

TECHNOLOGICAL ESTIMATION OF IVANO-FRANKIVSK REGION OAK TIMBER STORAGE FOR VINE AND BRANDY COOPERAGE

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The technological estimation of oak timber sources of the Ivano-Frankivsk Region for the using in the tonnellerie is presented. Possible volumes for producing of logs for wine and brandy barrels are estimated.

Oak timber, log. stave, macrostructure of wood, phenolic substances, aromatic substances

Possibilities of oak timber using in oenology technologies depends on its specific anatomical, physical and chemical properties. Investigations of those wood parameters for different oak species in different natural site indexes in countries, which are world leaders of wine production, started more than 30-50 years ago. [1, 2, 3]. Scientific works for technological estimation of Ukrainian oak timber sources provide the basis for national cooperage regeneration on the new quality level.

The purpose of the investigation. Determination of locations, anatomical, physical and chemical oak wood properties, which provides the best compositions of taste and aromatic components in wines and spirits after barrel maturation. Estimation of possible volumes for producing of logs for wine and brandy barrels.

Methods of studying. To estimate the potential harvesting volumes of high quality clapboard logs, that meets the quality requirements of the European market, 7 experimental plots was founded on the typical cutting areas in oak stands of Ivano-Frankivsk Regional Forestry Administration (I-FRFA).

At each site we have selected logs that can be used as a wine or brandy clapboard logs. [4] In addition, 20 clapboard logs were selected by random numbers on each area. Area of sapwood and part of core was measured at the top of each log, using mosaic distribution, by the anatomical properties suitable for the production of clapboard. Quality of round timber was determined by the current norms - ГОСТ 9462-88.

Ten samples of wood were selected in core area of logs in 3 m from stump cutoff, to characterize the chemical properties of wood on each sample plots. The content of phenolic compounds in aqueous and alcoholic extracts investigated on the PhEC. Content fragrant lactones, vanillin, furfural, eugenol was studied using traditional methods on modified gas chromatograph "Kristall-2000" with flame ionization detector, capillary column ВИТОКАП -AL - 0.3 СИ, phase - VITOWAX-F (imob.) length 50 m, internal diameter 0,32 mm.

Theoretical and experimental investigations. Quality of logs, which was selected for clapboard production on experimental plots, was within 1.1 – 1.5 quality classes; sapwood percentage of the total volume was in the range of 19.5 – 23.5 %; percentage of the rejected zone of wood core – 5.1– 8.1 %. Percentage of core, which was suitable for high quality stave production, in the Δ_3 index site showed the tendency to increase from 71.1 to 72.5 with increasing of average total precipitation (Tab. 1, Fig. 1).

This tendency can be approximated to the parabolic dependence, because in locations with average total precipitation more than 800 mm oak stands productivity decreases under wet soils influence, increasing of stones content in soils, increasing of erosion. Rate of growth by the height and diameter of oak becomes lower, increases knots content in wood and heterogeneity of macrostructure.

The average width of annual rings of oak wood and the percentage of late wood in this region are higher than in forestry regions, which are located some to the north from it – West Forest and Steppe and Western Polessye Zones of

Ukraine. It is middle-layer macrostructure of stave oak timber by the classification of French cooperage investigators. [1, 3]

Table 1. Peculiarities of clapboard logs on experimental plots

№№ of experimental plots	Forestry enterprise, department	Average data of clapboard oak wood distribution by technological zones of clapboard logs, %			Average quality of clapboard logs	Average total precipitation, mm
		sapwood	industrial core wood	rejected zone of wood core		
1, 2	Bolehiv forestry	21.9±2.3	72.5±2.2	5.6±1.5	1.2±0.2	800
3, 4	Kalush forestry	22.1±1.9	72.1±1.7	5.8±1.3	1.1±0.1	640
5, 6, 7	Kolomya forestry	21.1±2.1	71.1±2.2	7.8±1.9	1.5±0.,3	570

