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The possibilities of growing common grape vine (*Vitis vinifera* L.) in the conditions of the Lower Beskids area

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Abstract. The aim of this work was to examine the possibility of growing vines in climatic and soil conditions of the Lower Beskids region. Therefore, a survey was conducted on cultivation, preservation, protection of vines and wine production technology. The design of the vineyard and the wine processing plant was planned precisely. A profitable vineyard grown in the Lower Beskids is only possible if the decision is well-planned. The investment will succeed if certain conditions are met, i.e. a suitable place, grape varieties that are resistant to frost; adaptation to climatic and soil conditions. Viticulture, together with wine production and tasting, may be the main attraction of agritourism farms.
Key words: *suitable place, viticulture, cultivation, preservation, protection, production technology*

INTRODUCTION

The world history of wine goes back over 6 thousand years. The oldest archaeological traces of wine-making were found and documented in Georgia and Armenia. In Poland, the precursors of wine production were the Benedictines and the Cistercians, who grew grapevine by their monasteries and made wine for the liturgical purposes (Myśliwiec 2009, Bosak 2011, 2013). Later on, vineyards were also set up by hospitals, because wine was believed to be an effective remedy for a number of illnesses. Monastery vineyards were also leased to individuals. At that time, wine began to be perceived as a beverage. In consequence, its market value increased. In the 13th century, wine became a luxury of the rich, whereas the 14th century brought a breakthrough. It was a period of the most rapid proliferation of vineyards. Even townspeople set up their own vineyards. Most of them were located in Silesia, Zielona Góra, Poznań, Toruń, Płock, Sandomierz, Lublin, and Cracow [Myśliwiec 2013]. Presently, for several years, Poland has seen an increasing interest in vineyards and wine-making. The reason behind this is mainly the warmer climate in Poland creating more favourable conditions to grow grapevine, but also the popularity of enotourism, growing new varieties of grapevine more adapted to the Polish climate, consumers' growing awareness of the dietary and health benefits of wine, as well as farmers looking for new ways and possibilities to intensify farming (Tarko et al., 2008, Czech et al., 2009). Podkarpacie is a region with old local wine-making traditions (Bosak 2013, Myśliwiec 2013). The region has played an important role in the revival of Polish wine-making [Bosak 2013], since not all regions offer such favourable conditions for vineyards. The most suitable for Polish vineyards are south-west-facing slopes with the height of up to 300 metres above sea level. The temperature requirements of grapevines are most accurately reflected by the so-called sum of active temperatures (SAT), i.e. the sum of average daily temperatures on all days of the growing season with a temperature >10°C. The SAT values for specific varieties are as follows: very early – 2000–2200°C, early – 2200–2500°C, medium early – 2500–2700°C, medium late – 2700–2900°C, late – 2900°C. It is assumed that the SAT value, necessary for a satisfactory yield of grapevine, is between 2500–2600°C (Kopeć 2009, Myśliwiec 2009, Bosak 2013, Irimia et al., 2017) (Figure 1). The Podkarpackie Voivodeship is located in Region II with relatively cold winter weather and the lowest temperature below -25°C. With a strongly developed root system, vines require deep, clayey-sandy soil with an increased water capacity. In the case of poorly drained, too heavy soil, e.g. loamy soil, vines grow poorly, especially the young ones. Moreover, European vine varieties require soils with a nearly neutral pH level (6.5-7.2). It is very important to lime the soil during their growth (Siebielec et al., 2012). A lot of interspecific hybrids, in particular related to *Vitis riparia* and *Vitis labrusca*, grow well and provide high yield also in slightly acidic soil (pH 5.5-6.0). In general, soil fertility is a desirable feature in case of most varieties (Myśliwiec 2009, Irimia et al., 2017).

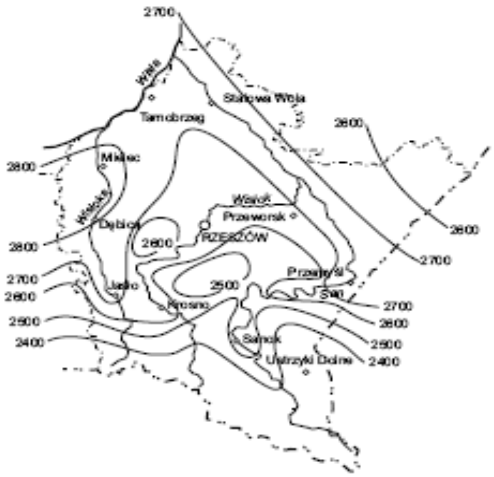


Figure 1. Total Active Temperatures (SAT) in the Podkarpackie Voivodeship
Source: own research based on Myśliwiec 2009

Larger commercial vineyards are established in warmer regions, where the mezzo-climate conditions are most favourable. The majority of authors (Myśliwiec 2009, Grabowski & Korytowski 2009, Mazurkiewicz-Pizło 2010, Marcinkowska 2010, Bosak 2013, Irimia et al., 2017) emphasise that there is a chance for maintaining wine production profitability only if the SAT criteria are met. Vine growing also requires the knowledge on the biology of the species, vine cultivation, protection from diseases and pest, and harvesting. Therefore, the aim of this paper was an attempt to assess the possibility of developing vineyards in the territory of the Lower Beskids.

