Bulgarian Journal of Agricultural Science, 22 (No 3) 2016, 368–373
Agricultural Academy

SOIL-CLIMATE CHARACTERISTICS DURING CULTIVATION OF GRAPE CULTIVAR MAVRUD

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Abstract

BANOV, M., A. ATANASSOV, K. FARTZOV and A. IVANOV, 2016. Soil-climate characteristics during cultivation of grape cultivar Mavrud. *Bulg. J. Agric. Sci.*, 22: 368–373

The most important factors for growing grape and for wine production are soil and climate.

The presented material considered soil and climatic characteristics of the territory of a particular vineyard. Growing grape variety is „Mavrud".

Subject to the soil and climate characteristics is agricultural land – plot EKATE № 58058, cadastral № 01001, 01002 01003, 01004, village Pravishte, municipality Saedinenie, located in the Loziata neighborhood, vegetated with vines „Mavrud".

The data for climate characteristics show, that the area is suitable for growing grape and for wine production.

The soil research at the investigated region was made on the basis of archive data and field and on site research. Samples were taken on site. Those samples were then analyzed regarding the following parameters: distribution of the mechanical fractions; contents of organic matter (humus); medium reaction (pH in water solution); general phosphorus; general potassium; carbonates ($CaCO_3$).

A soil survey was carried out in order to determine the soil cover in the Pravishte village. The results of the soil research show that the subject area falls into one soil type – Leached Vertisols.

A morphological description has been made, physico-chemical properties are determined and a summary of the above mentioned soil type is prepared.

Key words: climate, soils, grape, vines

Introduction

The cultivation of wine grapes and producing quality red and white wines in recent years is one of the priorities of the Bulgarian farmers.

Expert evidence shows that the production and quality of grapes vary widely between vineyards. In terms of vineyards cultivated by tenant farmers, wineries and cooperatives with good financial opportunities where agrotechnical and phytosanitary requirements are fully met, it is expected to receive quality grape harvest and higher average yield. From older vines, where have been applied partial care it is expected to receive grape harvests with lower quality and therefore lower average yield. There are also areas which are not undertaken any care, what leads to the production of small quantity of grapes.

In regard of this, during the creation and cultivation of vines it is important to pay attention to the requirements of the grape into the agri-environmental conditions – climate, soil, topography and others.

The presented material considered soil and climatic characteristics of the territory of a particular vineyard. Growing grape variety is „Mavrud".

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Materials and Methods

The object of the study is located in Pravishte village, Saedinenie municipality, Plovdivn. Subject to the soil and climate characteristics is agricultural land – plot EKATE № 58058, cadastral № 01001, 01002 01003, 01004, village Pravishte village, located in the Loziata neighborhood, vegetated with vines „Mavrud".

For soil characterization on site, it was taken soil samples to the depth of the soil profile.

After preparation, soil samples were analyzed in several indicators: mechanical composition (Kachynski, 1958); carbonates content – by the method of Sheibler (Vilenskiy, 1945; Nikolaev, 1962); content of organic carbon – by the modified method of Tyurin (Kononova, 1963); pH (H_2O) – potentiometric (Arinushkina, 1962); content of nitrogen (mg/kg) (Bremner, 1965); content of phosphorous (mg/100 g) (Ivanov, 1984).

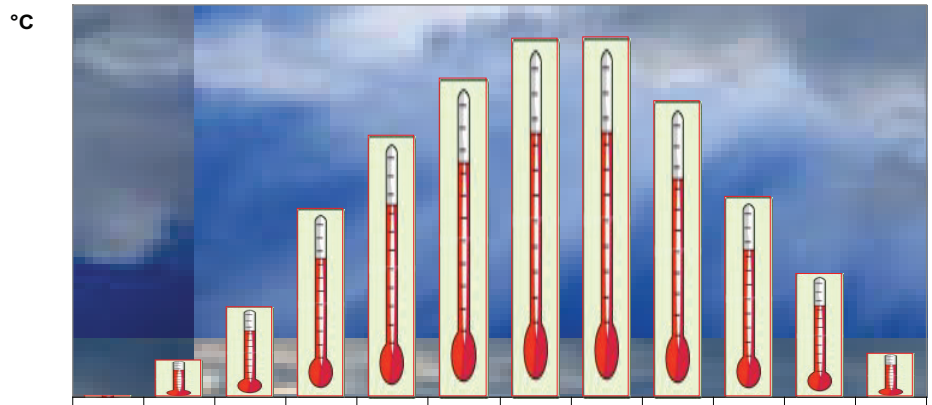
Climatic features have been prepared on the basis of average data of climate yearbooks of Bulgaria (Climatic Reference Book of Bulgaria, 1982; Climatic Reference Book of Bulgaria, 1983; Koleva and Peneva, 1990).

