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POTENTIAL OF THE LAND IN ARCHAR VILLAGE FOR CREATION OF VINES FOR QUALITY WINE GRAPE VARIETIES. CLIMATIC AND GEOGRAPHIC SPECIALITY OF THE TERROIR

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Abstract

The most important factors, defining the concept of "terroir" for a great wine are soil and climate. The climate allows the vine to adapt to the given location and under specific conditions. In this sense, interest in our study was part of land in Archar village in North terroir "Danubian Plain", characterized by its specific climate. The influence of the light over the vine plant estimate by the values of the helios-thermos coefficient. The average value for the base station was 4.22 and in terms of the brightness determined the studied object as suitable for the cultivation of all vine varieties. The radiation conditions in the studied area were suitable for growth of vine and did not impose restrictions on the choice of formations, planting distance and orientation of the rows of the plantation. The data for the average monthly air temperature for the warmest month of the year shown, that the area was suitable for the production of vine intended for relatively large set of guidelines for realization - for champagne wine, white and red quality wines, white and red table wine, dessert wines, as well as for the production of dessert grapes. During the period of grapes ripening - August and September were found relatively high values of the average temperature amplitudes. The stated values ensure optimal conditions for the process of photosynthesis and respiration and provides a normal and harmonious accumulation of sugars and acids in the grapes. The vegetation period was 200 days. The stated value was sufficient and provides a normal vegetation period for most varieties.

Key words: *vine, terroir, wine, grape.*

INTRODUCTION

The most important factors, defining the concept of "terroir" for a great wine are soil and climate. The climate allows the vine to adapt to the given location and under specific conditions (Falcetti, 1994). In this sense, interest in our study was part of land in Archar village in Northern terroir "Danubian Plain", characterized by its specific climate.

The influence of the climatic elements - temperature, humidity and solar radiation are the main factors of which depend the vital functions of the vine. In certain values they promote the growth, the regular fruit-bearing and the obtain of quality grape production. One of the most important forms for determination of the climatic conditions are agro-climatic resources of the territory (Wilson, 1998). In terms of climate conditions the region of Northern Bulgaria is characterized by humid continental climate.

MATERIALS AND METHODS

The object of the study is located in Archar village, Dimovo municipality, Vidin region, "Long Meadow" place. For the properly solve of a number of production problems in the creation of vineyards is necessary to know the physiographic special features of the area, where located the soil-climatic and in many cases the microclimatic conditions of the terrains, determining the different development, growth and specific qualities of the grape production.

Dealing with indicators such as: average monthly temperatures during the vegetation period, average dates of sustainable establishment of average day air temperatures above or below a certain limit, temperature amounts for the period with average air temperatures above a certain limit, duration of these periods and the period without frost, indicators for characterization the conditions of moisture and others, would contribute for the proper and timely implementation of various

agronomic practices, providing production efficiency (Leeuwen et al., 2004).
The presented in this study results were an attempt to provide guidelines for the creation of new vineyards and the choice of wine grape varieties.

RESULTS AND DISCUSSIONS

General climatic characteristic

In climatic attitude the studied terrain for creation of new vineyard in Archar village belongs to European-continental climatic region, humid continental climatic sub region and North climatic region of the "Danubian Plain".
The climate is characterized by well-defined continental type. The annual rainfall amount was from 515 to 610 mm. The rainfall minimum was during the winter period (February and November) and the maximum was in the summer period (June and May) as the difference between summer and winter rainfall was average 15-20% of their annual amount (Kiriakov, 1954).
The area is characterized by cold winter and hot summer. The average air temperature in January was from 1.5 to 2.0 °C and the average air temperature in July was from 22.0 to 23.5 °C. The average annual air temperature was in ranges from 10.5 to 11.5 °C.
Spring comes later compared to the Middle and East region of "Danubian Plain". The average date of the danger passing of the last spring frost was April 5.
Some main data of the general climatic characteristic of the Northern climate region of "Danubian Plain" shown in Table 1.

Table 1. General climatic characteristics of the northern climatic region of "Danubian Plain"

Climate indicator	Measure	Value
Average starting date of permanent retention of the temperature above 10°C	Date	5 IV
Average end date of permanent retention of the temperature below 10°C	Date	24 X
The earliest date of the last spring frost	Date	17 III
Average date of the last spring frost	Date	5 IV
The latest date of the last spring frost	Date	2 V
The earliest date of the first autumn frost	Date	2 X
Average date of the first autumn frost	Date	22 X
The latest date of the last autumn frost	Date	22 XII
Average duration of free of frost period	Days	199

For characterization of the climate elements for the studied terrain in Archar village are used data from 55 years period of observation, registered at the nearest meteorological station - Vidin, with geography position 22°51I East longitude; 43°39I North latitude and 35 m altitude (Subev, 1959).

