science, which is included in the Scopus database.

In publications recommended by the Committee for Quality Assurance in the Field of Education and Science of the Ministry of Education and Science of the Republic of Kazakhstan: in the scientific and expert journal «Researches, Results" (2021, No. 4 (89), pp. 89–98; in the scientific and expert journal "Researches, Results» (2025, No. 4 (105)., pp. 42–50; Bulletin of Korkyt Ata Kyzylorda University. Agricultural Sciences" series (2023, No. 3–2 (66), pp. 141–149).

Approbation of the work

The results of the dissertation research were discussed at the meeting of the «Agronomy» department. In addition, important sections of the dissertation work were presented at the following international and republican scientific conferences: «Thesis on the 75th anniversary of the academician of the National Academy of Sciences of the Republic of Kazakhstan and the Academy of Agricultural Sciences of the Republic of Kazakhstan Meiyrman Galiolla Tolendiuly» in the context of adaptation to global climate change Scientific and practical conference «Current issues in agricultural science» Almaty region, Karasai district, Almalybak village–2021; «The importance of educational programs in training modern agricultural specialists» Kaplanbek Higher Agrarian and Technical College of the Human Potential Development Department of Turkestan region. 2021; and presented at the international scientific and practical conference «Technologies and engineering ICITE–2021» Shymkent, 2021.

10. Structure and volume of the dissertation work

The text of the dissertation work consists of 135 pages, 5 appendix, including sections on normative references, definitions, designations and abbreviations, introduction, review of scientific literature, research materials and methods, research results and their analysis, conclusion, recommendations for production and list of used literature. The results and data obtained during the experiment are presented in 34 figures, 29 tables. The number of used literature is 167 titles, including 150 references to the works of foreign authors.