RESEARCH METHOD AND CONDITIONS

The aim of the paper was fulfilled based on surveys and a SWOT analysis. The surveys were conducted in the Lower Beskids in the period from April–September 2017, among others in the Skołyszyn municipality (Figure 2).

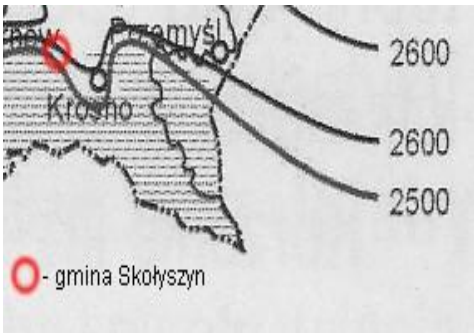


Figure 2. Total Active Temperatures (SAT) in the Beskid Niski
Source: own research based on Myśliwiec 2009, Bosak 2013

The research involved a targeted survey containing 24 questions that enabled the evaluation of the possibility to grow grapevine and its influence on a number of aspects. The questionnaire was distributed among 150 vineyard owners in the Lower Beskids. It included questions on the vineyard location, growing conditions, method of setting up and running the vineyard, fertilisation and cultivation of vines, protection from diseases and pests, grape harvesting methods, purpose of the crops, profitability of growing grapevines and wine-making, and the promotion of the products. The structure of the respondents in terms of gender, age, and education is presented in Table 1.

Table 1. Characteristics of respondents

Specification	The age range				
	21-35	36-45	46-55	56-65	>65
	Participation in particular age groups within particular categories				
	0%	0%	65%	35%	0%
	Gender				
Women	2%	18%	35%	15%	15%
Men	0%	0%	65%	35%	0%
	Education				
Primary	0%	0%	0%	0%	0%
Vocational	0%	0%	0%	0%	0%
Secondary	0%	0%	9%	0%	0%
Higher	%	%	91%	0%	0%

Sources: own research

The vast majority of the surveyed vine growers were men, making up 95.5% of the survey participants. Very rarely, vineyards were run by women (9.1%). Most respondents – 65% of the vine growers – were in the working age of 46–55, whereas as many as 35% were aged 56–65 (Table 1). Most respondents held a higher education degree (91%), some completed secondary education (9%) (Table 1). This implies that in order to set up a vineyard, specialist knowledge is required, which can be obtained through higher education.

For the purpose of statistical calculations, the Statistica v. 10.1 PL software was used, including descriptive function analysis.

FINDINGS AND DISCUSSION

The structure of Lower Beskids farm area was fragmented. Most vineyard owners had farms with a surface area of 5–15 hectares, (55% of the respondents); 36% of the surveyed vineyard owners declared farms with a surface area of 1–5 hectares, whereas 9% stated that their farms covered an area of 15–30 hectares (Figure 3).

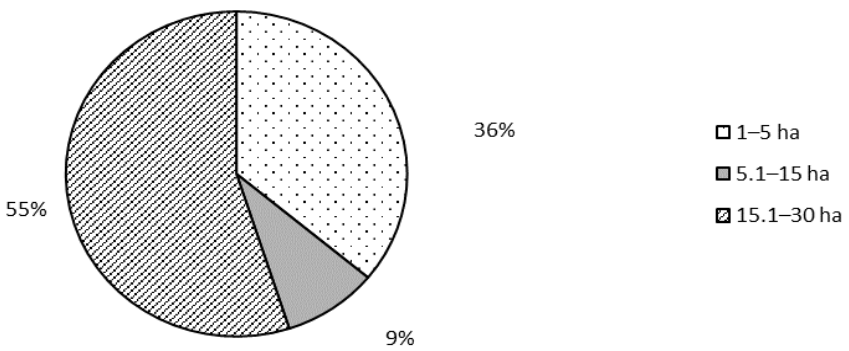


Figure 3. Surface of the surveyed farms
Source: own research

The surface area of vineyards in the surveyed farms was also significantly diversified, ranging from 0.5 to 5 hectares (Figure 4). The greatest part of the respondents (49%) owned very small vineyards with an area of up to 0.5 hectare. 32% of the survey participants had vineyards covering 1.1–2 hectare; 14% of the respondents owned vineyards with a surface

area of 0.5–1 hectare, whereas only 5% were the owners of commercial vineyards of 2.1–5 hectares (Figure 3). Such ownership structure of the surveyed farms points to their significant fragmentation. According to the Central Statistics Office (2017), farming in this region involves mainly small family farms with no large revenue, therefore setting up a vineyard, even not a big one, with a surface of 0.5–1 hectare can have a significant influence on the income of the family farm.