Results and Discussion

Climate characteristics

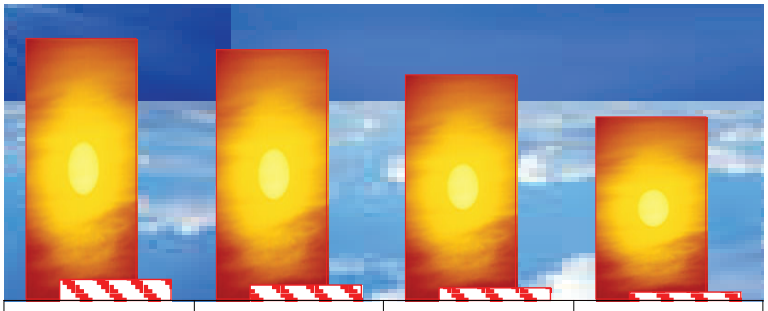
Temperature characteristics

The warmest months in the annual temperature cycle are July and August with an average monthly air temperature respectively 22.9 and 23.0°C (Figure 1). The coldest month is January, but averaged data does not show typical minus temperatures. Generally the early months of the year – January, Febru-



Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Temperature	0.1	2.4	5.8	12.0	16.7	20.3	22.9	23.0	18.9	12.8	7.9	2.8

Fig. 1. Average monthly air temperatures in the investigated region



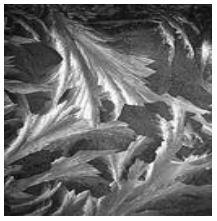
Number of days	> 0	> 5	> 10	> 15
Temperature sums	4415	4225	3805	3095
Number of days	365	267	210	153

Fig. 2. Temperature sums with average daily air temperatures in the investigated region higher than 0, 5, 10, 15 °C and period lengths measured in days

Table 1
Average and end dates of the last spring and first autumn frost and average length of the frost free period in the investigated region

Last spring frost			First autumn frost			Frost free period (days)
Earliest	Average	Latest	Earliest	Average	Latest	
15. III.	06. IV.	28. IV.	12. X.	04. XI.	03. XII.	211





← Frost free period ± 211 days →

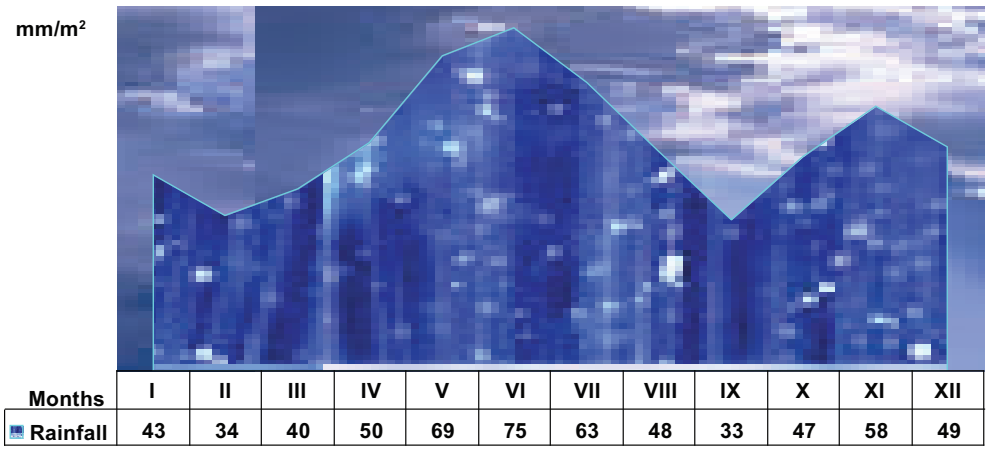


Fig. 3. Average monthly rainfall amounts in the researched area (average annual amount 609 mm/m²)

ary, March are much colder than the ending ones – October, November and December. The rest of the months are characterized with an almost symmetrical increase and decrease of the average monthly air temperatures around the summer maximum.

With the current temperature conditions (Figure 2) in the investigated area, during an average of about 210 consecutive days in a year, the daily average temperatures are higher than 10°C and shape a temperature sum for this period of about 3805°C.

