# THE SUPERVISION OF THE ECO-PHYSIOLOGIC GROUPS OF MICROORGANISMS FROM THE SOIL, GIVEN THE CONDITIONS OF PRACTICING A DURABLE WIN-GROWING TECHNOLOGY

## MONITORIZAREA GRUPELOR ECOFIZIOLOGICE DE MICROORGANISME DIN SOL, ÎN CONDIȚIILE PRACTICĂRII UNEI TEHNOLOGII VITICOLE DURABILE

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**Abstract.** *After the abundant and torrential precipitations, the acclivous terrains, planted with grape vines are supposed to certain erosion processes that determine the decrease of the production capacity of the soil. In order to prevent these phenomena and for the superior capitalization of the terrains and of the natural resources from the hilly area, we propose the use of a durable win-growing technology meant to contribute to: the maintenance of the soil micro-flora and the biodiversity of the win-growing ecosystems, the growth of the soil fertility through natural means, the pollution decrease, etc. The S.C.D.V.V. Iasi has been experiencing for 2 years the main technological links, on a demonstrative lot cultivated with the Feteasca Regala genus. In order to underline the importance to practice this type of culture there have been made several observations and determinations that allowed the evaluation of the total micro-flora and of the eco-physiologic groups of microorganisms from the soil, in relation with the vegetation phenol-phases, the evolution of the pedoclimatic factors and of the grape vine phytosanitary protection treatments.*

**Rezumat.** *Terenurile în pantă, plantate cu viță de vie, în urma precipitațiilor abundente şi torențiale, sunt supuse unor procese erozionale, care conduc la scăderea capacității de producție a solului. Pentru prevenirea acestor fenomene şi pentru valorificarea superioară a terenurilor şi a resurselor naturale din zona colinară, se propune utilizarea unei tehnologii viticole durabile care să contribuie la: menținerea microflorei solului şi a biodiversității ecosistemelor viticole, creşterea fertilității solului pe cale naturală, scăderea poluării, etc. In cadrul S.C.D.V.V. Iaşi, timp de 2 ani, s-au experimentat principalele verigi tehnologice, într-un lot demonstrativ cultivat cu soiul Fetească regală. Pentru evidențierea importanței practicării acestui tip de cultură, s-au efectuat o serie de observații şi determinări, care au permis evaluarea microflorei totale şi a grupelor ecofiziologice de microorganisme din sol, în corelație cu fenofazele de vegetație, evoluția factorilor pedoclimatici şi a tratamentelor de protecție fitosanitară a viței de vie.*

The prevention of the erosion phenomenon and the superior capitalization of the acclivous terrains from the grape vine plantations represented the objective of a durable win-growing technology. This technology aims to establish the role of the grape vine in the preservation of the acclivous soils, if we alternate layers of the black field (BF) and durable grass overgrowing (DGO). In order to underline the importance of practicing this soil maintenance system [2,3,5], SCDVV Iasi has been experiencing for two years the main technological links, on a demonstrative lot with a bank side of under 10%, cultivated with the Feteasca Regala genus. Beside the observations regarding the unfurling of the vegetation phenol-phases, the fertility and the potential/real productivity, the prominence of the mechanical and technological features of the grape production, the wood maturation and the resistance of the grape vines during the winter etc., there have been also made microbiological determinations in three variations, ascent, middle and downstream in the (BF) and (DGO) soils that allowed the evaluation of the total micro-flora and of the eco-physiologic groups of microorganisms in correlation with the pedoclimatic factors and of the grape vine phytosanitary protection treatments.

## MATERIAL AND METHODS

The microbiological analyses have been made on soil samples of 100 g, sampled with the help of a special sound from a 5 cm depth, after the removal of the superficial layer. The soil samples have been introduced in plastic bags and transported to the laboratory immediately. The soil samples have been sifted through metallic sifters with 2 and 5 mm meshes.

The quantitative determinations representing the total number of microorganisms [6] and the number of microorganisms from the eco-physiologic groups have been made according to the Pochon J., Barjac H. [4] quantitative method.During the working protocol, the total number of microorganisms was determined in the special artificial culture development ambient [4] and the ecophysiologic groups of microorganisms in liquid selective culture ambient, looking for the temporal reaction that characterizes the respective group, either through the substratum metabolization, or through the appearance of a catabolism in the ambient.

The quantitative determinations have been expressed through the number of total microorganisms/g of soil, according to the McCrady tables and, then, for the graphic representation, in base two logarithms (Aizaki M.) [1].