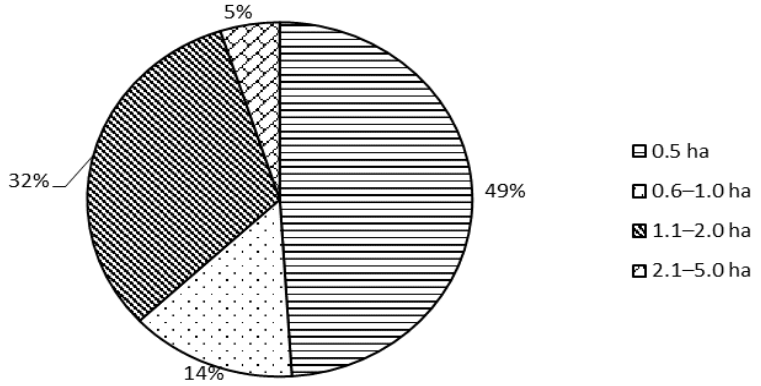


Figure 4. Vine growing surface
Source: own research

Usually, vine growing in a farm is carried out by 1–3 people, which was the case for >50% of the survey participants. Only 30% of the surveyed vineyard owners declared hiring extra help in peak season, e.g. for harvesting (Figure 5).

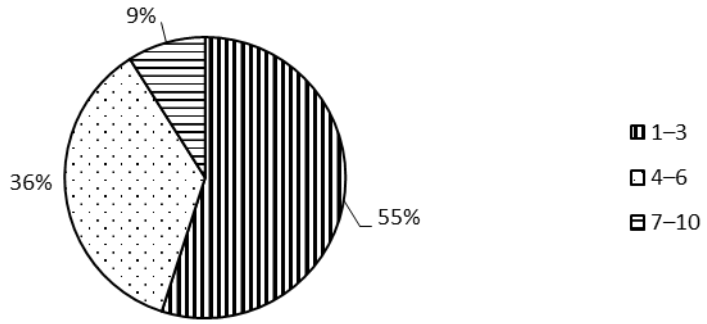


Figure 5. Number of people involved in vine growing
Source: own research

Most often, the respondents declared they had run the farm for 6–10 years (77%); 18% for only 2–5 years, and 5% for 11–25 years (Figure 6). The majority of the plantations were set up only 6–10 years ago, which may be connected to the growing awareness of the health value of grapes and wine, as well as the increasing popularity of such businesses among farmers in the Lower Beskids and the profitability of vine growing (Tarko et al., 2008, Krośniak et al., 2009, Radziwiłko 2012).

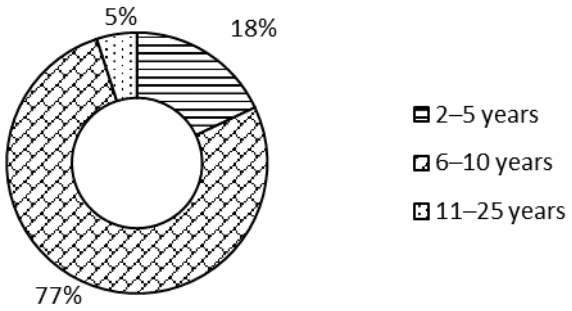


Figure 6. Period of running the farm
Source: own research

The main reason behind setting up a vineyard by their owners was the desire to do something different, or a hobby (65% and 30.5% respectively), whereas it was the main source of income for as few as 4.5% of the respondents (Figure 7). According to Mańko et al., (2014) and Woźniczko & Orłowski (2015), the current status of a vine grower and wine maker has changed considerably, with more and more people taking up such activity for profit, as compared to the hobbyists who were until recently the largest group of vineyard owners.

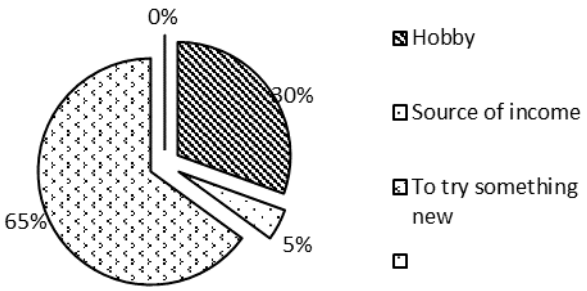


Figure 7. Reason for setting up the vineyard
Source: own research

The survey participants believed that the microclimate at their farms was favourable for vine growing, and most vineyards were south-west-facing, as declared by 95% of the respondents (Figure 8). According to Krupa & Stokłosa (2015), the Podkarpackie Voivodeship has become possibly one of the most attractive wine tourism regions. It is a typical sub-mountainous area, the bulwark of the Carpathians, characterised by gentle slopes, clayey soil, hot summers, and sunny autumns.

