STUDIES CONCERNING THE IMPACT OF THE CROP TECHNOLOGIES ON THE RESILIENCE CAPACITY OF THE VITICULTURAL ECOSYSTEMS

STUDII PRIVIND IMPACTUL TEHNOLOGIILOR DE CULTURĂ ASUPRA CAPACITĂȚII DE REZILIENȚĂ A ECOSISTEMELOR VITICOLE

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Abstract. *The influence of the grapevine technologies on the viticultural ecosystem and, respectively on the resilience capacity (tolerance of the dynamic good balance of an ecosystem to the action of anthropogenic factors) was highlighted by the researches which were carried out in Valea Calugareasca viticultural center within 2006-2007. Three technological factors were taken into study: soil maintenance system, fertilization system and disease/pest control system inside three sub-types of viticultural ecosystems: plateau, slopes arranged and not arranged in terraces. The experimental results obtained outlined that under the ecoclimatic conditions characterized by high helyothermic regime and poor water resources, the experimented technological variants had differentiated impact on the resilience capacity of the viticultural ecosystem. The resilience capacity of the viticultural ecosystems taken into study was generally ensured within the experimental variants (CV < 15%), in respect of the pest and disease control system, of the soil management system and of the fertilization system, too. Under conditions of pedological drought, the permanent herbage of the intervals between the grapevine rows represented a technological intervention which determined a diminution of grapevine fertility and productivity.*

Rezumat. *Influența tehnologiilor de cultură asupra ecosistemului viticol şi respectiv a capacității de rezilință (toleranța echilibrului dinamic al unui ecosistem la acțiunea factorilor antropogeni). a fost pusă în evidență prin cercetările efectuate în centrul viticol Valea Călugărească în perioada 2006-2007.Au fost luați în studiu 3 factorii tehnologici:sistemul de întreținere a solului, sistemul de fertilizare şi sistemul de combatere a bolilor şi dăunătorilor în cadrul a 3 subtipuri de ecosisteme viticole:platou, versant neamenajat şi versant terasat. Rezultatele experimentale obținute au evidențiat faptul că în condițiile ecoclimatice, caracterizate printr-un regim heliotermic ridicat, pe fondul unor resurse hidrice reduse, variantele tehnologice experimentate au avut un impact diferențiat asupra capacității de rezilință a ecosistemului viticol.Resilience capacitya ecosistemelor viticole luate în studiu a fost, în general asigurată în domeniul variantelor experimentale (CV < 15%), atât în ceea ce priveşte sistemul de combatere a bolilor şi dăunătorilor viței de vie, cât şi în privința sistemului de lucrare a solului şi a celui de fertilizare.*
În condiții de secetă pedologică, înierbarea permanentă a intervalelor dintre rânduri a reprezentat o intervenție tehnologică ce a determinat o reducere a fertilității butucilor de viță de vie şi a productivității acestora.

The functioning of the viticultural ecosystem and its productive capacity may be modified by the action of the anthropic factors represented by the applied culture technologies (Dejeu and Matei, 1996; Fregoni, 1998; Avenard and colab., 2003; Cozzolino, 2004)

The research performed in the Valea Călugărească viticultural centre during 2006-2007 focused on establishing the influence of some differential systems of soil maintenance, viticultural plantations fertilization, disease and vine pest control of the viticultural ecosystem and its resilience capacity

MATERIAL AND METHOD

The experimented technological factors were:

A Factor: Vine pest and disease control system, with the degrees:
a_1 – chemical control; a_2 – integrated control; a_3 – biological control.

B Factor – Soil maintenance system with the degrees:

b_1 – black field; b_2 – black field + selective herbicidation; b_3 – permanent grass growing; b_4 – soil mulch.

C Factor – Fertilization system, with the degrees:

c_1 – not fertilized; c_2 – organic fertilization; c_3 – mineral fertilization (on DOExp level); c_4 – organic - mineral fertilization.

The research has been performed within 3 ecological stationeries located under different relief and soil conditions, namely:

S_1- Ecosystem of the vine plantations under plateau conditions (hill top) - Cabernet Sauvignon variety;

S_2- Ecosystem of the vine plantations located on wild hill side (14-16% slope)- Italian Riesling variety;

S_3- Ecosystem of the vine plantations located on terraced slope (broad 17.2 m terraces with 8 rows of vine) – Merlot variety.

