

## Variety «Rebula» (*Vitis vinifera* L.) determines the terroir Goriška brda «Collio» in Slovenia

## Le cépage « Rebula » (*Vitis vinifera* L.) détermine le terroir Goriška brda «Collio» in Slovenia

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**Abstract:** A «terroir» is a group of vineyards from the same region, belonging to a specific appellation, and sharing the same type of soil, weather conditions, grapes and wine making savoir-faire, which contribute its specific personality to the wine. White wine variety «Rebula» or «Ribolla gialla» is a local and traditional variety, which is mentioned already in XIII. century like variety for tax paying and merchandise. «Rebula» became the most popular and known variety from «Goriška brda» winegrowing region; therefore it is competitive to terroir determination, including main ecological characteristics indeed. The vineyards with «Rebula» are located on three different soil types, saturated soil (active lime, appearance of grits), anthropogenized soil (vitisol, larger mineral, particles and active lime) and coluvial soil (active lime, high groundwater level) and also on different altitudes, where different grape quality of «Rebula» is observed. The four different *terroirs* of soil type and climatic characteristics are determined in Goriška brda, where the vineyards of «Rebula» are cultivated on terraces, plateaus and plans. The production of «Rebula» still increases, therefore the best interactions among weather conditions, soil type and cultivation practices of «Rebula», for the same object as the best grape quality, have to be determined in near future.

**Key words:** grape, Rebula, quality, terroir, Goriška brda

### Introduction

Slovenia has a long tradition in viticulture, where the first statements about it extend into Roman Empire. «Rebula» or «Ribolla» is a local white variety, which grown only in Slovenian and Italian winegrowing regions called Goriška brda and Collio. The regions are divided by national boundary, but since Slovenia has become a member of European Union the frontier has dropped. The regions of Goriška brda and Collio have a common history according to variety «Rebula», where it has become a most popular and known wine, especially in Goriška brda winegrowing region. The first announce of the variety «Rebula» was observed in 60 - 65 years after Christ by Lucius Janius Moderatus Colomella in a book «De re Rustica» like «Rubellana alubelis», «Rabuncula» or «Rabucula». With the original name «Rebula» was written in XIII. century like variety for tax paying and merchandise. «Rebula» should be derived from the word «*ribollire*», what in Italian language means anew fermentation. Governor of Udine in 1549 forbidden cut out the vine plants of «Rebula» (rebolla, ribuelle, rabuelle, ribuelle zale, ribolla di Rosazzo, raibola, rabola), because it gave the source of salary for inhabitants from that region (Cosmo and Polsinelli, 1957; Radikon *et al.*, 1995).

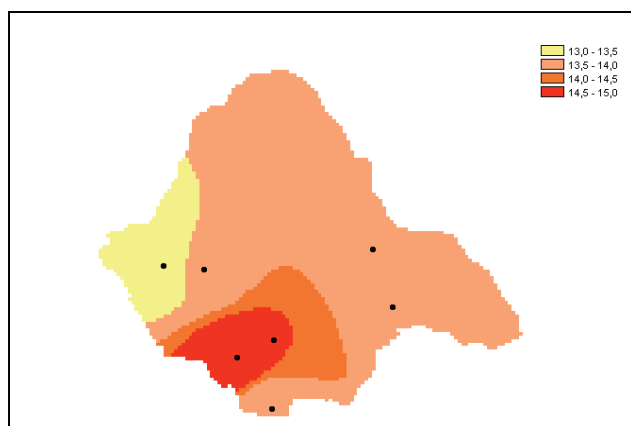
At the moment in Goriška brda winegrowing region the variety «Rebula» plays a part of 35 % of total grape production, what could be also presented in total of 560 hectares (Škvarč *et al.*, 2002; Register, 2005). «Rebula» has a potential to produce a great grape quantity per vine with average values of sugar 17 – 22 % Brix and of total acid 4.6 – 6.5 g L<sup>-1</sup>, what bring alcohol around 9.5 – 12.0 % vol. or more (Nemanič, 1999; Peterlunger, 2000). «Rebula» grown in the vast winegrowing areas of Goriška brda which differ in macroclimatic and soil properties, but also in exposition, inclination and height above sea level. The differences in grape quality of «Rebula» were observed according to grown area, which could be described with climatic, soil and growing properties, therefore the optimisation of its growing necessities are essential, especially for *terroir* determination.

