

## ASSESSMENT OF CONDITION OF VINEYARDS IN ODESA OBLAST ACCORDING TO UKRAINIAN VINEYARD CADASTRE DATABASE

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*Обґрунтовано актуальність сучасних підходів до складання кадастру виноградників в Україні. Розглянуто методичні підходи до складання кадастру виноградників в країнах розвинутого виноградарства. Описано особливості складання сучасного кадастру виноградників. Викладено етапи складання кадастру виноградників на прикладі окремої адміністративної області на засадах ампелоекологічної оцінки території. Представлено результати детальних обстежень ділянок виноградних насаджень (кількісного та якісного стану), геодезичної зйомки їх меж, характеристики рельєфу, ґрунтового покриву і мікрокліматичних ресурсів території.*

**Ключові слова:** кадастр виноградників, виноградні насадження, Vin-Cad-Ukr, геодезична зйомка, екологічні умови, виноградарсько-виноробні господарства.

**Problem statement.** A cadastre is a comprehensive geographic information system of legal, natural, economic, and spatial data about individual recording objects of the system with different levels of management. The vineyard cadastre in Ukraine created on such principles is important for the development of agriculture in general, and the viticulture, in particular, obtaining local competitive viticulture product and its entry the international markets.

The vineyard cadastre as a recording system of quantitative and qualitative characteristics of vineyards, is designed to provide up-to-date information about natural, economic and legal status of the land to state authorities, local governments, organizations, institutions and citizens to organize its rational use, control production volumes and the quality of the obtained viticulture products, regulation of the relations in which they are involved.

Management of the vineyard cadastre in Ukraine is an extremely important issue today. Reforming the agricultural sector requires comprehensive, complete and reliable information about land. So far, Ukraine does not have complete information about agricultural land used for vine growing.

Before 1991 the censuses of perennial crop plantations were periodically

conducted, and a single Ukrainian vineyard cadaster was created in 1980. Censuses of vineyards were made in 1953, 1979, 1985, and 1998, 2009. Due to this the number of vineyard farms, their total area, number of plants, including bearing ones, varietal and age composition of vineyards and other characteristics were specified. However, a significant gap in time between censuses (10 years and more) should be noted, which did not allow to continuously perform quantitative and qualitative recording of vineyards [1, 2].

**The review of recent research and publications.** In order to regulate viticulture in European countries, a vineyard register is performed, which takes into account all vineyards and their characteristics, location, and legal rights to them, in order to control subsidies and verify the legality of these plantations. There are several approaches for compiling a vineyard cadastre in the EU. The basis for its creation is the existing cadastral and topographic maps (France, Germany, Austria, Italy, and Spain), otherwise, a cartographic database is compiled based on aerial photographs and orthophoto (Portugal, Greece).

Despite the high complexity and expenses of such work, this approach has a number of advantages, as a special information system is formed along with the collection of data, which is based on a GIS, and orthoimage, used as a basis, can serve as an excellent visual example.

High requirements for the organization of a modern vineyard cadastre were presented to the new member states of the European Community (Hungary, Romania, Bulgaria, etc.). According to these requirements, it was necessary to compile a new vineyard cadastre, which would include detailed information on each area used for vine growing. First of all, this is due to the regulation of viticultural product in the European market and strict control of its quality. In Hungary, in order to meet the demands of the European Union for the management of a vineyard register, a viticulture information system was created using GIS – VINGIS. The system was introduced in 2001, and since then it has been modified and improved. Aerial photographs were used as a basis and subsequently overlaid by additional cartographic materials [3, 4].

In 2014, due to the financial help of the United States and the European Union, compiling the vineyard registers (cadastres) in the Republic of Moldova and Georgia (a pilot project in Racha-Lechkhumi) started. The methodological approaches for creating the vineyard cadastre in Moldova were based on the established compliance of environmental conditions of the territory with the biological needs of grape varieties. This cadastre also was supposed to determine the potential grape yield depending on certain environmental conditions.