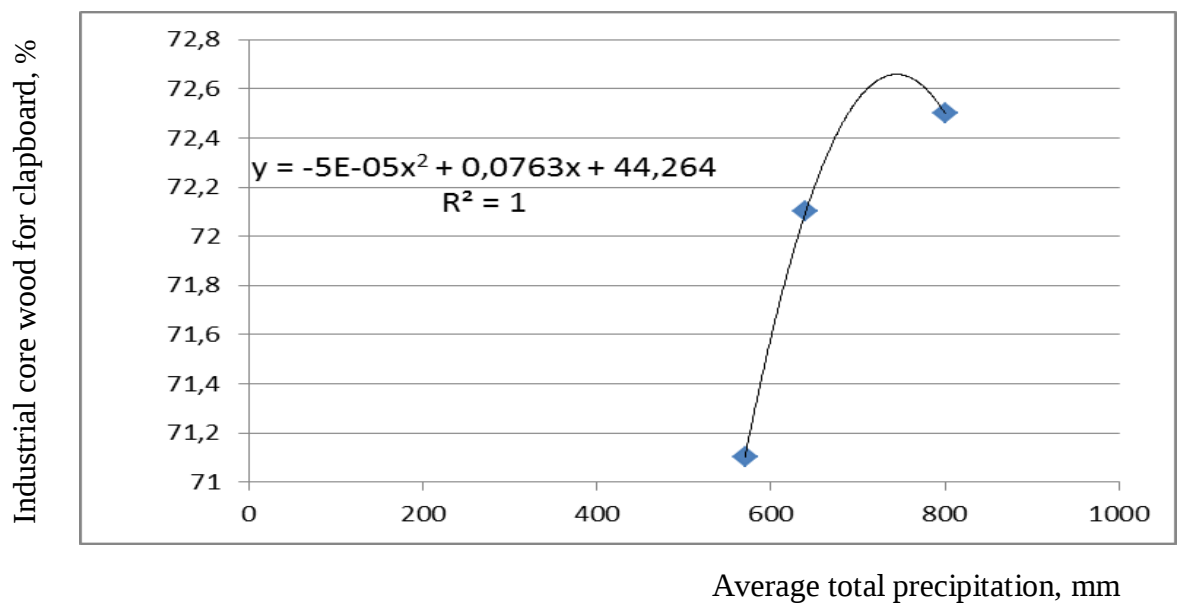


Fig. 1. Increasing of percentage of industrial core wood for clapboard in stave logs in Δ_3 index site by increasing of average total precipitation

Barrels from this wood create rich compositions of taste components in wines after cask maturation. But, lower wood porosity decrease their efficacy for short time wine maturation in compare with thin-layer oak wood with rate of growth low than 1.5 mm (Fig. 2).

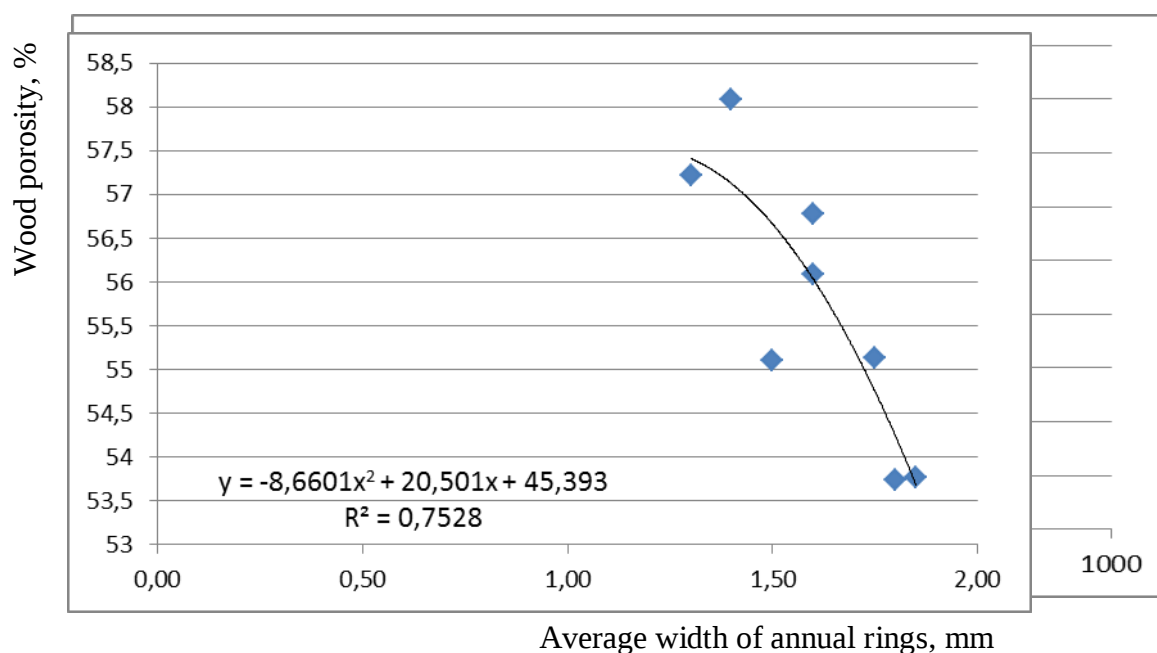


Fig. 2. Tendency of dependence between average width of annual rings and wood porosity for wine stave logs

The average width of annual rings of oak wood and the percentage of late wood in brandy clapboard logs are higher than in forestry regions, which are located some to the north – West Forest and Steppe and West Polesye Zones of Ukraine. There are positive correlations between parameters of macrostructure and hydrothermal coefficient in these regions (Fig. 3). It is middle-layer macrostructure of stave oak timber by the classification of French cooperage investigators. They consider that the oak wood with 3.5 mm average width of annual rings is macro-layer timber. [1, 3] But, Ukrainian ecology conditions demand to choose the native oak wood with 2.5 mm average width of annual rings as macro-layer timber and to recommend it for brandy cask production.