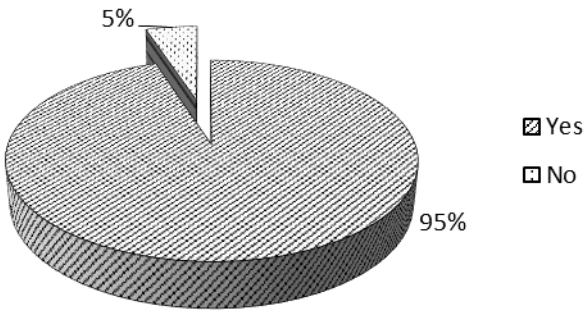


Figure 8. Favourable microclimate
Source: own research

Vineyard owners declared they obtained seedlings from nurseries or from their own plantings, mainly from layers or rooted cuttings (Figure 9).

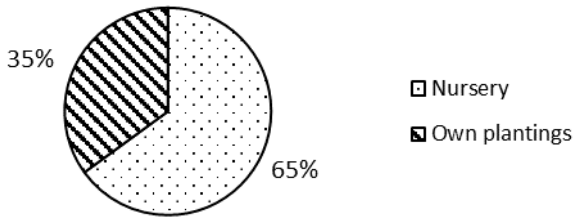


Figure 9. Sources of vine seedlings
Source: own research

Grapevine is mainly grown with the use of the conventional system (91%) (Figure 10), which involves organic and mineral fertilisers (Figure 11) as well as chemical protection against diseases and pests (Figure 12). According to Bell & Hensche (2005), Ekbic et al., (2010) and Domagała-Świątkiewicz & Gąstoł (2013), fertilisation is an important part of grapevine growing. It increases the vegetative growth of vines and the yield, as well as improves the quality of grapes.

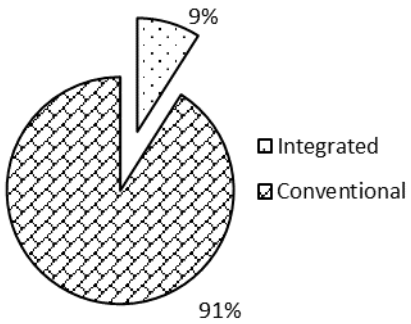


Figure 10. Vine growing system
Source: own research

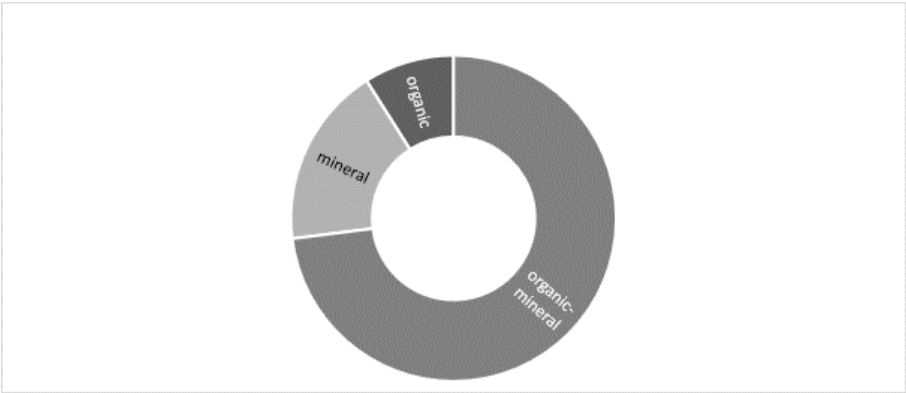
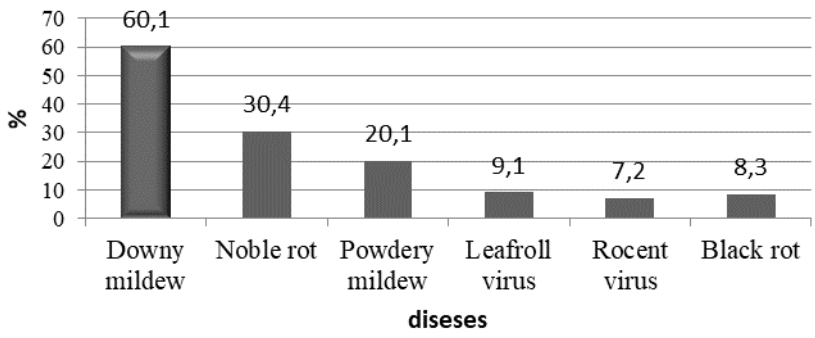
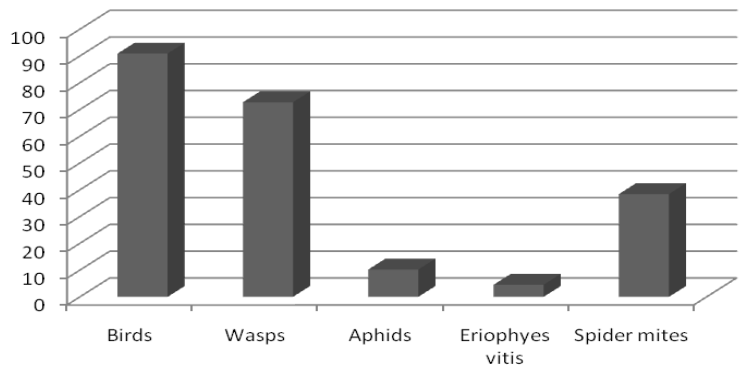