The viticultural ecosystem dynamic balance's tolerance to the anthropic factors represented by the applied culture technologies represents the "resilience capacity" of that particular system.

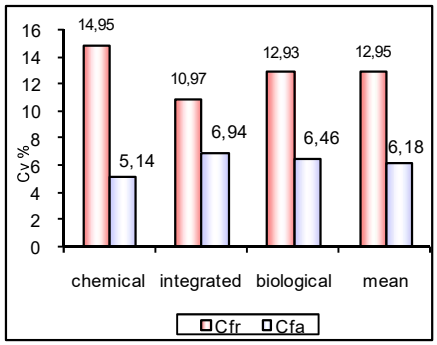
In order to assess the "*resilience capacity*" of the viticultural ecosystems, a series of synthetic indicators have been taken into consideration, that may quantify the viticultural ecosystem operation: fruitage constant, vine cenosis productivity expressed into productivity indexes and the grape production (kg/grape vine) and the vine cenosis productive quality, preserving useful entomofauna.

The variation coefficient (CV%) of the above-mentioned synthetic indicators has been used in order to express and delimit the resilience capacity. For the normal functioning of the viticultural ecosystem, a maximum 15% variation of these indicators was considered acceptable.

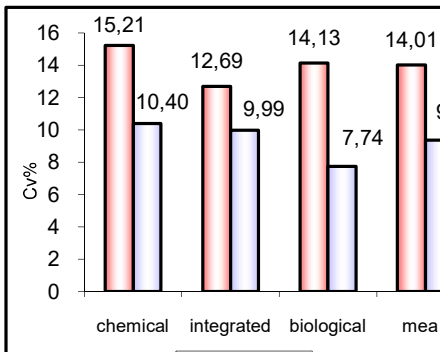
RESULTS AND DISCUSSIONS

Resilience capacity according to the vine pest and disease control system

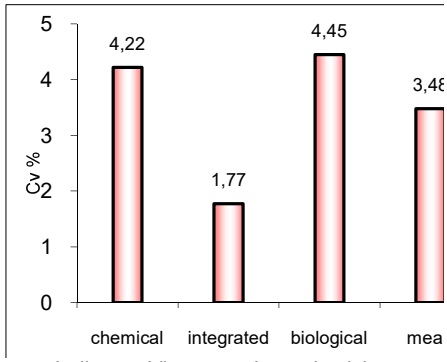
Analyzing the variation coefficients of the main synthetic indicators one may notice that in terms of expressing the resilience indicators the maximum values of the variation coefficients generally have not overrun the 15% value for the fertility, productivity indexes, grape production and its quality coefficients (Fig.1).



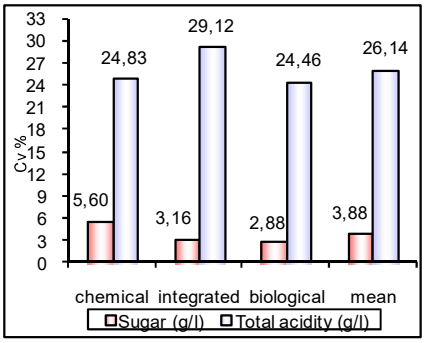
Indicator: Fruitage constant



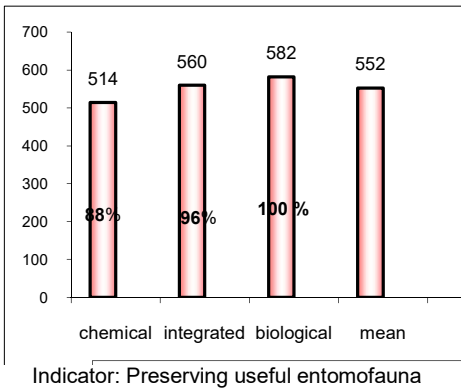
Indicator: Vine cenosis productivity (expressed into productivity indexes)



Indicator: Vine cenosis productivity (expressed into grape production)