Conducting the recording of vineyards in the European Union requires the use of the latest technologies and techniques. Today, modern geographic information systems are widely used to manage a vineyard register in developed viticultural countries. They provide an opportunity to analyze the geospatial database, collect a huge amount of statistical data for each site, and facilitate the collection, systematization, and presentation of information about vineyards. The use of such techniques as remote sensing, yield capacity monitoring, and assessment of

topographic, soil, and climatic conditions of the territory using GIS allows to determine the connection between yield and environmental characteristics in different parts of the vineyard. On the basis of digital topographic maps using GIS, it is possible to generalize, analyze and visualize a large amount of spatial information of environmental conditions which are important for grape growing (terrain, geology, soils, hydrology, climatic conditions), as well as vegetation, the incidence of infected plants, etc. Today, the collection of this information using only analog maps or tables does not provide the accuracy and reliability that would meet the demands of effective industry management [4–8].

Thus, when creating a modern vineyard cadastre of Odesa oblast in Ukraine, the experience of European countries and the requirements for compiling the vineyard registers were studied and analyzed.

Obtaining an accurate geospatial data is crucial for creating the vineyard registers in European countries. To create the vineyard cadastre in Ukraine, it is necessary to use aerial photographs, land and geodetic surveys [1, 9].

According to Ukrainian draft law 9139 “About grapes and viticultural products” the all-Ukrainian Vineyard-Winery register according to EU standards and regulations should be established from 2026. Taking into consideration that methodologies, software and Vineyard cadastre database of Tairov institute were prepared based on EU and international experience, it could be used as a basis for all-Ukrainian register creation.

**The purpose of the article** is to analyze the existing Ukrainian vineyard cadastre database and present the vineyards’ characteristics of Odesa oblast.

**Research methodology.** Methods of mathematical statistics were applied during the study, including correlation and regression analysis, and methods of moving average. Throughout the research, the archival materials of the NSC “V.Ye. Tairov Institute of Viticulture and Winemaking” (Tairov Institute), SE “Odesa Land Management Research and Design Institute”, reporting materials of land management surveys of PE “ODESAGEOPROEKT” were used. Topographic and soil maps with accompanying materials and reports of research work from Tairov Institute departments were used in this study. Microsoft Office software was used in this research. Vin-Cad-Ukr software product was improved for creating and managing the vineyard cadastre database.

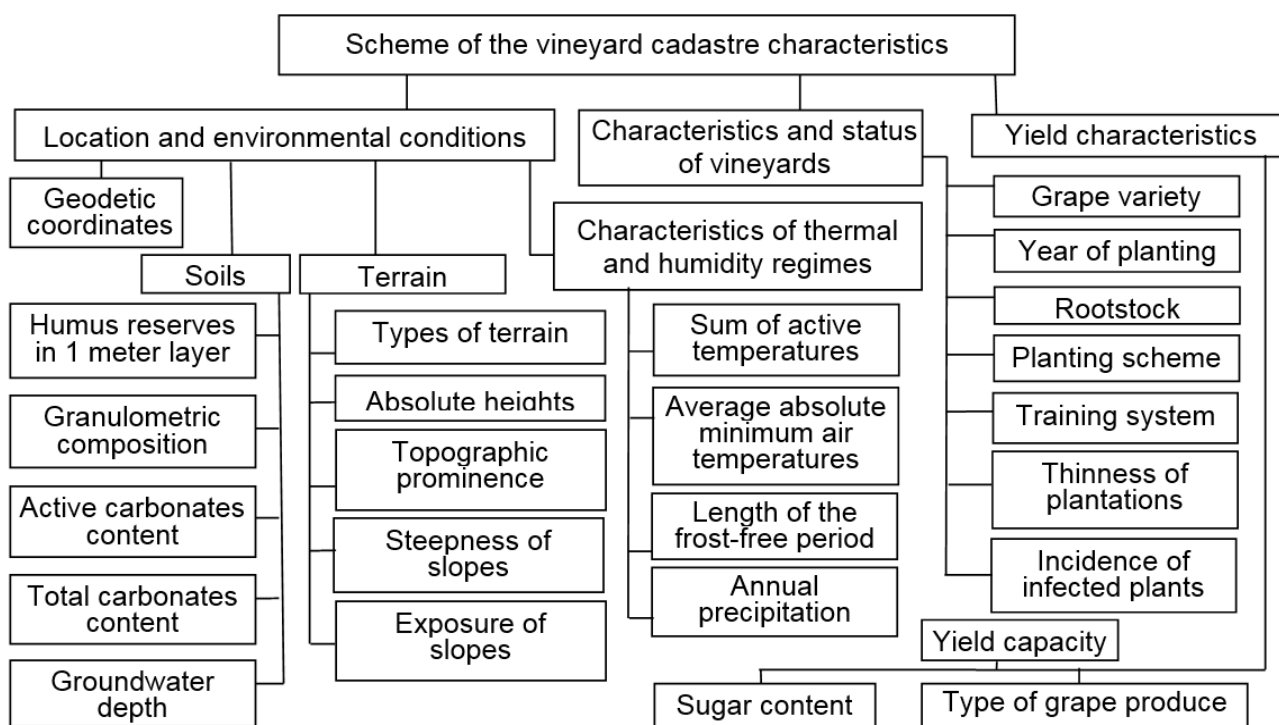
According to European practice Method of compiling the vineyard cadastre taking into account environmental conditions (Ukrainian Patent 43810. Vlasov, V.V., Shaposhnikova, O.F., 2009), Method for complex assessment of state of existing vineyard (Ukrainian Patent 37552. Vlasov, V.V. et al., 2008) and “Methodical recommendations for compiling the vineyard cadastre in Ukraine” (approved by the Ministry of Agrarian Policy and Food of Ukraine, 2011) were developed and patented by Tairov Institute. The vineyard cadastre in Ukraine is created to obtain data about quantitative and qualitative characteristics of vineyards, comprehensive analysis of environmental conditions of the territory (terrain, soil, microclimate), and determine their location [10].