Figure 11. Vine fertilisation
Source: own research

The most frequent diseases in vineyards include downy mildew, powdery mildew, and noble rot; and much more seldom – leafroll virus, rocent virus, or black rot (Figure 12). The most frequent pests, according to the survey participants, were birds and wasps, more seldom aphids, *Eriophyes vitis*, and spider mites (Figure 13).



The sum of infectious diseases is over 100%, as the respondents had the opportunity to choose several answers.
Figure 12. Diseases on vine plantations
Source: own research



The sum of infectious diseases is over 100%, as the respondents had the opportunity to choose several answers
Figure 13. Vine pests
Source: own research

The basic methods of protection against grapevine diseases at the plantation included planting resistant varieties, biological protection, natural methods, or the least popular direct limiting of the sources of infection (Figure 14). Protection against pests usually involved applying a special mesh to deter birds, destroying wasp nests, and chemical protection (Figure 15). According to Czulak (2011), using varieties resistant to pest attacks is the oldest and most effective gardening method. A good example is the phylloxera, which is deadly to European varieties of *Vitis vinifera* and has caused significant wine production downturn in Europe, whereas it is harmless to the American variety. According to Kapłan & Suszny (2015), effective vine growing requires healthy nursery stock.

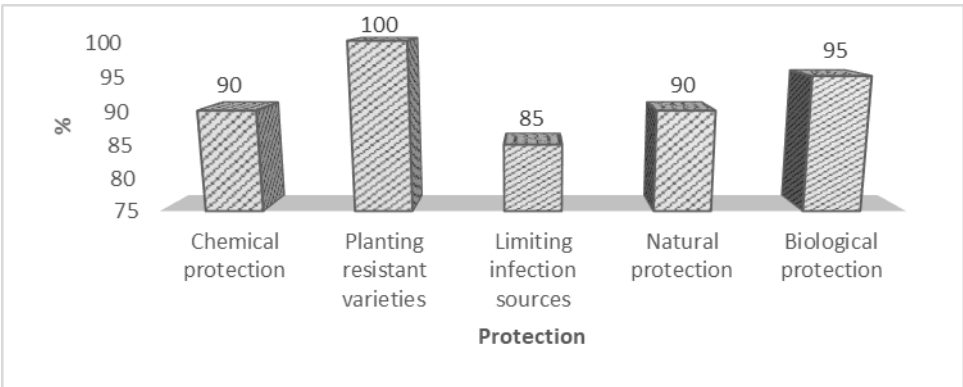


Figure 14. Protection from vine diseases
Source: own research

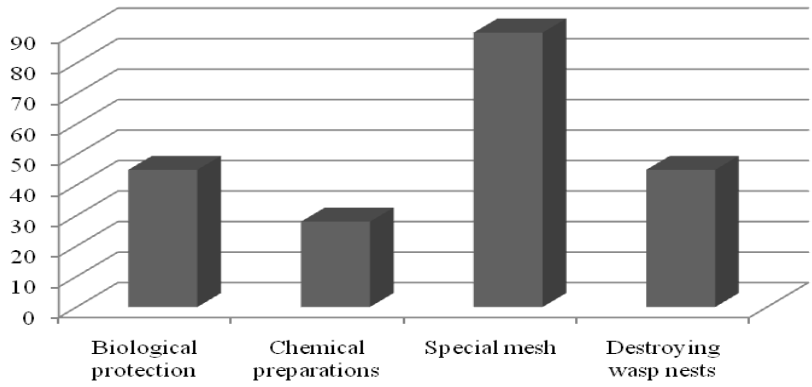


Figure 15. Protection from vine pests
Source: own research

The primary frost protection is covering, mainly earthing up or half-covering with earth (Figure 16).