Indicator: Vine cenosis productive quality



Indicator: Preserving useful entomofauna

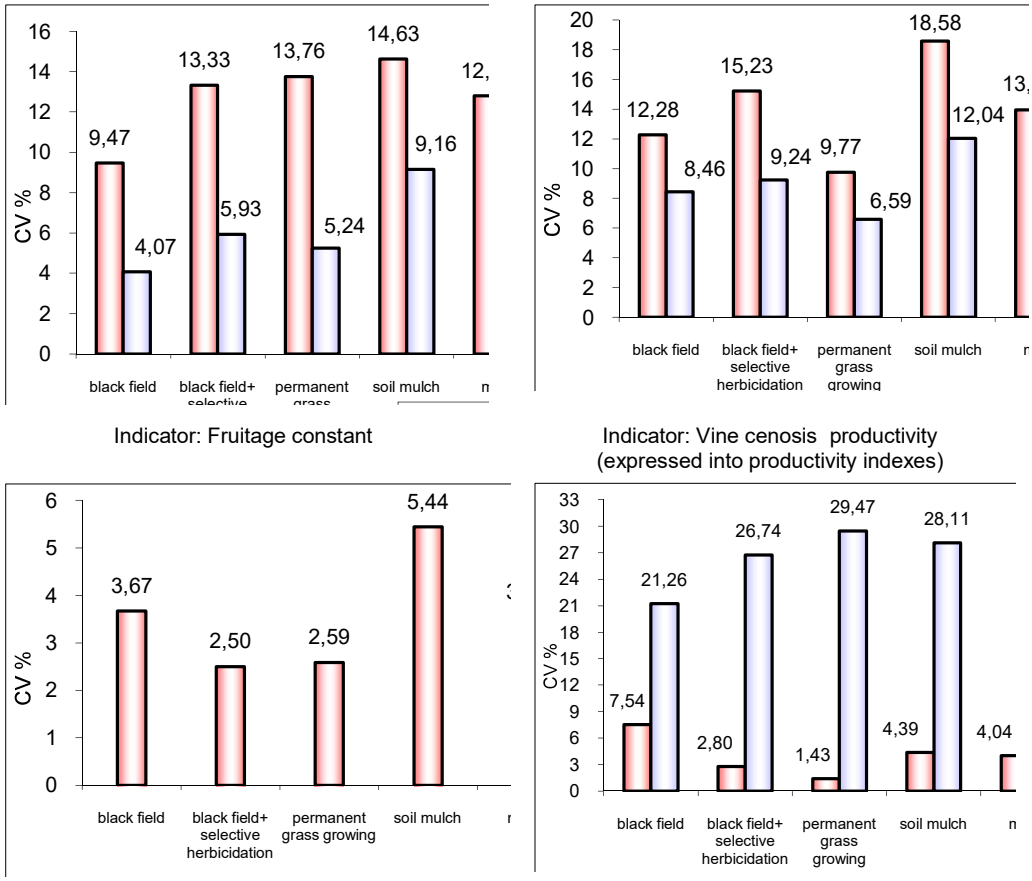
Fig. 1- Resilience capacity according to the vine pest and disease control system

In case of wort acidity, the variation coefficient had high values, over the resilience level, due to the fact that the Italian Riesling variety grown within S_2 (unarranged slope) recorded a very low wort acidity, being a drought sensitive variety.

Regarding the abundance of useful entomofauna, it was noticed that the controlling system that assured the greatest abundance (no. of species and no. of individuals/species) was the biologic control system. Compared with this system, the other two controlling systems: chemical and integrated ones have determined a 12%, respectively 4% reduction of the useful insects populations, that do not affect the resilience capacity.

Resilience capacity according to soil maintenance system in viticultural plantations

Regarding the influence of the soil maintenance systems over the ecosystem's resilience capacity, variation coefficients values have been higher, emphasizing their higher impact on the ecosystem's functionality (Fig.2)



Indicator: Fruitage constant

Indicator: Vine cenosis productivity (expressed into productivity indexes)

Indicator: Vine cenosis productivity (expressed into grapes production)

Indicator: Vine cenosis productive quality

Fig. 2 – Resilience capacity according to soil maintenance systems

Analyzing the variation coefficients values, it was noticed that generally, the viticultural ecosystem's resilience capacity was assured for the soil

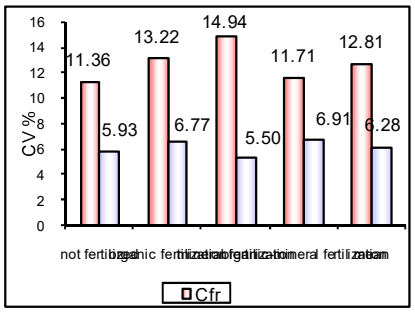
maintenance systems regarding the fruitage constant and the grape production quality, the CV values not overpassing the 15% threshold. As for the vine cenosis productivity and wort acidity, the variation coefficient took over higher values than 15%, overpassing the viticultural ecosystem's resilience capacity.