In 2020 researchers of Tairov Institute received the copyright to the “Vin-Cad-Ukr Software” computer program (Vlasov et al., 2020).

According to the methodology of Tairov Institute, the vineyard cadastre database is an information database of the economic organization and location of vineyards, their qualitative and quantitative status, varietal composition, and environmental conditions of the territory. The use of information from the vineyard cadastre makes it possible to obtain up-to-date data about plantations by state authorities, wine producers, consumers and to realistically assess the possibilities of the industry and its development potential. Only under these conditions, Ukrainian viticultural produce will take a notable place in the world market, where the requirements for it are very high.

The database facilitates the formalization of the production of PDO/PGI wines via creating the vineyard passport / specification (a document containing information about the location of the vineyard and its condition, yield and quality characteristics, analysis of environmental conditions in the growing area etc.).

The most important task of the vineyard cadastre is to obtain information about: the vineyards location (coordinates of the site boundaries); quantitative and qualitative characteristics, and the plantations condition (ampelographic composition, planting scheme, training system, age of plantations, assessment of weed infestation and incidence of infected plants, etc.); environmental conditions of sites; yield (yield, sugar content, acidity); type of grape produce obtained by the farm. The above-mentioned data determine the main components of the vineyard cadastre (Fig. 1).



**Fig. 1. Block diagram of the vineyard cadaster characteristics (Vlasov V., 2009)**

Identification of the vineyard on-site, namely, determining the geodetic coordinates of vineyards boundaries, is one of the main tasks of the vineyard

cadastre. The necessity for such data is justified by the connection between the quality of the grape yield and wine products with the vineyard location and environmental conditions of the area. Determining the vineyard location is performed using modern high-precision GPS equipment.

The vineyard cadastre, as a constantly updated database, provides an opportunity to address industry issues using up-to-date and verified information. The data from such a database can be summarized in a report, also specialized extracts and documents can be created. Data on economic, ecological, and ampelographic status in the vineyard cadastre are accumulated to organize further rational industry management, evaluation of economic activity, improvement of cultivation technology and the quality of grapes, etc.

The vineyard cadastre contains a large amount of data and is created in the form of an electronic database of attributive and graphic information. The goals of the vineyard cadastre are achieved through the use of a specifically developed Vin-Cad-Ukr software, which is able to process different data, allows file exchange between the newly created database of the vineyard cadastre and the database of Ukrainian state land cadastre, results of plantation surveys etc., which provides mutual support between software products used for solving issues in viticulture and winemaking.