## Material and methods

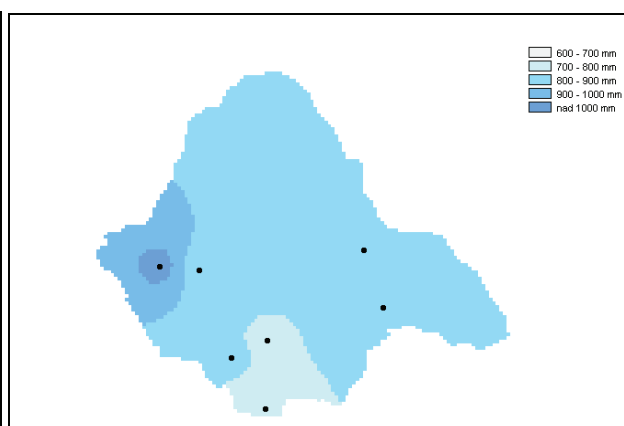
In the study was included variety «Rebula» according to soil, climatic properties and to momentary cultivation practices in all viticulture areas into Goriška brda (Slovenia). Goriška brda is divided into 15 winegrowing areas, with average vineyard area of 140 hectares. The already known data about soil types, climatic characteristics and grape quality data were taken into account and their interactions were observed. The soil types were taken from the National Pedology Map of Goriška brda, but the climatic parameters were observed according to annual data from seven automatic Adcon climatologically stations dispersed around winegrowing area for period between 2000 and 2004. The cultivation practice of each vineyard was taken from National Register of Grape and Vine Producers collected by Ministry of Agriculture, Forest and Food (Register, 2005). The grape quality was annotated by biggest wine cellar in the region Vinska klet Goriška Brda. The all data was collected and statistically processed by Stathgraph 4.00 and Idrisi programs.

## Results and discussions

The study took first into account the main terroir parameters, climatic (average air temperature, precipitations and evapotranspirations) and soil properties (type of soil) which are shown in figures 1, 2, 3, 4 and in Table 1. According to average air temperature Goriška brda could be divided into four zones, within air temperature differs maximum for 2 °C. The coldest areas are located in west but warmest in southwest part of Goriška brda. Differences in air temperature could be also bind to average precipitation, where the coldest part of Goriška brda took the biggest quantity of precipitation (more than 1000 mm). The most dry part of Goriška brda is the south site, where the average precipitation are less than 800 mm. the biggest vineyard areas are into zone with average air temperature around 13.5 – 14.5 °C and precipitation between 800 and 900 mm (figure 1 and 2). The average potential evapotranspiration (ETP) was also observed. The biggest ETP (720 – 740 mm) was determined in south-west part, but the lowest (680 – 700 mm) in west, south and east-central part of Goriška brda (figure 3).



**Figure 1 - Spatial distribution of average air temperature (°C) in period of 2000 - 2004 in Goriška brda. The black points present automatic climatology stations.**



**Figure 2 - Spatial distribution of average precipitation (mm) in period of 2000 - 2004 in Goriška brda. The black points present automatic climatology stations.**

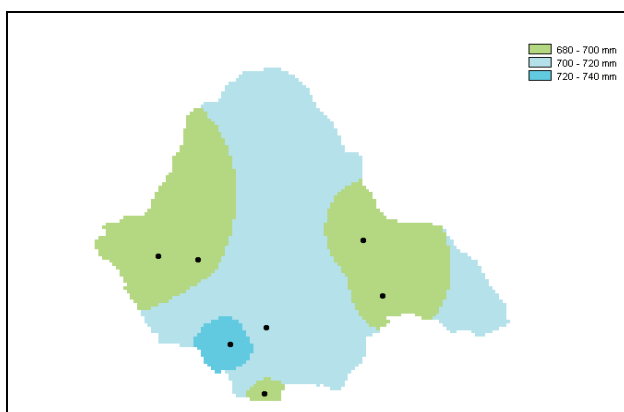


Figure 3 - Spatial distribution of average potential evapotranspiration (mm) during growing season in period of 2000 - 2004 in Goriška brda. The black points present automatic climatology stations.