## RESULTS AND DISCUSSIONS

The soil is an open, very complex and dynamic system for which the fertilization depends on its balance and on the metabolic activity of the microorganism populations. The number of microorganisms from the soil is limited and modified by the climatic factors, especially when we refer to temperature and humidity, as well as by the agro-technical works. In the present paper, the microbiological determinations have been interpreted by taking into account the evolution of the pedoclimatic factors from 2006 and 2007. The goal of this study was to obtain value data to support the durable win-growing technology.

The assembly analysis of the climatic factors in 2006 (table I) shows that the winter was very cold, with absolute minimum temperatures of -25°C in the air and of -29°C at the ground level. The spring was capricious, chilly and humid, the average temperatures from March, April and May were of 2,1°C, 11,1°C and 15,3°C. June was characterized by cold and rainy periods, the quantity of precipitations varied between 5, 4-8, 9 mm.

According to the position on the bank side, during all the months, greater humidity values have been registered in the ascent, lower in the downstream and intermediary in the middle of the bank side both in the case of the black field (BF) and in the durable grass overgrowing area (DGO). During June and July, the absolute minimum and maximum temperatures were of 15, 8°C and 31°C, respectively of 21,0°C and 34,5°C. The average temperature values during this period of the year have been, as follows, 21,5°C, 21,0°C and 16,2°C.

*Table I*

**Metheorologic parameters from Copou metheo station, in 2006, SCDVV Iasi**

| Time (month) | Temperature °C air | | | Temperature °C soil | | | Rainfalls (mm) |
|---|---|---|---|---|---|---|---|
| | Average | Maximum | Minimum | Average | Maximum | Minimum | |
| January | -7,0 | 8,6 | -25,1 | | 13,2 | -29,0 | 0,9 |
| February | -2,9 | 11,2 | -17,3 | | 13,5 | -25,0 | 0,19 |
| Marth | 2,1 | 22,2 | -13,2 | | 30,5 | -18,6 | 2,8 |
| April | 11,1 | 21,6 | 0,8 | | 44,2 | -2,5 | 2,0 |
| May | 15,3 | 32,0 | 5,1 | | 54,0 | 0,6 | 1,35 |
| June | 19,3 | 32,2 | 7,7 | | 58,2 | 5,8 | 2,48 |
| July | 21,5 | 31,0 | 10,9 | | 32,1 | 28,2 | 65 |
| August | 21,0 | 33,7 | 10,1 | | 30,6 | 27,6 | 69 |
| September | 16,2 | 25,9 | 7,8 | | 22,6 | 21,0 | 67 |

The precipitations from July-September have been close to normal and they decreased starting from September, the water deficit (%) in the soil being higher on the durable grass overgrowing areas (DGO) – table II.

*Table II*

**The water deficit (%) for a depth of 0 / 30 cm in the ascent, middle and downstream, for the experimental terrain in 2006**

| Time (month) | Black field (ON) Water deficit (%) | | | Durable grass overgrowing (DGO) Water deficit (%) | | |
|---|---|---|---|---|---|---|
| | Ascent | Middle | Downstream | Ascent | Middle | Downstream |
| April | 36 | 35 | 34 | 38 | 32 | 30 |
| May | 46 | 49 | 51 | 58 | 62 | 66 |
| June | 73 | 74 | 74 | 75 | 75 | 74 |
| July | 66 | 73 | 80 | 49 | 56 | 63 |
| August | 63 | 64 | 66 | 74 | 74 | 74 |
| September | 74 | 70 | 66 | 79 | 81 | 82 |

In these climatic conditions, following the microbiological determinations made on the experimental parcel, there was registered a total number of microorganisms represented through sizes of orders of $10^8 – 10^9$.

From the graphical representation of the quantitative data regarding the ecophysiologic groups of microorganisms, figure 1-a,b,c, in the soil samples (BF) and (DGO) from the ascent middle and downstream areas, it was determined that the number of ammonification microorganisms is equal for both the (BF) and (DGO), both in ascent and downstream, registering values that are 4,6 % higher for the soil samples from the middle of the bank side.

The number of nitric microorganisms was the same for the (BF) and (DGO) soil samples at the middle of the bank side and downstream, but smaller in the ascent. The number of nitric microorganisms in the ascent, middle and downstream was identical no matter what maintenance mode of the intervals between the grape vine rows. Also, the number of denitrifying microorganisms in the three places was the same valoric view point.