Solar radiation, radiation balance and sunshine duration

The average duration of sunshine for the period with average day air temperatures higher than 10°C or for the vegetation period of the vine was 1500 hours. The total solar radiation for the period with average day air temperatures higher than 10°C was about 4100 MJ/m^2 and the radiation balance for the same period was 1800 MJ/m^2. The values were lower compared to those in the middle part of "Danubian Plain". Photo synthetically active radiation for the period with average day air temperatures, higher than 10°C was 1900 MJ/m^2 and was also lower. The influence of the light on the vine plant is assessed by the values of the helio thermal coefficient. The average value for the base station was 4.22 and in regard to the light determine the studied object as suitable for cultivation of all vine varieties.

Temperature conditions

Regime of the average day and night temperatures

The average annual temperature of the base station in Vidin town for a period of 55 years was 11.21°C and vary in confidence interval from 10.62 to 12.39°C (Kichukova, 1983).

Table 2. Average monthly air temperatures with confidence intervals

Month	Average temperature (°C)	Standard digression	Confidence interval	
January	-1.71	3.21	-2.56	-0.86
February	0.59	2.87	-0.17	1.35
March	5.42	2.44	4.78	6.07
April	11.99	1.48	11.60	12.38
May	17.26	1.42	16.88	17.63
June	20.70	1.14	20.40	21.00
July	22.75	1.29	22.41	23.10
August	21.74	1.36	21.38	22.10
September	17.63	1.47	17.24	18.02
October	11.56	1.69	11.11	12.01
November	5.74	1.81	5.26	6.22
December	0.88	2.26	0.28	1.48
Annual	11.21	2.26	10.62	11.81

The regime of the average monthly temperature was stable, except January, February and March, when possible alternate of periods with

suddenly warming with periods of cold weather.

The below zero average January temperatures were found for a total of 38 year for the observed 55 year period, or in 69% of the cases. The lowest average monthly temperature in January -10.6°C was registered in 1942 and the highest 4.9°C in 1983.

During the rest winter months - February and December average below zero temperatures are registered respectively for 20 years of the observed period (36% of cases) and for 18 years (33% of cases). The lowest average temperature in February was -8.9°C and in December -5.9°C.

In 69% of the cases, the average temperature in July had values above 22.0 °C. Average values below 21.0 °C marked only for one year of the observed period or 1.8% of the cases. The lowest average temperature in July was 20.7 °C registered in 1969 and the highest 28.0 °C in 1957.

Day and night motion of the air temperatures

The day and night motion of the temperatures characterized by day and night amplitude, formed as difference between the average monthly maximum and average monthly minimum temperature. The monthly average amplitude of the air temperature and the interval of variation shown in Table 3.

Table 3. Average monthly amplitude of day and night temperatures in °C

Month	Average monthly amplitude	Standard digression	Confidence interval	
January	5.1	3.2	4.3	6.0
February	6.0	3.8	5.0	7.0
March	7.8	4.9	6.5	9.1
April	9.3	5.5	7.8	10.8
May	9.4	6.0	7.8	11.0
June	10.1	5.9	8.5	11.6
July	10.8	6.2	9.1	12.4
August	11.1	6.5	9.4	12.8
September	10.6	6.2	9.0	12.3
October	8.8	5.3	7.4	10.2
November	5.7	3.7	4.7	6.7
December	5.2	3.8	4.2	6.2

Regime of the absolute minimum air temperatures

Actually measured temperature minimum and the average of the absolute minimum air temperature for Vidin station and observation period of 55 years shown in Figure 5.

The absolute temperature minimum -32.5°C was measured in January 1947. The temperature minimum for the rest winter months - February and December were respectively -27.0°C and -24.5°C and was registered in 1956 and 1931 and 1948.

The average of the absolute minimum temperatures for January was -15.97°C and defines the region as scooped. Scoop for the young vines during the creation of the vine plantation is absolutely necessary.

The probability for reporting of absolute temperature minimum of -26.0°C which can damage by frost the multiannual vine stem was low - 10% in January and 2% in February. Temperatures of -22.0°C which can damage one-year vine stem had higher probability - 14% in January; 8.0% in February and 5% in December. Absolute temperature minimum of -15.0°C which can damage by frost part of the buds of the vine had high probability 54% in January, 44% in February; 22% in December and 9% in March.

Economic significant amount of the possible damages by the effects of extremely low temperatures is determined by the continuance of their establishment, by cold resistance of the different varieties, by general physiological condition of the plants.

