

Analysis and Evaluation of the Main Ecoclimatic Conditions from Romanian Vineyards

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Abstract

Vines act as indicators in relation ecoclimatic changes and they are particularly sensitive to temperature changes. Temperature is a limiting factor and define the distribution area for all plants. The main objective of this paper is to present the climatic conditions such as temperature, insolation, rainfall and cloudiness of Romanian main vineyards (Dealul Bujorului, Murfatlar, Târnave, Iași, Ștefănești-Argeși). The thermal balance with the highest values was recorded in Murfatlar vineyard having a value of 5288 ($\sum tg$), the active thermal balance ($\sum ta$) 4815, and the useful thermal balance ($\sum tu$) 2514. Insolation and precipitations are in normal parameters for viticulture. The highest values of the real heliothermic index (I_{H_r}), hydrothermal coefficient (CH) and wine bioclimatic index (I_{bcv}) were recorded in Murfatlar vineyard ($I_{H_r}=4.1$; $CH=0.8$ and $I_{bcv}=11.4$). The result show that the ecoclimatic conditions from the studied vineyards are favorable, that makes possible the production of both red and white wines of high quality in these areas.

Keywords: *climatic conditions, insolation, rainfall, temperature*

Introduction

Temperature is a limiting factor, it works by limiting the distribution area for all plants, and also for viticulture.

Aims and objectives

The main objective of this paper is to present the climatic conditions such as temperature, insolation, rainfall and cloudiness of Romanian main vineyards (Dealul Bujorului, Murfatlar, Târnave, Iași, Ștefănești-Argeși).

Materials and methods

The climatic data conditions were obtained from the Agro Expert system (meteorological station for each vine area studied) and also from the National Meteorological Administration. Based on their specific formulas (Țârdea and Dejeu, 1995; Pop, 2010), ecoclimatic indicators

were determined, important for the growth and the fruition of vines, such as global thermal balance ($\sum t^{\circ}g$); active thermal balance ($\sum t^{\circ}a$); useful thermal balance ($\sum t^{\circ}u$); thermal coefficient (C_t); annual and monthly rainfall amount; amount of hours of sunshine ($\sum ir$) and real sunburn coefficient (C_r). To get a broader image on how climatic factors influence the growth and fruition of vines, the heliothermic index (HI), hydrothermal coefficient (CH) and bioclimatic index (I_{bcv}) were calculated (Bora *et al.*, 2015).

Results and discussion

The length of the vegetation period is within the normal cultivation limits of vines, 185 days vineyard Dealul Bujorului, 198 days vineyard of Murfatlar, 183 days vineyard Târnava, 174 days vineyard Iași and 184 days vineyard Ștefănești-Argeș. In the experimental years 2010-2014,

the thermal balance with the highest values was recorded in Murfatlar vineyard having a value of 5288 ($\Sigma t^{\circ}g$), the active thermal balance ($\Sigma t^{\circ}a$) 4815, and the useful thermal balance ($\Sigma t^{\circ}u$) 2514. Insolation and precipitations are in normal parameters for viticulture. The highest values of the real heliothermic index (I_{H_r}), hydrothermal coefficient (CH) and wine bioclimatic index (I_{bcv}) were recorded in Murfatlar vineyard ($I_{H_r}=4.1$; $CH=0.8$ and $I_{bcv}=11.4$).

Conclusion

The result of this research show that the ecoclimatic conditions from the studied vineyards are favorable, that makes possible the production of both red and white wines of high quality in these areas.