**Research results.** In 2012, according to the List of research and development programs in viticulture and horticulture (Ministry of agrarian policy and food of Ukraine) the NSC “V. Ye. Tairov Institute of Viticulture and Winemaking” began working on compiling the vineyard cadaster in Ukraine (Odesa oblast) taking into account environmental conditions of the territory. The result of this study was an electronic database of the vineyard cadastre of 4 administrative districts in Odesa oblast (Artsyzy, Bolhrad, Ovidiopol, and Tarutyne) and the creation of a Vin-Cad-Ukr software product. Vin-Cad-Ukr software. Kyiv: Copyright and related rights).

The electronic database contains the information about condition of vineyards (name of the vineyard farm, area, age, and condition of plantations, varietal composition, geodetic coordinates, and cartographic materials with environmental characteristics of the territory) and could be used in the creation of any reporting forms.

During 2014–2018 and 2019–2020, Tairov Institute was involved in the implementation of the Regional development program of the agro-industrial complex in Odesa oblast. As a result, research was conducted and maps of terrain, soil, and microclimate in the territories of village councils of thirteen viticultural districts in Odesa oblast were developed; an assessment (monitoring) of the vineyard condition in the region was performed, and the database of the vineyard cadastre was created and updated.

Generalizations of results for the 2012–2020 period shows that there are 179 growing grapes farms in 13 districts of Odesa oblast (Table 1). After the decentralization in Odesa oblast, there was a big problem in obtaining complete and reliable information on the planting and uprooting of vineyards. Solving this issue in Ukraine is possible only if the creation and management of the vineyard cadaster will be regulated by the government.

**Table 1. Distribution of vineyard areas in Odesa oblast\***

Administrative units (district) **	Number of vineyard farms, 2020	Vineyard area, ha, 2018	Vineyard area, ha, 2020
Artsyz <sup>3</sup>	14	1030.20	971.4
Bilhorod-Dnistrovskiy <sup>2</sup>	10	2608.58	2528.91
Biliaivka <sup>1</sup>	4	106.54	111.31
Bolhrad <sup>1</sup>	38	3754.17	3683.77
Izmail <sup>3</sup>	19	920.82	966.77
Kiliia <sup>3</sup>	7	860.96	886.47
Lymanske <sup>3</sup>	1	50.84	48.12
Ovidiopol <sup>1</sup>	14	1216.87	1344.61
Reni <sup>3</sup>	19	862.55	859.05
Rozdilna <sup>3</sup>	4	440.97	444.10
Sarata <sup>1</sup>	11	1599.80	1680.60
Tarutyne <sup>2</sup>	27	2760.51	3020.92
Tatarbunary <sup>2</sup>	11	1325.04	1303.42
Total	179	17537.85	17849.45

Note: \* Vineyard areas of agricultural enterprises;

\*\* Research was started in: <sup>1</sup> – 2016, <sup>2</sup> – 2017, <sup>3</sup> – 2018.

Source: own research, based on data of agricultural enterprises, regional agricultural departments, and geodetic surveys under the Regional development program of the agro-industrial complex in Odesa oblast.

As a result of the decentralization, 13 viticultural districts of Odesa oblast were merged into five (Bilhorod-Dnistrovskiy, Bolhrad, Izmail, Odesa, and Rozdilna). The largest number of vineyard farms is concentrated in Bolhrad district (72), while there are only three farms in Rozdilna district.

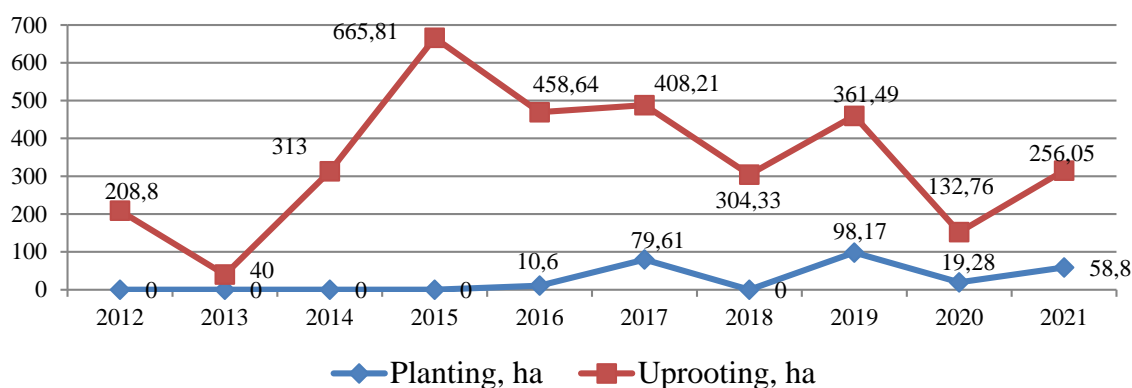
According to the results of geodetic surveys, 17.8 thousand hectares of vineyards were surveyed in the region. Vin-Cad-Ukr electronic database includes 1669 individual plots with georeferencing.