The average monthly number of the days with extreme low air temperature has the following values:

- 0.1 days in January for temperatures from -30.0 to -34.9°C;
- 0.4 days in January and 0.1 days in February for temperatures from -29.9 to -25.0°C;
- 0.8 days in January; 0.4 days in February and 0.2 days in December for temperatures from -24.5 to -20.0°C;
- 1.8 days in January, 1.0 days in February; 0.2 days in March and 0.8 days in December for temperatures from -19.9 to -15.0°C.

The extreme cold weather during the vegetation period also unfavourable affect the growth of the vine.

The probability for establishment of temperatures -2.5°C and -1.0°C in April was respectively 20 and 44%, or such temperatures is expected respectively for two and for five years of every 10 year period. Those

temperatures cause damage to the vine in late spring frosts and after bud swell and burst. Figure 8 shown, that with probability of 20%, or for 2 of every 10 years are expected late spring frosts after the average date of bud swell in the region - 15 April and this must be considered when choosing a system for pruning the plants.

Below zero temperatures in May were registered exceptionally rare and the probability of establishment was very low. In September were not reported below zero temperatures of -2.0; -3.0°C where can be observed damage to the unripe grapes. Temperatures of -4.0 °C, which damaged ripe grapes was reported in October with probability 12%, or such damage can be expected for a 1 of every 10 year period.

Regime of the absolute maximum air temperatures

The absolute temperature maximum, measured in Vidin station was in August 1945. The highest absolute maximum temperatures was registered in June and July 1938, respectively 38.8 and 40.8°C. The average of the absolute maximum air temperatures exceed 35.0°C in July and August, when in practice can be observed damages to the vine plants as a result of their action. The establishment of a temperature in the range of 35.0 to 40.0°C and over 40.0°C causes blight on the leaves and grapes, particularly in dry weather and hot winds.

Absolute maximum temperature of 35.0°C was not established in April, and in May the probability was low - 6.0%. During the summer months the probability for reporting of temperatures above 35.0°C was high: 28% in June; 66% in July and 60% in August, or such temperatures were established respectively for 3; 7 and 6 of every 10 year period. The probability for registering of extremely high temperatures over 35.0°C in September was 10%, or such temperatures are expected for 1 of every 10 year period.

The size of the economic important damages as a result of the extremely high temperatures depend on the continuance of their establishment. The average number of the days with temperatures from 35.1 to 40.0°C by months was as follows: in May - 0.2 days; in June - 0.7 days; in July - 3.2 days; in August - 2.9 days and in September - 0.2 days. Eventual damages to the plants can be expected in case of two consecutive days with temperatures above 35.0°C.

Temperature amount of biologically active temperatures

The average temperature amount of biologically active temperatures was 3737°C with confidence interval from 3642 to 3832°C.

The probability for recruitment of temperature amount of 3100°C, necessary for the ripening of the early vine varieties is provided with almost 100% probability. The probability for recruitment of temperature amount of 3500°C, necessary for the ripening of the medium early vine varieties was high - 77%. The sufficiency of the temperature sum of 3700°C, necessary for the ripening of late vine varieties was 50%. The temperature sum of 3900°C, which guarantee the ripening of very late vine varieties was insufficient with probability of 25%.

Regime of the atmospheric humidity

The average annual amount of the rainfall, registered for an observation period of 55 years in the base Vidin station was 541 mm and vary in the confidence interval from 512 to 570 mm. More important were the rainfall reported during the vegetation period - April 1 to September 30. The average rainfall amount during the vegetation for the area was low - 298 mm (confidence interval from 271 to 323 mm). Normal growth of the vine is realized at annual rainfall amount of 600 to 800 mm and during the vegetation period amount of 400 to 500 mm. The established in the area average values of the annual rainfall and the rainfall during the vegetation period were not enough and did not provide the necessary moisture for the growth of the vine.

Annual rainfall amount of 600 mm was found in 28% of the observed cases, or such amount was expected average for 3 of every 10 year period. The probability for reporting of annual amount of 800 mm was practically zero. The necessary rainfall amount during the vegetation period of 400 mm was reported with a probability of 15% or such amount of rainfall is expected for about 2 of every 10 year period. The probability of rainfall of 500 mm during vegetation period was very low - 1.9%.

The maximum rainfall was in June, and the minimum in August. The winter months -

January and February were relatively dry in which can not provide the necessary water reserve in the soil.
Importance for formation of the water reserve in the soil and for limiting the harmful effect of extremely low temperatures in the winter had snow precipitations. The average number of days with snow cover and its height were greatest in January and February.
The relative humidity has importance for the normal physiological processes in the vine. Average monthly values and their confidence interval shown in Table 4.