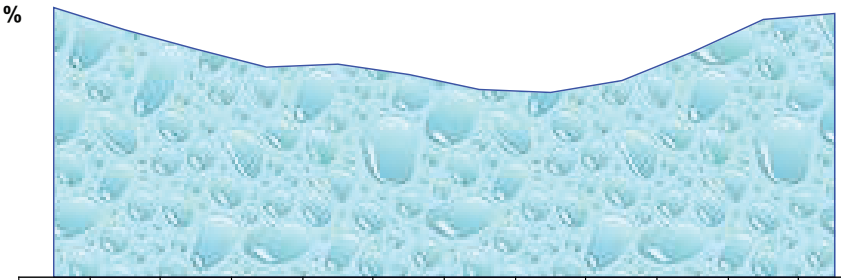
The spring and autumn frost (also called "tipping") are part of some of the most important climatic characteristics. Their influence on the successful agricultural activity is well known – in some years they cause significant losses of agricultural production, reducing or completely destroying the yields of different crops.

Agro-meteorologists consider a day of frost, such that the minimum temperature measured at a weather cell placed two meters above the ground is ≤ 0°C and the average daily air temperature is positive.

Some of the reasons for the late spring and earliest autumn frosts are the intense advection of cold air masses, abnormal for this time of year and the related subsequent radiation cooling.

Table 1 shows the multi-annual average and end dates of the last spring and first autumn frosts and the average frost-free period, specific to the investigated region.

The estimated average annual dates of the last spring and first autumn frosts, depending on the variability of the phenomenon and the length of the monitoring period are subject to some error (σ). In this case we considered a 40 year period and the error in the calculated average date of the last spring frost is within the scope of 1–2 days and that for the first autumn frost – in the range of 2–3 days. Similar studies for a 70 year period show errors of respectively 1.3–1.5 days regarding the spring frost and 1.9–2.3 days for the autumn frost, which proves those results to be reliable.



Months	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Relative humidity	85	78	72	66	67	64	59	58	62	71	81	83

Fig. 4. Average monthly relative air humidity in the researched area (Annual average 71%)

Rainfall characteristics

The researched area is characterized by an average of 609 liters per square meter annual rainfall. The monthly distribution (Figure 3) clearly shows two maxima – May-June (69 to 75 mm/m^2) and November (58 mm/m^2) monthly amounts.

Figure 4 shows the monthly distribution of relative humidity. It is the lowest in July – August(from 59 to 58%) and the highest during the winter months December, January - 83 to 85%.

Soil characteristics

The soil research at the investigated region was made on the basis of archive data and field and on site research. Samples were taken on site. Those samples were then analyzed regarding the following parameters: mechanical composition (Kachynski, 1958); carbonates content – by the method of Sheibler (Vilenskiy, 1945; Nikolaev, 1962); content of organic carbon – by the modified method of Tyurin (Kononova, 1963); pH (H_2O) – potentiometric (Arinushkina, 1962); content of nitrogen (mg/kg) (Bremner, 1965); content of phosphorous (mg/100 g) (Ivanov, 1984).

A soil survey was carried out in order to determine the soil cover in the Pravishte village. The results of the soil research show that the subject area falls into one soil type - Leached Vertisols.

A morphological description has been made, physico-chemical properties are determined and a summary of the above mentioned soil type is prepared.

The results of the conducted analytical research of the collected soil samples are presented in Tables 2 and 3.

These soils have semi-strong humus horizon (50–65 cm) and soil depth from 100 to 115 cm. Their mechanical composition is slightly clayey in the surface and lower horizons. The soil forming materials are medium or heavy sandy-clay. Typical of vertisols is that when dry, they strongly compress