In Odesa oblast, the grape assortment is represented by 40 wine (15.6 thousand hectares), 56 table (2.0 thousand hectares), and 4 rootstocks varieties (0.1 thousand hectares). Hybrid forms occupy 0.1 thousand hectares. Among wine varieties, the largest area is occupied by Cabernet Sauvignon, Aligote, Merlot, and Chardonnay, varieties occupy almost the same area of about 1.5 thousand hectares. Aromatnii, Grenache, Zagrei, and Portugizer occupy the smallest areas among wine varieties (up to 1 ha).

Among table varieties, the largest area is occupied by Moldova (577.63 ha), and the second most common table cultivar is Arcadia (362.63 ha). The smallest areas of up to 0.5 ha are occupied by Blagovist, Kishmish tairovskii, Kometa, Lesya, Nadezhda, and Yubileinyi varieties. The vineyards are planted with Ukrainian and foreign planting materials imported from Italy, Serbia, Germany, Moldova, Montenegro, France, Slovenia, Hungary, Bulgaria, and Austria.

As a result of this research, it was found that the condition and level of the used agricultural techniques vary significantly. Quite a high level of vineyard management is observed in large vineyard farms, mostly wine producers (LLC “Agrofirma Shabo” in Shabo, Bilhorod-Dnistrovskyi district, OJSC “AE “Chornomorska perlyna” in Bazaryanka, Tatarbunary district, “Vinhoh Oksamytny Ltd.” in Oksamytny, Bolhrad district, OJSC “Dolynka” in Dolynka, Sarata district). On the above-mentioned farms, there is a high level of mechanized work in the vineyards and technological discipline of managing the plantations.

Over the last 10 years (2012-2021), 3148.99 hectares of vineyards were uprooted in vineyard farms of Odesa oblast, and only 266.46 hectares were planted (Fig. 2).



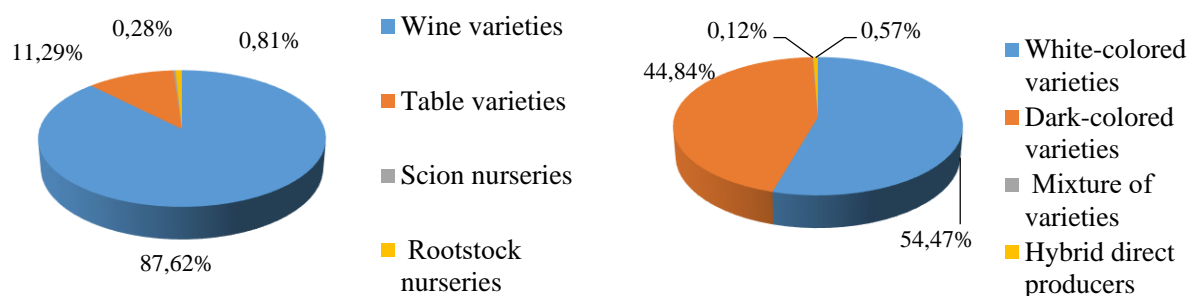
**Fig. 2. Dynamics of planting and uprooting of vineyards in Odesa oblast**

The main reasons for uprooting plantations are their unsatisfactory agronomic status, the influence of weather and climatic conditions, and the lack of a proper price for grapes, as a result of the monopoly of several large buyers. To maintain the area of plantations at the same level in the vineyard structure, it is necessary to maintain the ratio: 80 % of bearing vineyards and 20 % of non-bearing ones. Unfortunately, in Odesa oblast, this ratio is 97 % to 3 %. If this trend persists, Odesa oblast may lose vineyards in the future, which is extremely unacceptable for the region's economy.