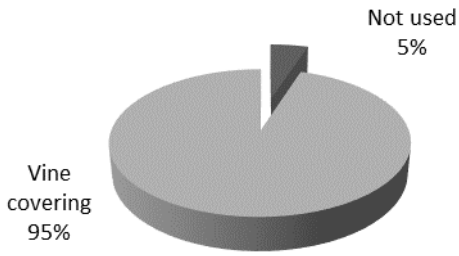


Figure 16. Frost protection
Source: own research

Vine training is most frequently based on the Guyot system, or more seldom, on diagonal or bent wires, and Y-shaped trellising (Figure 17). According to Bosak (2013), the system works best for dessert and must grapes. In the case of high-yield varieties, a double Guyot wire is recommended, and for dessert varieties with a tendency of alternate bearing, it is recommended to use a single Guyot wire (Myśliwiec 2009, Bosak 2013).

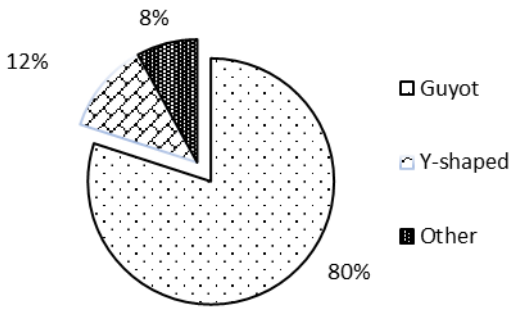


Figure 17. Canopy training
Source: own research

The basic way of soil cultivation for grapevine growing is mechanical fallow (80%), whereas only 20% of the respondents use furrow sodding (Figure 18).

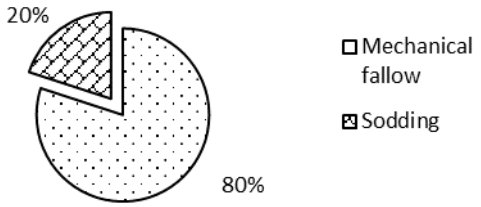


Figure 18. Soil cultivation for vine growing
Source: own research

The basic methods of improving the fruit quality include: bunch thinning, leaf removal, tops pruning before flowering, cutting off lateral shoots, or shoot and flower thinning (Figure 19). According to Dobrowolska-Iwanek et al., (2014), the primary aim of pruning is to achieve balance between fruit production and vegetative growth. Leaving a larger number of buds results in more shoots and fruit and in turn – higher yield and increased shading, which may affect the health of vines. An excess of grape clusters has a negative effect on their size and crop quality, as well as the harvest time and frost resistance of the plants. According to Daniel et al., (2012) and Białobrzeska & Opała (2012), the right management of shoot, leaf and fruit amount helps optimise the production of good-quality grapes resistant to pathogens.

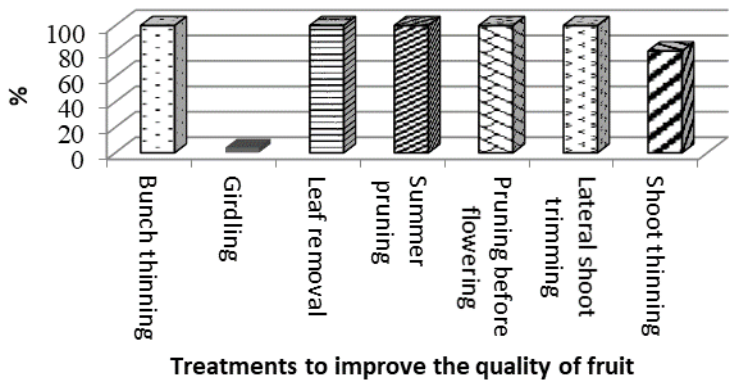


Figure 19. Fruit quality improvement *
Source: own research

In terms of vine growing, the most costly, according to vineyard owners, were the seedlings (54%). Plant protection products represent 14%, fertilisers – 9%, training and related travel costs – 5%, trellising and other costs – 18% of direct costs (Figure 20).

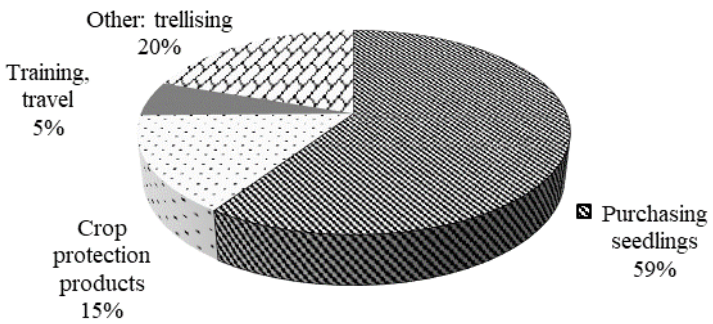


Figure 20. Vine-growing costs
Source: own research

All of the survey participants responded that they grew grapevines for wine production, and in addition, they used the fruit for preserves or direct consumption (Figure 21).