Morphological Description

A^I plough	0–22 cm	Black (10YR2/1), lightly humid, compressed – crumbly surface, slightly clayey, lightly dusty grainy-crumbly structure, tunnels resulting from earthworms, vertical cracks, not boiling when treated with hydrochloric acid, gradual transition.
A^{II}	22–44 cm	Black to heavy dark gray (10YR2.5/1), lightly humid, dense, slightly clayey, bulky-prysmatic structure, tunnels resulting from earthworms, vertical cracks, not boiling when treated with hydrochloric acid, visible transition.
AB	44–66 cm	Heavy dark gray to heavy dark grayish brown (10YR3/1.5), lightly humid, dense, slightly clayey, prysmatic structure, single tunnels from earthworms, vertical cracks, not boiling when treated with hydrochloric acid, gradual transition.
B1	66–90 cm	Heavy dark grayish brown (10YR3/2),with darker than in the upper horizon flow formations, lightly humid, dense, slightly clayey, prismatic structure, vertical cracks, not boiling when treated with hydrochloric acid, gradual transition.
B2	90–110 cm	Heavy dark grayish brown to dark brown (10YR3/2.5), humid, dense, slightly clayey, prismatic structure, not boiling when treated with hydrochloric acid, clear transition with “pockets”.
C1к	110–130 cm	Dark brown to brown (7.5YR4/4), humid, dense, slightly clayey, prismatic structure, vigorous boiling when treated with hydrochloric acid, clear transition
C2к	130–142 cm	Lighter than the upper layer, lightly dense, heavy sandy-clayey, bulky-prismatic structure, multiple vigorous boiling when treated with hydrochloric acid

Table 2
Mechanical composition

Indicators	Particle size in mm (%)							Sum
Horizon and sample depth /cm/	Sum >1	1–0.25	0.25–0.05	0.05–0.01	0.01–0.005	0.005–0.001	< 0.001	< 0.01%
A^{I} plough 0–22	0.3	8.9	9.9	15.4	6.2	10.8	45.2	62.2
A^{II} 28–38	1.3	7.2	10.2	12.6	5.1	9.9	50.2	65.2
AB 49–59	1.0	9.0	10.6	11.7	5.5	8.5	50.4	64.4
B1 73–83	1.1	7.4	9.7	12.4	5.0	6.4	54.5	65.9
B2 95–105	1.7	8.0	13.9	10.8	5.1	5.9	51.7	62.7
C1к 115–125	1.6	6.5	10.1	11.2	4.8	6.2	42.1	53.1

Table 3
Chemical composition

Sample depth (cm)	Hygroscopic moisture (%)	Humus (%)	Carbonates (%)	Total nitrogen (%)	Total phosphorus (%)	pH in H_2O
A^{I} орн. 0–22	8.36	3.22	0.0	0.144	0.097	5.7
A^{II} 28–38	9.83	2.26	0.0	0.112	0.074	5.5
AB 49–59	10.16	1.81	0.0	–	–	5.6
B1 73–83	10.28	1.43	0.0	–	–	6.0
B2 95–105	9.89	1.22	0.0	–	–	6.4
C1к 115–125	8.30	–	14.56	–	–	6.9

and form deep vertical cracks, while when moist they swell, which is due to the nature of the montmorillonite clay in them. These soils are medium humus, poorly stocked with general nitrogen and general phosphorus. Carbonates were deposited more/less than 1 meter deep. Soil reaction in the plowing horizon is from slightly acidic to neutral.

Suitability of the land for growing vines

The classification of the agricultural lands in the investigated areas and their suitability for growing vines according to their quality levels is done based on Methods for working with the cadaster of agricultural land in the Republic of Bulgaria – 1988, approved by the Ministry of Agriculture and Food.

Determining the quality levels, and hence the suitability for growing grapes, is based on data obtained from the soil samples tested for physical and chemical properties of soils, topography, soil forming materials, climate, as well as the biological characteristics of the different cultures.

The quality evaluations are distributed in 5 groups according to the suitability of lands for growing vines, based on a 100 point system.

The assessment for vineyards without irrigation is 69. The lands belong to the „good land“ for the culture, while implementing irrigation the assessment is 95 – „very good land“ for vineyards.

First group (very good lands)	Category **first**	Quality score over 91
	Category **second**	Quality score 81–90
Second group (good lands)	Category **third**	Quality score 71–80
Third group (average lands)	Category **fifth**	Quality score 51–60
	Category **sixth**	Quality score 41–50
Fourth group (poor lands)	Category **seventh**	Quality score 31–40
	Category **eight**	Quality score 21–30
Fifth group (unusable lands)	Category **ninth**	Quality score 11–20
	Category **tenth**	Quality score 0–10

Conclusion

The presented material considered soil and climatic characteristics of the territory of a particular vineyard. Growing grape variety is „Mavrud”.

Climatic features have been prepared on the basis of average data of climate yearbooks of Bulgaria. The soil research at the investigated region was made on the basis of archive data and field and on site research.

The data for climate and soil characteristics show, that the area is suitable for growing grape and for wine production.

Data show that these lands are "very good" for growing grapes – 69 points without irrigation and 95 points under irrigation.

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Received April, 1, 2016; accepted for printing April, 14, 2016