The vines are trained to a vertical trellis. More than 90% of vineyards have a 3 m distance between rows. A small amount of grapevines is grown in narrow rows (from 2 to 3 m) and wide rows (from 3 to 4.5 m). Depending on the vigor of the certain variety and soil fertility, the distance between the plants in a row varies from 1 to 2 m. Cordon training system is mainly used according to the border type (with medium and high trunks). In some vineyards, Guyot, goblet, and fan shapes are also implemented.

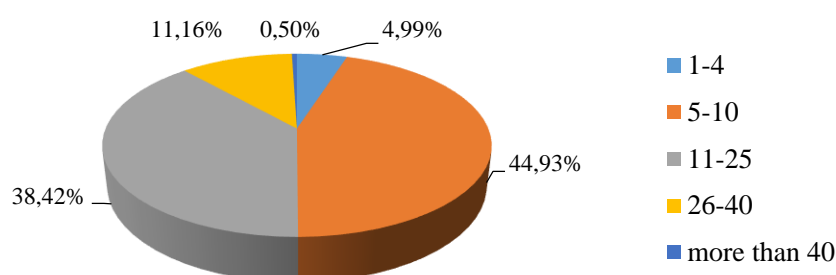
In Odesa oblast 88 % and 11 % of the total area of vineyards are occupied by wine varieties, and table cultivars, respectively, and the ratio of dark-colored varieties to varieties with white berries is 45 % to 54 % (Fig. 3). Table grape varieties are mostly represented by a group of early (41 %) and late (36 %) ripening cultivars.

Vineyards also differ in age. Thus, vineyards aged 5–10 and 11–25 years occupy almost the same area, whereas non-bearing plantations and vineyards which are over 40 years of age occupy 5 % and 0.5 % of the area, respectively (Fig. 4).



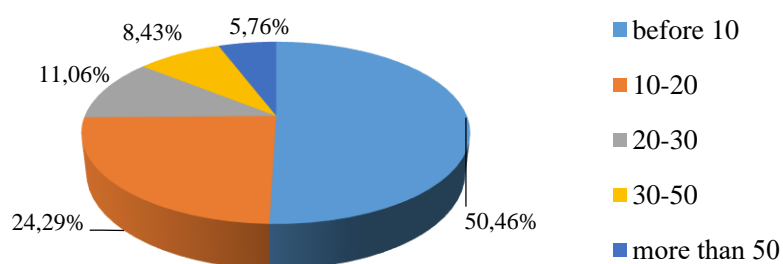
**Fig. 3. Modern assortment of vineyards in the region**

As a result of the assessment of vineyards and analysis of the obtained data, it was determined that most vines (82 %) are up to 25 years of age.



**Fig. 4. Characteristics of vineyards by age composition**

The thinness of grape plants in vineyards varies significantly, depending on the age and scheme of planting, weed infestation in the area, and the incidence of infected plants. As a rule, vineyards that are over 25 years present the highest thinness of plantations, especially in the presence of perennial and quarantine weeds. The high thinness of plantations is caused by chronic diseases: phytoplasma, crown gall disease, esca, eutypa dieback, and others. The study of characteristics showed that more than 50% of the vineyard area has up to 10 % of the thinness (Fig. 5).



**Fig. 5. Characteristics of vineyards by the thinness of plantations**

More than 6 % of plantations in Odesa oblast have more than 50 % of the thinness. These are areas that are not cultivated and are subject to uprooting. The conducted surveys of the vineyard condition in Odesa oblast allow us to claim that:

1. 77 % of the vineyard area is used according to the generally accepted technology, and it provides a standard amount of produce (highly promising vineyards);

2. 15 % of the vineyard area requires additional measures to facilitate reaching the bearing age of the grapevines; in some areas it is recommended to carry out reconstruction (elimination of the thinness of grape plants, change training system of plants, etc.); yields provide produce at low standard levels (promising vineyards);

3. 8 % of the vineyard area with age exceeding the normative term of productive usage, they have high thinness, are overwhelmed by perennial weeds, and are affected by chronic diseases, and the yield does not provide produce at an economically reasonable level (unpromising vineyards).