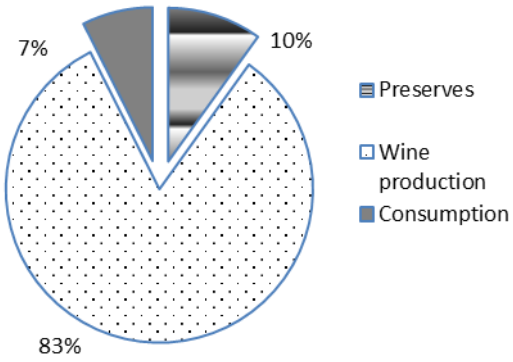


Figure 21. Fruit purpose
Source: own research

The respondents unanimously stated that they promoted their produce mainly at such events as: “Wine Days” or “Winemakers Convention” (Figure 22).

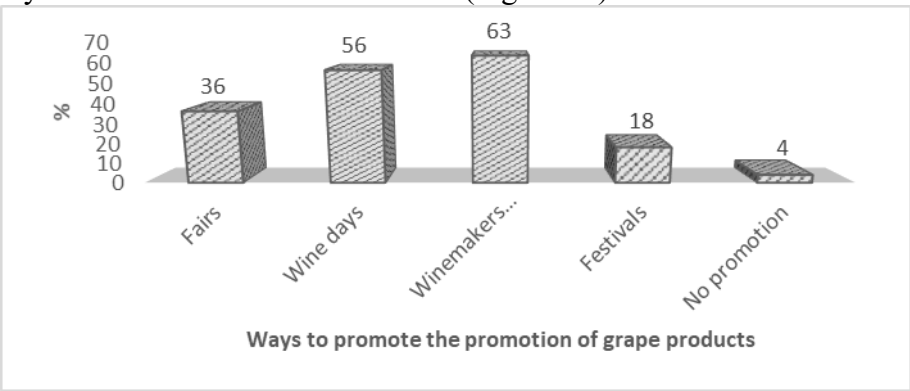


Figure 22. Methods of grape product promotion
Source: own research

Only 9% of the survey participants combined wine-making with agrotourism services, whereas the rest of them focused solely on running a vineyard (Figure 23). Combining a vineyard with agrotourism is an optimal solution for Lower Beskids farms, mainly for startups. According to Mazurkiewicz-Pizło (2010) and Marcinkowska (2010), direct sales are the key, because the visitors would like to get to know not only the taste of wine, but also the whole process of wine-making, including the tools and storage facilities.

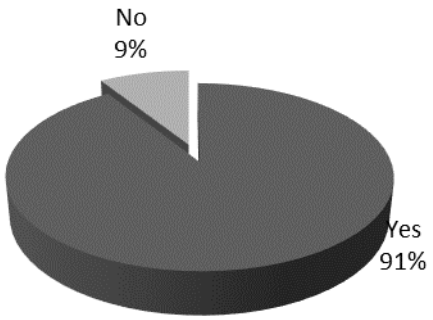


Figure 23. Combining a vineyard with agrotourism
Source: own research

All respondents claimed that their vineyard were profitable, so we may expect that the existing ones will be expanded and new ones will appear in the region (Figure 24). Mańko et al., (2014) have come to a similar conclusion.

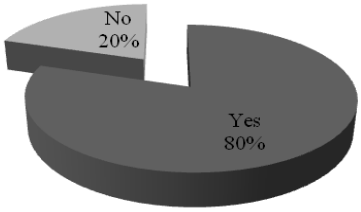


Figure 24. Does the winery bring profit?
Source: own research

Vineyard owners observed increasing interest in wine tourism in the entire Podkarpacie and they planned to increase their vineyard area. In order to improve and expand their knowledge, 91% of them regularly attended various kinds of wine training, taking place mostly at the Agricultural Advisory Centres, the Wine Institute, but also abroad, organised by the Winemakers Association (Figure 25). According to Sokół (2015), in order for wine tourism to grow, it is necessary for vineyard owners to cooperate more with the tourism industry, e.g. travel agencies, hotels, restaurants. It is also important for local governments to promote enotourism in collaboration with winemakers' organisations and other stakeholders in Poland (Krupa & Stokłosa 2015).

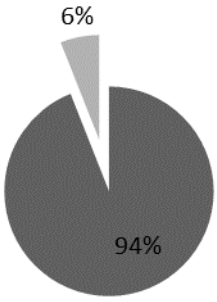


Figure 25. Participation in wine-making training
Source: own research

Future winemakers should be able to apply for EU funds for new vineyards and wineries, as well as take part in programmes supporting vine growing and wine production. The Lower Beskids vineyard owners expressed significant interest in setting up their own enotourism farms.