Table 1 - Soil identification and description (Stritar, 1991, FAO, 2001).

Soil unit	FAO Classification	Factor description		Landform	Most frequent use
		Internal	External		
Saturated soil (1279)	Calcaric Leptosol	Active lime, Appearance of Sandstone	Exposure, Access, Relief	Plateaus, Terraces	Vineyards, Forests, Pastures
Anthropogenized soil (rigosol) (1234)	Anthrosol	Larger mineral particles, Active lime	Access, N/S exposure size of terraces	Terraces	Vineyards, Orchards, Nurseries
Coluvial soil (1085)	Calcaric Regosol	Active lime, Groundwater		Planes	Vineyards, Orchards, Horticulture, Lucerne

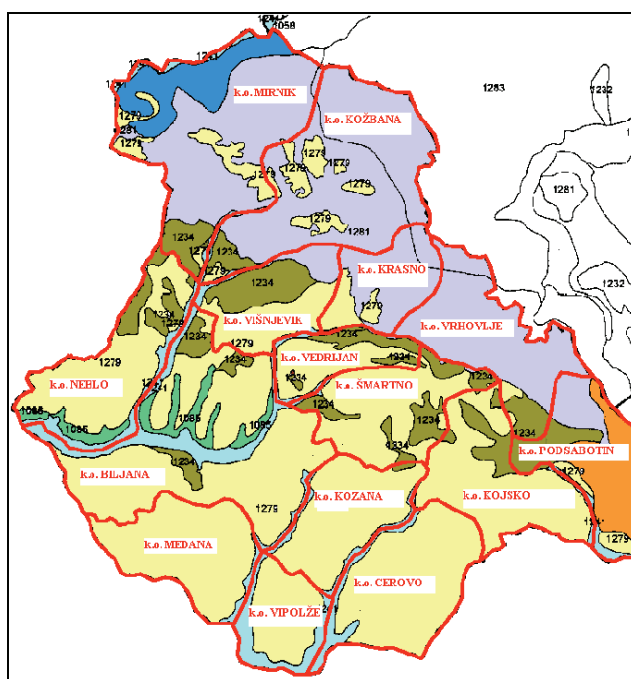
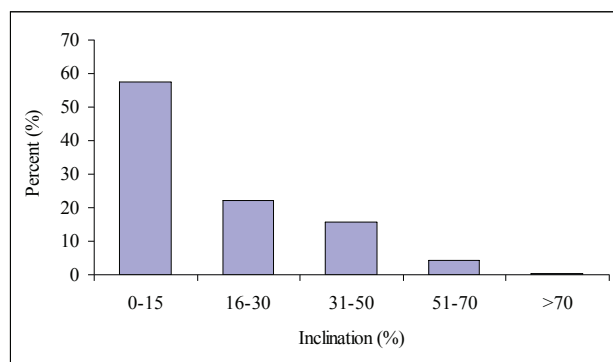
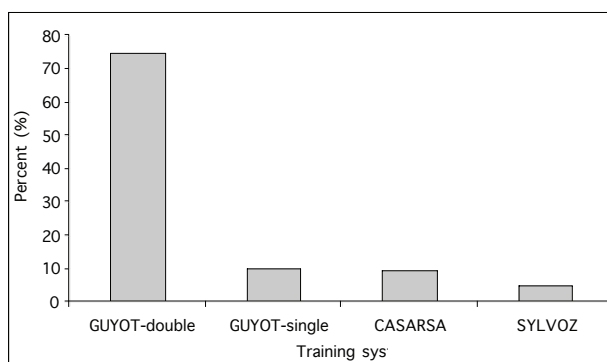


Figure 4 - Pedology map of Goriška brda winegrowing region.

The soil types are geographical presented in figure 4 and described in table 1. The most frequent type of soil is calcareous leptosol; saturated soil (1279) with active lime, where are settled vineyards and forests. The second most frequent soil type is anthrosol, rigosol (1234) and the less vineyard areas are on coluvial soil, calcareous regosol (1085). The calcareous leptosol known as «*fliš*», but also rigosol rounded of most area, where the vineyards are settled on terraces with big inclination. Over than 50 % of vineyards are on inclinations bigger of 16 % (figure 5). The system of terraced vineyards is recommended because of strong precipitation in summer time, what reduce vast soil erosion. Around 75 % of the Rebula vines are grown on double Guyot, followed by casarsa and single guyot (figure 6). The double guyot gives to the «Rebula» the optimal relation between vegetation and fertility, confirmed by Ravaz index.