In the two years of research with shortage of water values, during the vine vegetation period (especially in 2007), the soil maintenance by permanent grass growing had a negative impact on the viticultural ecosystem, negatively influencing the grape vine fertility and consequently the vine cenosis productivity.

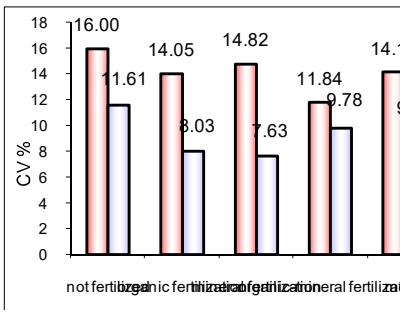
Regarding the grape production quality, there was no negative influence noticed on the grapes sugar content while wort acidity is lower. Using mulch with green fertilizers remains (sowed in spring, hashed and left on the ground as mulch) contributed to the increase of grape vine productivity and implicitly to the grapes/grape vines production, due to the fact that under the aridity conditions recorded during the two years of research, this system enabled the maintenance of soil humidity reducing surface evaporation.

Resilience capacity according to soil fertilization system in viticultural plantations

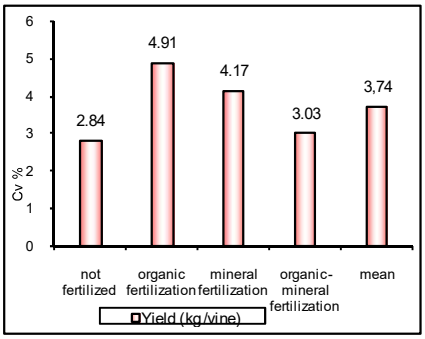
For the fertilization systems, the resilience capacity of the viticultural ecosystems has been ensured, the variation coefficient taking over lower values than the 15% threshold (Fig 3).



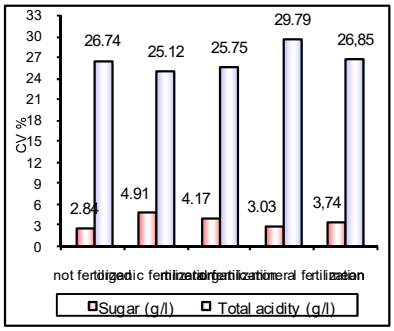
Indicator: Fruitage constant



Indicator: Vine cenosis productivity (expressed into productivity indexes)



Indicator: Vine cenosis productivity (expressed into grapes production)



Indicator: Vine cenosis productive quality

Fig. 3 – Resilience capacity according to soil fertilization systems

The only exception was recorded for wort acidity, for which the variation coefficient's values are higher than 15%.

A positive influence over the fruitage constant and the vine cenosis productivity was induced by the organic and organic – mineral fertilization ensuring the greatest grape productions.

In case of vine plantations non-fertilization, the fruitage constant as well as the vine cenosis productivity decreased, the CV taking over > 15% values for Ipr, which emphasizes that no fertility may cause a disturbance of the viticultural ecosystems' functionality, especially under stressing eco-climatic conditions and intensive exploitation of the viticultural plantations.

As for grapes production quality there is no significant influence induced by a certain fertilization system over the sugar content in the grapes and wort acidity.

CONCLUSIONS

1. The viticultural ecosystems' resilience capacity studied was generally ensured in the domain of the experimented technological variant, regarding vine pest and diseases control system, as well as the soil maintenance and fertilization systems.

2. The control systems differently influenced the useful entomofauna preservation, the biologic control system ensured the greatest abundance of the useful insect populations compared with the other two controlling systems: chemical and integrated.

3. Under pedologic drought, the soil maintenance by mulch with green fertilizer remains, contributed to the increase of grape production, due to the fact that this system enabled the maintenance of soil humidity reducing surface evaporation. The permanent grass growing of the paths between the rows was a technological intervention that induced the fertility reduction and the grape vines productivity, overpassing the viticultural ecosystems' resilience capacity.

4. The organic and organic-mineral fertilization systems had a positive influence on the fruitage constant and the vine cenosis productivity compared to the non fertilized system, emphasizing that no fertility may cause a disturbance of the viticultural ecosystems' functionality, especially under stressing eco-climatic conditions and intensive exploitation of the viticultural plantations.

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