The percentage of late wood in wine clapboard logs in this region is within 64.4–67.6 % and within 63.2–68.2 % in brandy stave logs. These parameters are suitable for wine and brandy clapboard. [1, 3, 5, 6]

The content of phenolic substances in wine and brandy clapboard wood is similar to the best European samples (74–90 mg/g). The highest concentration of

them detected in timber from Kalush forestry, where the hydrothermal coefficient is the best for oak stands growth.

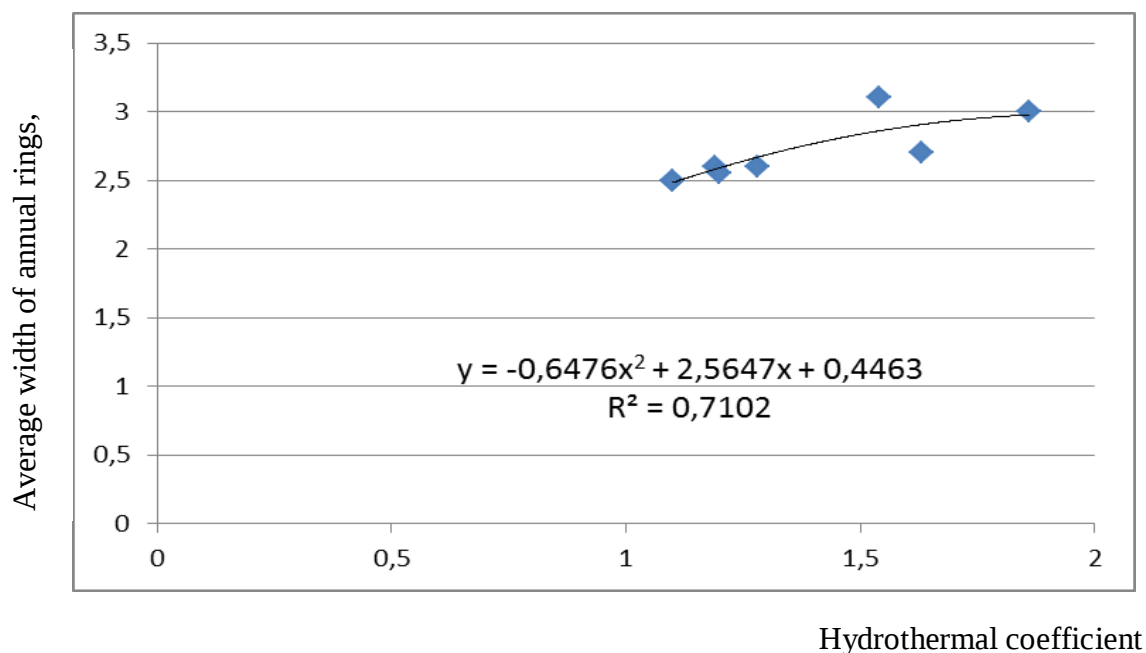


Fig. 3. Tendency of dependence between average width of annual rings in the core wood of brandy clapboard logs from Ivano-Frankovsk Region, West Forest and Steppe and Western Polessye Zones of Ukraine from hydrothermal coefficient

The content of β -methyl- γ -oktalakton cis-+trans-forms in wine stave from Bolehiv and Kolomya forestries is near 6 – 7 % lower than average content in French English oak wood timber. But the best samples of brandy clapboard wood are similar to the average French timber (5.13 – 5.52 mcg/g). The Ivano-Frankivsk stave wood is not worth than the best West European English oak timber by the content of eugenol (1.02–1.96 mcg/g) and even overcome them by the content of vanillin (3.31–9.25 mcg/g). [1, 2, 3, 5]

The furfural content in oak timber from experimental plots 30-40 % higher than in clapboard from West Polessye and similar to its content in oak wood from West Forest and Steppe Zone (1.65–4.23 mcg/g).

So, Ivano-Frankivsk conditions are suitable for harvesting of high quality wine and brandy clapboard oak timber, which is marketable for West Europe.