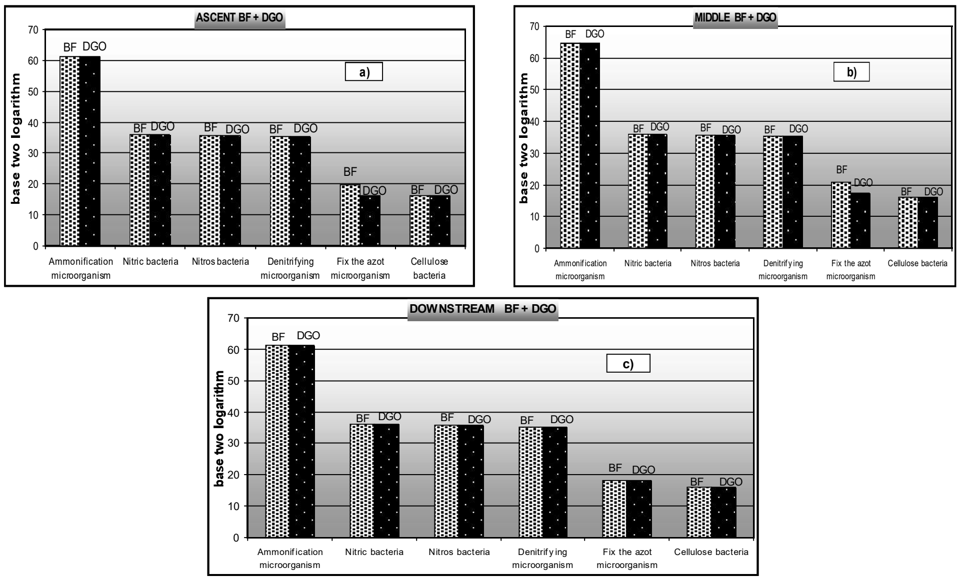


**Fig. 1 a,b,c.** Base two logarithms from the number of microorganisms in the soil samples from 2006, sampled from the worked field (BF) and of the durable grass overgrowing (DGO).

The dates represented in figure 1a and 1b point out a difference by number of aerobe microorganisms that fix the azote, that is higher on the durable grass overgrowing areas (DGO) than in black field (BF). The number of cellulose bacteria is the same indifferent by the place of soil test (ascent, middle, downstream) and by mentenance style of vine rows.

A general view over the obtained microbiological data shows the existence of a well-defined balance between the ecophysiologic groups of microorganisms from the soil of the parcel expressed in the 2006 temperature and humidity conditions.

In 2007, the climatic conditions presented in table III show a warmer winter that in 2006, the maximum air temperatures oscillating between 0$^{o}$C and 16,6$^{o}$C. At the end of February, there were registered very low temperatures of -19,6$^{o}$C in the air and -25$^{o}$C at the ground level. The spring was also warmer than usual, with monthly average temperatures of 7,3$^{o}$C in March, 10,2$^{o}$C in April and 34,5$^{o}$C in May. The excessive heat continued during July, with values of more than 40o C for some days, with daily averages between 16$^{o}$C and 31$^{o}$C. These values attenuated during August and September. The year of 2007 was also characterized by very high values (%) of the water deficit from the soil, because of the lack of precipitations (table IV) that also maintained during July.

*Table III*

**Metheorologic parameters from Copou metheo station, in 2007, SCDVV Iasi**

| Time (month) | Temperature °C air | | | Temperature °C soil | | | Rainfalls (mm) |
|---|---|---|---|---|---|---|---|
| | Average | Maximum | Minimum | Average | Maximum | Minimum | |
| January | 4,1 | 16,9 | -10,5 | 2,3 | 18,0 | -9,0 | 0,69 |
| February | 0,8 | 16,6 | -19,6 | 0,3 | 22,4 | -25 | 1,08 |
| Marth | 7,3 | 20,2 | -1,0 | 7,7 | 32,0 | -4,2 | 0,80 |
| April | 10,2 | 22,6 | 1,6 | 12,7 | 46,8 | -1,8 | 0,83 |
| May | 18,9 | 34,5 | 0,5 | 25,3 | 61,0 | -1,8 | 0,90 |
| June | 22,8 | 37,0 | 11,6 | 30,0 | 61,6 | 10,9 | 0,51 |
| July | 25,0 | 42,3 | 11,0 | 32,3 | 66,0 | 8,8 | 1,30 |
| August | 22,0 | 38,8 | 11,6 | 26,3 | 58,9 | 8,4 | 2,94 |
| September | 15,3 | 26,7 | 4,8 | 16,6 | 39,0 | 2,8 | 2,78 |