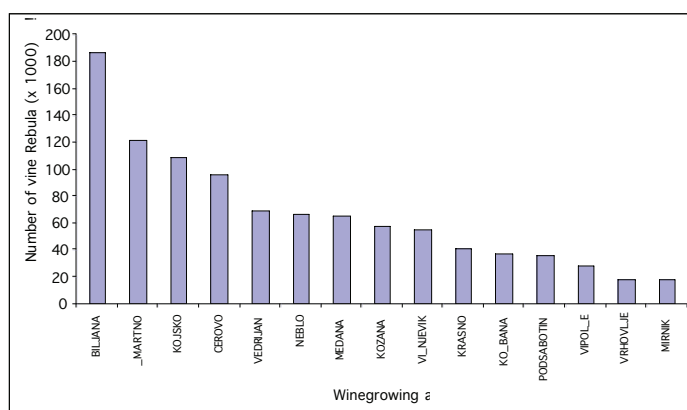


**Figure 5 - Percent of vineyards of «Rebula» according to inclination in Goriška brda winegrowing region.**

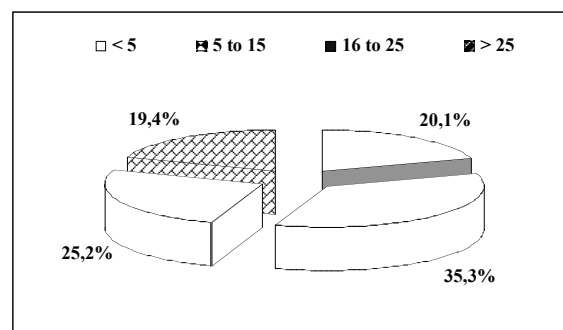


**Figure 6 - Percent of vineyards of «Rebula» according to training system in Goriška brda winegrowing region.**

The total number of «Rebula» vines according to winegrowing areas is presented in figure 7. The half number of total «Rebula» vines is grown in five, since 15 winegrowing areas in Goriška brda, where Biljana (cca. 190.000) takes the biggest «Rebula» vines number, followed by Šmartno, Kojško, Cerovo and Vedrijan. Comparison of soil type (figure 4) and number of «Rebula» vines (figure 7) confirms that «Rebula» grown above all on *fliš* soil and terraced vineyards, where the average climatic characteristics (air temperature, precipitation and ETP) were presented. The vineyards differ also in age, where more than 55 % of vineyards are younger than 15 years. The young vineyards with «Rebula» confirm that it has become a popular and a request variety, where the successes should be expected presently.



**Figure 7 - Number of vines of «Rebula» according to winegrowing area in Goriška brda winegrowing region.**



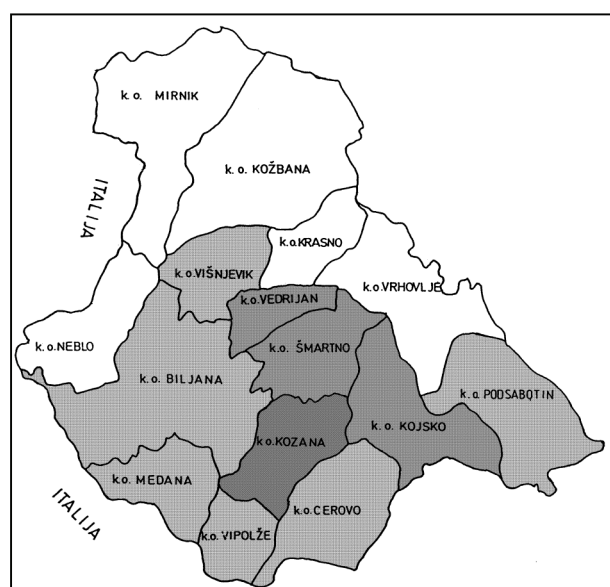
**Figure 8 - Percent of vineyards of «Rebula» according to vineyard years in Goriška brda winegrowing region.**