SWOT Analysis

The SWOT analysis focused on four factors:

- Strengths – the factors that are the strong side of Lower Beskids, which are an advantage to wine-making and enotourism;
- Weaknesses –the factors that are the weak side of the region and are to be eliminated;
- Opportunities – external factors, not directly tied to the behaviour of the local community, but with the right actions on their part, they can help develop wine-making in the Lower Beskids;
- Threats – external factors not directly tied to the behaviour of the local community, but possibly hindering the region's development.

The SWOT analysis of the strengths and weaknesses of the region involved: the location of the Lower Beskids, the demographic factors and the local labour market situation,

conditions favourable to economic development, economy, technical infrastructure, culture and enotourism development.

The **SWOT analysis** was conducted for vineyards as an enotourism product. Its aim was to emphasise the strengths and weaknesses, as well as to identify the opportunities and threats that can occur in Podkarpacie.

Strengths:

- there are conditions favourable to horticulture;
- climate and soil conditions suitable for vine growing in the Lower Beskids;
- advantageous age structure of the society reflected in a large percentage of pre-working age labour;
- increasing number of well-educated people;
- large availability of unemployed labour;
- increasing business activity of the population;
- ancient tradition and history of the Lower Beskids region;
- well-developed cultural infrastructure, active cultural centres;
- popularity of enotourism, which is the fastest growing sector of the global tourism industry;
- Poland is one of few EU countries with no ban on setting up new vineyards;
- possibility of obtaining EU funds;
- wine from the local vineyards is a unique tourism product;
- high quality of the wine;
- winemakers programmes, e.g. “The Vineyards of Podkarpacie”, “Wine trails in Podkarpacie”, that support the development of vine growing and wine production;
- publicity and media support.

Weaknesses:

- lack of regulations on e.g. vine varieties for wine production, wine-making guidelines, including quality wine-making and labelling;
- the obligation of small farm owners to pay social security (ZUS) contributions;
- a small number of agrotourism farms making their own wines;
- poor promotion of the existing enotourism farms;
- poor promotional activities of the local government;
- problems with obtaining information on existing vineyards (e.g. little information online);
- insufficient infrastructure (the condition of the roads, accommodation facilities, gastronomy).

Opportunities:

- the Ministry of Economic Development in collaboration with the Ministry of Finance are working on a draft regulation on repealing the wine labelling system;
- Corrigendum to Regulation (EU) No 251/2014 of the European Parliament and of the Council on the definition, description, presentation, labelling and the protection of geographical indications of aromatised wine products and repealing Council Regulation (EEC) No 1601/91 (OJ L 105, 8.4.2014);
- enotourism can become an additional source of income for agrotourism farms, and the development of this sector can result in an increase of work places, in particular in the countryside;
- growing interest in the new type of tourism among visitors;
- promotion of vineyard towns in Poland and abroad;
- the satisfaction of agrotourism farm owners with their business;

- the location of the Lower Beskids near the Polish border.

Threats:

- unless the situation changes soon, Polish farmers may lose the opportunity to sell their own wine, because Poland may become subject to EU limits, and if nothing changes, local producers will be substituted with foreign investors;
- due to the lack of regulations, the grey market may grow in Poland;
- convenient location of the cities of Rzeszów, Mielec, and Dębica resulting in the outflow of investors and qualified labour;
- poor enotourism offer;
- increasing land prices.

CONCLUSIONS

Based on the analysis of the survey responses and the evaluation of the Lower Beskids conditions, we can conclude that the development of wine-making in the region is viable, because of the favourable soil and climate conditions, the development of local agrotourism, as well as wine-making regulations amended by the Act of 2011. A significant factor in setting up a vineyard is the selection of the right vine varieties resistant to diseases, pests, and low temperatures. The favourable location of a vineyard can provide the optimal light conditions and support the fruit ripening process. An important element of the next step – wine production – is the right adaptation of the facilities, which should be functional and allow for quick and convenient grape processing.

To sum up, based on the SWOT analysis regarding the development of wine-making and enotourism in Poland, it turns out that there are more strengths than weaknesses and that the opportunities outweigh the threats. The biggest issue is the wine-making law. However, thanks to such institutions as the Association of Podkarpacie Winemakers we can hope that we will soon be able to purchase good Polish wine directly from the producer with no need for labelling by the winery owner.

On 1 January 2009, the Excise Duty Law came into force, which resulted in changes in the wine-making sector (Mańka et al., 2014). Apart from the legal issues, the remaining weaknesses and threats seem less important to the winemakers of Podkarpacie. With the appropriate means, promotional methods, training programmes and possible financial support granted by the EU, in a few years, the Lower Beskids may witness the birth of fully-fledged enotourism farms. Favourable vine-growing climate, the increasing number of vineyards, and a higher quality of wine are just a few elements providing a good starting point for a discussion on a development of a series of enotourism farms in the region.

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