**Conclusions.** 1. Vineyard cadastre database, methodologies and software of Tairov institute could be used as a basis for all-Ukrainian Vineyard-Winery register creation, that will be maintenance according to EU standards and regulations.

2. Ukrainian vineyard cadastre database presents the data of 179 vineyard and winemaking enterprises of Odesa oblast, based on the conducted research, expeditionary inspections, and processing of the obtained information.

3. 1 669 vineyard plots with different vine varieties (around 17.8 thousand hectares) were georeferenced into Vin-Cad-Ukr electronic database based on the results of the geodetic surveys.

4. Odesa oblast vine assortment presented with 40 wine, 56 table, and 4 rootstock varieties. There is a significant excess of the area occupied by wine varieties, and the ratio of dark and white-colored varieties is almost the same.

5. The table vine varieties are mostly represented by a group of early (41 %) and late (36 %) ripening cultivars.

6. Around 82 % of the vineyards were planted after 1995 and 77 % of the vineyard area is used according to the generally accepted technology, and provide a standard amount of yield.

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### Annotation

**Vlasov V. V., Liashenko G. V., Buzovska M. B., Bulaieva Iu. Iu., Popova H. K.**  
***Assessment of condition of vineyards in Odesa oblast according to Ukrainian vineyard cadastre database***

*Management of the vineyard cadastre in Ukraine is an extremely important issue today. The vineyards censuses were done in 1953, 1979, 1985, 1998, and 2009.*

*Methodical approaches for creating the vineyard cadastre in countries with developed viticulture were analyzed in the article. High requirements for the organization of a modern vineyard cadastre were presented to the new member states of the European Community (Hungary, Romania, Bulgaria, etc.). According to these*

requirements, it was necessary to compile a new vineyard cadastre using GIS, which would include detailed information on each area used for vine growing.

Modern approaches for creating the vineyard cadastre in Ukraine were substantiated. According to European practice Method of compiling the vineyard cadastre taking into account environmental conditions (Ukr. Patent 43810), Method for complex assessment of state of existing vineyard (Ukr. Patent 37552) and “Methodical recommendations for compiling the vineyard cadastre in Ukraine” were developed and patented by Tairov Institute. In 2020 researchers of Tairov Institute received the copyright to Vin-Cad-Ukr software.

The characteristic features of compiling a new vineyard cadastre were described in the article. According to the methodology of Tairov Institute, the vineyard cadastre database is an information database of the economic organization and location of vineyards, their qualitative and quantitative status, varietal composition, and environmental conditions of the territory. The use of information from the vineyard cadastre makes it possible to obtain up-to-date data about plantations by state authorities, wine producers and consumers, and to realistically assess the possibilities of the industry and its development potential.

The stages of compiling the vineyard cadastre based on ampeloecological assessment of the area were described on example of Odesa oblast. The results of detailed vineyard surveys (quantitative and qualitative data) were presented.

Based on the conducted research, expeditionary inspections, and processing of the obtained information the data of 179 vineyard and winemaking farms in Odesa oblast were presented in Ukrainian vineyard cadastre database. 1669 vineyard plots with different vine varieties (around 17.8 thousand hectares) were georeferenced into Vin-Cad-Ukr electronic database based on the results of the geodetic surveys.

Odesa oblast vine assortment presented with 40 wine, 56 table, and 4 rootstock varieties. There is a significant excess of the area occupied by wine varieties, and the ratio of dark and white-colored varieties is almost the same. The table vine varieties are mostly represented by a group of early (41 %) and late (36 %) ripening cultivars. Around 82 % of the vineyards are up to 25 years of age. 77 % of the vineyard area is used according to the generally accepted technology, and it provides a standard amount of yield (highly promising vineyards).

Vineyard cadastre database, methodologies and software of Tairov institute could be used as a basis for all-Ukrainian Vineyard register creation, that will be maintenance according to EU standards and regulations.

**Key words:** Vineyards, vineyard cadastre, Vin-Cad-Ukr, geodetic survey, environmental conditions, vineyard enterprise.