Table 4. Average monthly relative humidity, in %

Month	Average relative humidity (%)	Standard digression	Confidence interval	
January	84.29	5.13	82.93	85.65
February	81.02	6.05	79.42	82.62
March	74.15	6.93	72.31	75.98
April	68.38	4.96	67.07	69.69
May	69.71	4,.73	68.46	70.96
June	68.05	4.36	66.90	69.21
July	64.25	4.93	62.95	65.56
August	65.85	5.74	64.34	67.37
September	70.36	6.10	68.75	71.98
October	76.95	5.72	75.43	78.46
November	83.13	5.14	81.77	84.49
December	85.25	4.30	84.12	86.39

The intensive growth of the vine shoots is realized best at a relative humidity of 60 to 70%. For the period (April-June) in the area there were normal conditions for the process. During the period of the grains growth (July-August) the vine requires a higher relative humidity - 70-80%. The average monthly values of the index for these months were respectively 64.25 and 65.85% and assessed as insufficient. The critical minimum value of the air humidity of 40% and below 40%, in which reporting a decrease of the photosynthesis has not been established.
The conditions for humidification by months can be evaluated by the values of hydrothermal coefficient (HTC) by Selyaninov (Selyaninov, 1958) shown in Table 5.
The average monthly values of HTC were below the limit 1.00 in July, August and September for which the conditions for humidification assessed as insufficient.

Wind regime
During the coldest month of the year - January prevailing western winds, and in July - western and eastern winds.
During the warmest month of the year the speed was highest for the northwestern and western winds. In January the speed was highest also for the western and North-Western winds. Their appearance in winter was due to the transmission of cold winds.

Table 5. Average values of the hydrothermal coefficient by months

Month	Average amount of the average daily temperatures (°C)	Average rainfall amount (mm)	Average values of the hydrothermal coefficient (HTC)
January			
February	23.4	37.5	16.1
March	175.5	40.9	2.3
April	358.6	50.8	1.4
May	531.6	60.9	1.1
June	617.6	68	1.1
July	693.7	45.6	0.7
August	659.3	35.6	0.5
September	518.5	36.7	0.7
October	354.1	49.1	1.4
November	172.6	53.5	3.1
December			

Extreme elements of the climate
The area is located in the path of movement of thunderstorms with a local center Byala Slatina. The average annual number of the days with thunders was 19.1 as the month with the most marked thunderstorms date was June (Subev, 1960).
The relative frequency of the hails in the area was in range of 0.25 to 0.58. The average annual number of the days with hail was 1.7. The greatest number of the days with hail was in May.
Phenological forecast
The phenological phases in the growth of the medium early vine varieties for the region shown with different provide in Table 6.
Durable establishment of biologically active temperature of 10°C was on 6th April and durable drop below 10.0°C on 23th October. The vegetation period was 200 days. That amount was sufficient and provides a normal vegetation period for most vine varieties.

Table 6. Dates of occurrence of the phenophase in the vine with different degree

Phase of growth	Provide, %								
	10	20	30	40	50	60	70	80	90
Bud break	2. 04	8. 04	10. 04	13. 04	15. 04	18. 04	19. 04	22. 04	23. 04
Flowering	31. 06	5. 06	7. 06	9. 06	10. 06	11. 06	15. 06	17. 06	19. 06
Ripening (medium early varieties)	8. 09	15. 09	17. 09	19. 09	20. 09	25. 09	28. 09	29. 09	1. 10

CONCLUSIONS

The influence of the light over the vine plant estimate by the values of the helios-thermos coefficient. The average value for the base station was 4.22 and in terms of the brightness determined the studied object as suitable for the cultivation of all vine varieties.

The radiation conditions in the studied area were suitable for growth of vines and did not impose restrictions on the choice of formations, planting distance and orientation of the rows of the plantation.

The data for the average monthly air temperature for the warmest month of the year shown, that the area was suitable for the production of vine intended for relatively large set of guidelines for realization - for champagne wine, white and red quality wines, white and red table wine, dessert wines, as well as for the production of dessert grapes.

During the period of grapes ripening - August and September were found relatively high values of the average temperature amplitudes. The stated values ensure optimal conditions for the process of photosynthesis and respiration and provides a normal and harmonious accumulation of sugars and acids in the grapes.

In order to avoid a significant amount of the damages from extreme low temperatures was not recommended planting of varieties with very weak (Ugni Blanc) and weak (Dimiat, Sauvignon Blanc) cold resistance. Frost damage can be limited by the use of appropriate technology of the plant growth.

The vegetation period was 200 days. The stated value was sufficient and provides a normal vegetation period for most varieties.

In order to prevent possible frost on the vine plantation recommended the direction of the rows to be in the direction of prevailing western winds.

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