Tab. 1. Climate data from studied areas; period of 2010-2015

| Area | Studied elements | Average values | Extreme limits | | Optimal values for viticulture | | |
|---------------------------------------|-------------------------------------|--|--------------------------------|--------|--------------------------------|-----------|-----------|
| | | | Min. | Max. | | | |
| Vineyard Dealu Bujorului ¹ | The vegetation period | Days | 185 | 183 | 194 | 160-180 | |
| | Thermal balance | Global ($\Sigma t^{\circ}g$) | 3480 | 3354 | 3562 | 2700-4000 | |
| | | Active ($\Sigma t^{\circ}a$) | 3385 | 3316 | 3398 | 2500-3800 | |
| | | Useful ($\Sigma t^{\circ}u$) | 1681 | 1654 | 1702 | 1000-1800 | |
| | | Thermal coefficient (C_t) | 18.2 | 17.4 | 18.9 | 16-19 | |
| | Insolation (hours) | Real (Σir) | 1874 | 1851 | 1896 | 1200-1800 | |
| | | Coefficient of insolation (C_i) | 8.56 | 8.32 | 8.77 | - | |
| | Precipitations (mm) | Total annual (Σpp) | 505.0 | 501.0 | 513.0 | 500-700 | |
| | | Coefficient of precipitation (C_p) | 1.20 | 1.10 | 1.50 | - | |
| | The interaction of climatic factors | Real heliothermic Index (I_{H_r}) | 2.38 | 2.16 | 2.41 | 1.35-2.70 | |
| | | Hydrothermal coefficient (CH) | 1.06 | 1.03 | 1.10 | 0.7 | |
| | | Bioclimatic index (I_{bcv}) | 8.01 | 8.00 | 8.06 | 5 | |
| | Vineyard Murfatlar ² | The vegetation period | Days | 198 | 189 | 212 | 160-180 |
| | | Thermal balance | Global ($\Sigma t^{\circ}g$) | 5288 | 4853.8 | 5500.9 | 2700-4000 |
| | | | Active ($\Sigma t^{\circ}a$) | 4815.6 | 4509.1 | 5033.1 | 2500-3800 |
| Useful ($\Sigma t^{\circ}u$) | | | 2514.0 | 2299.1 | 2600.2 | 1000-1800 | |
| Thermal coefficient (C_t) | | | 24.32 | 22.34 | 25.67 | 16-19 | |
| Insolation (hours) | | Real (Σir) | 1637.6 | 1973.1 | 1435.1 | 1200-1800 | |
| | | Coefficient of insolation (C_i) | 8.27 | 9.3 | 7.32 | - | |
| Precipitations (mm) | | Total annual (Σpp) | 568.7 | 326.8 | 710.3 | 500-700 | |
| | | Coefficient of precipitation (C_p) | 2.04 | 1.26 | 2.81 | - | |
| The interaction of climatic factors | | Real heliothermic Index (I_{H_r}) | 4.1 | 3.4 | 4.9 | 1.35-2.70 | |
| | | Hydrothermal coefficient (CH) | 0.80 | 0.5 | 1.2 | 0.7 | |
| | | Bioclimatic index (I_{bcv}) | 11.4 | 6.4 | 17.8 | 5 | |
| Vineyard Tarnava ³ | | The vegetation period | Days | 183 | 166 | 192 | 160-180 |
| | | Thermal balance | Global ($\Sigma t^{\circ}g$) | 3449 | 3186 | 3683 | 2700-4000 |
| | | | Active ($\Sigma t^{\circ}a$) | 3347 | 3085 | 3546 | 2500-3800 |
| | Useful ($\Sigma t^{\circ}u$) | | 1556 | 1365 | 1875 | 1000-1800 | |
| | Thermal coefficient (C_t) | | 17.9 | 16.9 | 19.2 | 16-19 | |
| | Insolation (hours) | Real (Σir) | 1896.2 | 1558 | 2402 | 1200-1800 | |
| | | Coefficient of insolation (C_i) | 7.55 | 6.12 | 8.31 | - | |
| | Precipitations (mm) | Total annual (Σpp) | 580.5 | 349.5 | 698.0 | 500-700 | |
| | | Coefficient of precipitation (C_p) | 2.10 | 1.38 | 2.65 | - | |
| | The interaction of climatic factors | Real heliothermic Index (I_{H_r}) | 2.2 | 1.7 | 3.2 | 1.35-2.70 | |
| | | Hydrothermal coefficient (CH) | 1.1 | 0.8 | 1.3 | 0.7 | |
| | | Bioclimatic index (I_{bcv}) | 7.2 | 4.3 | 9.9 | 5 | |

| | | | | | | |
|-----------------------------------|-------------------------------------|--|---------|--------|--------|-----------|
| Vineyard Iași ⁴ | The vegetation period (days) | Days | 174 | 164 | 189 | 160-180 |
| | Thermal balance | Global ($\sum t^{\circ}g$) | 3371 | 3219 | 3653 | 2700-4000 |
| | | Active ($\sum t^{\circ}a$) | 3269 | 3077 | 3596 | 2500-3800 |
| | | Useful ($\sum t^{\circ}u$) | 1583 | 1427 | 1856 | 1000-1800 |
| | | Thermal coefficient (C_t) | 18.8 | 16,3 | 20.5 | 16-19 |
| | Insolation (hours) | Real ($\sum ir$) | 1442 | 1337 | 1513 | 1200-1800 |
| | | Coefficient of insolation (C_i) | 8.26 | 7.44 | 8.70 | - |
| | Precipitations (mm) | Total annual ($\sum pp$) | 557.2 | 365.5 | 674.3 | 500-700 |
| | | Coefficient of precipitation (C_p) | 2.08 | 1.04 | 3.00 | - |
| | The interaction of climatic factors | Real heliothermic Index (I_{H_r}) | 2.3 | 2.0 | 2.8 | 1.35-2.70 |
| Hydrothermal coefficient (CH) | | 1.10 | 0.8 | 1.6 | 0.7 | |
| Bioclimatic index (I_{bev}) | | 8.7 | 5.4 | 16.3 | 5 | |
| Vineyard Ștefanești ⁵ | The vegetation period | Days | 184.33 | 179 | 202 | 160-180 |
| | Thermal balance | Global ($\sum t^{\circ}g$) | 3529.10 | 3279.1 | 3942.1 | 2700-4000 |
| | | Active ($\sum t^{\circ}a$) | 3348.36 | 2690.5 | 3907.5 | 2500-3800 |
| | | Useful ($\sum t^{\circ}u$) | 1644.22 | 1290.9 | 1921.1 | 1000-1800 |
| | | Thermal coefficient (C_t) | 18.01 | 14.86 | 19.5 | 16-19 |
| | Insolation (hours) | Real ($\sum ir$) | - | - | - | 1200-1800 |
| | | Coefficient of insolation (C_i) | - | - | - | - |
| | Precipitations (mm) | Total annual ($\sum pp$) | 667.4 | 475.5 | 959.3 | 500-700 |
| | | Coefficient of precipitation (C_p) | 2.40 | 1.6 | 7.8 | - |
| | The interaction of climatic factors | Real heliothermic Index (I_{H_r}) | - | - | - | 1.35-2.70 |
| Hydrothermal coefficient (CH) | | 1.24 | 0.80 | 2.1 | 0.7 | |
| Bioclimatic index (I_{bev}) | | - | - | - | 5 | |

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