The most part of Ivano-Frankivsk forests located in Prikarpatye Forestry Region of Prikarpatye Forestry Zone. Forests of Galych, Rogatyn and half of Kolomya forestry located in Rostotsko-Opylskiy Forestry Region of West Ukrainian Forest and Steppe Zone. [7]

The largest square and stocks of oak plantings of observed are in Kolomya, Ivano-Frankivsk, Kalush, Rogatyn, Galych and Bolehiv forestries. It is in these forestry enterprises it is advisable to plan the clapboard logs harvesting. Oak stands are small cells at the bottom of the slopes in five mountain forestries: Broshniv, Vigoda, Delyatin, Nadvirna and Solotvyn. Their protective functions dominate on logging. So, there are only sanitary fellings there. There are no oak stands in other forestries of this region because of highland climatic conditions. A considerable part of Galych, Rogatyn, Ivano-Frankivsk and Kalush forestries went to nature reserves during last 18 years. This decreased the felling squares of oak stands on almost 20 %.

Red oak stands are young and middle-age. So, they have not felling functions now. Some mountain forestries have durmast oak stands. But average year cutting volume of this oak in this region is near 200 m^3 . These forestries have cutting areas of durmast oak once in 3–4 years.

The average estimated oak main cuttings in region are near 19.8 thousand m^3 in one year. It is advisable to plan the output of industrial wood (stave logs and other accompany sort logs) between 51 – 70 % in mature oak stands of Ivano-Frankivsk Region. This meets with the II class of stand marketability. Annual harvest possibility of high quality clapboard logs of oak stands fellings here are near 2.06 thousand m^3 (1.36 thousand m^3 wine stave logs and 700 m^3 brandy stave logs).

Average width of annual rings of oak wood and percentage of late wood in core are within 1.6 – 1.9 mm and 63.2 – 67.7 % for wine clapboard logs, but 2.5 – 3.1 mm and 64.4 – 68.2 % for brandy stave logs accordingly.

It is not advisable to create large cooperage plant in Ivano-Frankivsk Region for woodworking of 2.1 thousand m^3 high quality clapboard logs, because modern

technological lines (for example, from “Weinig gruppe”) have productivity by stave logs near 50 – 60 m³ in a shift. Such wood mill can produce 4200 – 4700 points of 200-liters barrels in 38 – 40 days. [8]

It will be more suitable to use for clapboard producing plants in plain located forestries of region, which usually woodworks 3 – 8 thousands m³ oak saw logs for special parquet and other blanks, for clapboard producing. It needs to create special stores for clapboard drying-maturation, to provide vertical power cleavers and special feeding mechanism for rotation of log pieces in band saws for changing of kerf position. It would be merchantable to locate the nearest barrel plant in Beregany or Buchach forestries of Ternopol Region. There are large own high quality wood stocks here and good developed road net for efficacy transportation of stave from Rivne, Volyn, Lviv, Ivano-Frankivsk and Tchernovtsi Regions. Only 5 – 6 Regional Forestry Administrations can sufficiently supply modern cooperage wood mill. For Ivano-Frankivsk Region it is advisable to create little tonnellerie line with 200-liters wine and brandy casks output near 18 points per shift in suburb of Ivano-Frankivsk city.

Conclusions

It is possible to make some conclusions about wood storage of oak stave logs in Ivano-Frankivsk Region:

- the best forestries for oak clapboard harvesting are Kolomya, Kalush, Ivano-Frankivsk, Bolehiv, Galych and Rogatyn;
- there are stave log stocks, which meets with demands to wine and brandy clapboard wood by anatomical structure and chemical parameters in each of these forestries, but prevails wine timber;
- largest brandy stave log storages are noted in Bolehiv, Kolomya and Kalush forestries in $\mathcal{D}_3$ and C_3 index sites;
- it is advisable to harvest wine clapboard logs in $\mathcal{D}_2$ and C_2 index sites;
- durmast oak and red oak have not industrial storage of stave logs in Ivano-Frankivsk Region;

- it would be useful to create more durmast oak plantations without mixing with other oak species for cooperage timber storage development.

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Resume.

Представлена технологічна оцінка сировинних ресурсів деревини дуба Івано-Франківської області на придатність для використання у виробництві винних і коньячних бочок. Встановлено можливі обсяги заготівель винного і коньячного клепкового кряжа.

Древесина дуба, клепка, клепковый кряж, макроструктура древесины, фенольні речовини, ароматоутворюючі речовини древесины дуба

В статье представлена технологическая оценка сырьевых ресурсов древесины дуба Ивано-Франковской области на предмет пригодности для использования в производстве винных и коньячных бочек. Определены возможные объемы загоовок винного и коньячного клепочного кряжа.

Древесина дуба, клепочный кряж, клепка, макроструктура древесины, фенольные вещества, ароматобразующие вещества.