The grape quality of last 5 years, according to winegrowing areas were collected and given in table 2. In last 5 years they produced average more than 3 million kg of grape «Rebula», although the quantities vary from

vintage to vintage, especially the grape vintage in 2003. The less average sugar contents (17.17 % Brix) was determined in year 2001, but biggest (19.09 % Brix) in year 2002. The average sugar contents have not great correlation with grape quantity, therefore climatic and soil properties were taken into detail. According to average sugar contents the four groups of winegrowing areas with similar grape quality were obtained and given in figure 9. The sweetest grape of «Rebula» (> 18.6 % Brix) was produced in area of Kozana, followed by areas Kojsko, Šmartno and Vedrijan. The least amounts of sugar in «Rebula» grape were determined in areas of Neblo, Mirnik, Kožbana, Krasno and Vrhovlje.

**Table 2 - Grape quantity and quality of «Rebula» according to winegrowing areas in Goriška brda winegrowing region.**

Vinegrowing area	2000		2001		2002		2003		2004	
	Quantity (kg)	(%Brix)	Quantity (kg)	(%Brix)	Quantity (kg)	(%Brix)	Quantity (kg)	(%Brix)	Quantity (kg)	(%Brix)
BILJANA	842.109	17.98	816.587	17.11	420.126	19.15	412.466	18.24	698.259	18.50
CEROVO	364.649	18.31	365.646	17.65	237.220	18.56	200.691	18.30	316.555	18.77
KOJSKO	393.095	18.10	390.756	17.31	216.708	19.26	208.939	18.05	332.498	18.81
KOZANA	215.251	18.70	242.915	17.59	93.550	19.59	106.577	18.23	187.467	18.83
KOŽBANA	136.290	18.32	127.679	16.58	68.114	18.94	37.123	18.95	95.730	18.76
KRASNO	148.947	17.76	137.435	16.47	72.541	18.84	61.402	18.29	129.877	18.23
MEDANA	266.150	18.12	261.671	17.61	158.217	18.88	151.843	17.83	221.874	18.08
MIRNIK	73.993	18.05	72.497	17.01	50.339	18.43	41.110	18.25	64.009	18.26
NEBLO	270.414	17.87	289.248	16.99	160.736	18.58	135.949	18.32	218.335	18.70
PODSABOTIN	116.092	17.92	91.471	17.39	59.477	19.35	57.453	17.86	101.253	18.57
ŠMARTNO	426.489	18.19	461.749	17.03	192.334	19.78	204.282	18.10	369.372	18.76
VEDRIJAN	293.374	18.09	285.922	17.12	139.690	19.52	154.484	18.10	214.543	18.28
VIPOLŽE	136.088	18.24	144.357	17.36	71.550	18.82	58.897	17.81	91.046	18.33
VIŠNJEVIK	214.512	18.03	215.536	16.67	116.708	19.13	110.796	18.13	167.514	18.41
VRHOVLJE	70.668	17.06	55.697	16.43	33.509	18.57	22.992	17.56	39.978	18.14
<b>Total</b>	<b>4.131.307</b>	<b>18.10</b>	<b>4.106.112</b>	<b>17.17</b>	<b>2.41.982</b>	<b>19.09</b>	<b>1.981.351</b>	<b>18.15</b>	<b>3.259.030</b>	<b>18.55</b>



Colour	Sugar content (% Brix)	°N of winegrowing areas
(Lightest shade)	< 18.0	5
(Light shade)	18.0 to 18.3	6
(Dark shade)	18.3 to 18.6	3
(Darkest shade)	> 18.6	1

**Figure 9 - Winegrowing areas according average sugar content of «Rebula» for the period 2000 to 2004.**

## Conclusions

The study took into account the main climatic, soil properties and cultivation practices of white wine variety «Rebula» to determine the *terroir* in Goriška brda winegrowing region in Slovenia. The observed climatic and soil data show that Goriška brda could be divided into more *terroirs*, considering also the cultivation practice in vineyards of «Rebula». The different grape qualities were determined, which confirmed the differences in *terroir* areas within Goriška brda. The division into four *terroirs* could be the best way to maintain and to improve the grape quality of «Rebula», what will be verified in present years.

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