*Table IV*

**The water deficit (%) for a depth of 0 / 30 cm in the ascent, middle and downstream, for the experimental terrain in 2007**

| Time (month) | Black field (ON) Water deficit (%) | | | Durable grass overgrowing (DGO) Water deficit (%) | | |
|---|---|---|---|---|---|---|
| | Ascent | Middle | Downstream | Ascent | Middle | Downstream |
| April | 72 | 78 | 84 | 74 | 76 | 78 |
| May | 78 | 80 | 83 | 95 | 97 | 100 |
| June | 101 | 100 | 100 | 101 | 100 | 100 |
| July | 76 | 83 | 90 | 99 | 106 | 113 |
| August | 44 | 41 | 37 | 31 | 32 | 34 |
| September | 77 | 77 | 78 | 81 | 78 | 74 |

In these climatic conditions, the microbiological analyses were different from 2006. The obtained results show a decrease of the total number of microorganisms from the soil, with a size of $10^6$ for this year, for all the sampling areas both for the (BF) and for the (DGO).

From the graphic presentation of the data regarding the degree of representation of the ecophysiologic groups, figure 2-a,b,c, we find that the number of microorganisms of ammonification is 5,7% higher in the ascent and 4,7% downstream in the case of the black field. The number of nitric microorganisms was variable in the (DGO) soil samples, equal in the ascent and downstream areas and 10% lower in the middle of the bank side. Regarding the presence of the nitric bacteria in the (BF), the registered values were equal for the middle and downstream areas and 4% lower in the ascent. For the grass overgrowing areas, this group of organisms is less represented, in comparison with the black field, with values of 16% in the ascent, 21% in the middle and 14% downstream.

The total number of denitrifying microorganisms both for (BF) and (DGO) was the same for the middle and downstream areas, with values that were 13% lower in the ascent. The total number of aerobe and anaerobe microorganisms that fix the azote, for 2007, was very low both for the (BF) and (DGO), because of the high temperatures at the ground level and the severe water deficit.

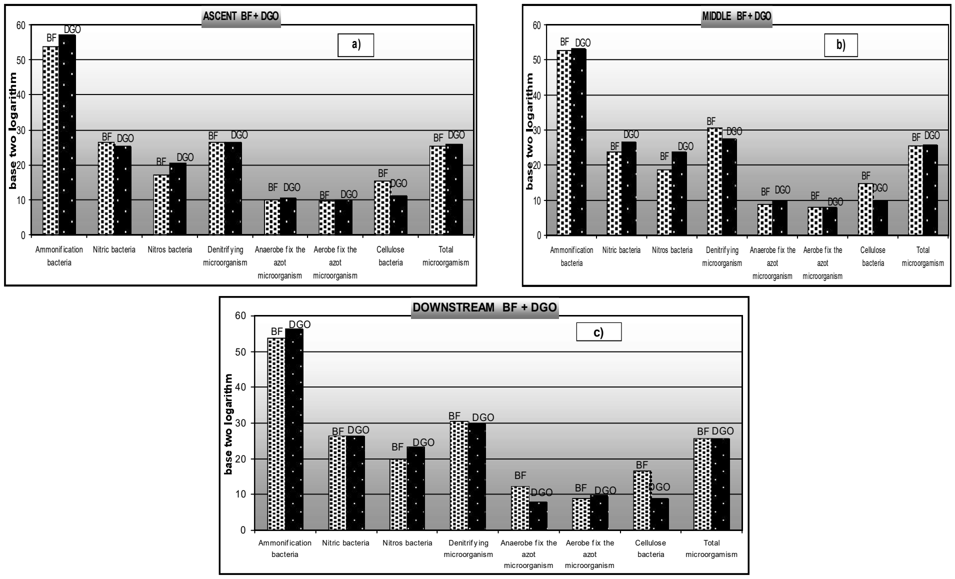


**Fig. 2 a,b,c.** Base two logarithms from the number of microorganisms in the soil samples, in 2007, from the worked field (BF) and of the durable grass overgrowing (DGO).

The total determined number of cellulose bacteria was 29 – 46% higher for the sampled areas (ascent, middle, downstream) of the black field, in comparison with the total number of cellulose bacteria determined on the durable grass overgrowing areas.

## CONCLUSIONS

1. The results of the microbiological analyses, given the climatic conditions from 2006, show a well-defined balance between the ecophysiologic groups of microorganisms from the experimental parcel.

2. Given the difficult climatic conditions from 2007, the ecophysiologic groups involved in the azote circuit proved to be the most resistant, while those belonging to the group of azote fixative aerobe and anaerobe bacteria proved to be the most affected ones.

## REFERENCES


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