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COMPLEX PLANNING SOLUTIONS FOR SOIL EROSION CONTROL ON A VINEYARD

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Abstract

The paper aims to present the complex planning solutions for soil erosion control on a given vineyard with a surface of 52 hectares, being located in the Ialomita River watershed, Ceptura area, Prahova County in Romania. Such solutions are based on the processing statistical data provided by Ploiesti Meteorological Station and Climatologically Atlas of Romania as well as on the computed soil loss by using Romanian soil erosion model. Data collected have been consisting into average annual precipitation, annual temperature and annual soil loss for the studied perimeter. The paper contains a descriptive memorandum concerning site description, current soil degradation and management situation, natural environment, needs and opportunities for designing the anti-erosion system, specific anti-erosion measures and works for vineyard. As a conclusion, the paper provides data about technical efficiency of designed measures and works as well as the answer of why these measures should be applied before arranging a vineyard.

Key words*: soil erosion control, planning, terraces, vineyard.*

INTRODUCTION

Romanian wine culture has been existing for almost 6000 years and dates back to history's earliest inhabitants. It is argued to be one of the oldest in all Europe. Vineyards throughout Romania have survived over the years and still produce these high quality wines today. Due to its local soil and climate Romania attracted countries such as France, Germany, and Italy to invest in vineyards since the 19C. (Oprea, 2001) Having that in view there can be found a large variety of different vines, such as Pinot Noir, Cabernet Sauvignon, Merlot, Chardonnay, and Sauvignon Blanc (Oslobeanu et al., 1991).

Dealu Mare wine region (Big Hill in English) is being spread on approximately 400 square kilometers over Sub-Carpathian Hills, this area being one of the most compact wine region in Romania (Dobrei et al., 2005). Old in tradition the Dealu Mare vineyard is the cradle of the red wines, whose special taste and flavor that are given by the local soil and climate (Cotea et al., 2003).

In this context, the paper presents the planning solutions for soil erosion preventing and control on a vineyard for an area of 52 ha, located in Dealu Mare wine region, Prahova County, Ceptura area.

In this region traditional hillside viticulture uses deep and surface tillage. But, due to increasing of mechanization, this technique contributes to the degradation of soil physical characteristics, surface erosion, transport of sediment as well as nutrient leaching (Salceanu, 2006). Controlled grass covering the inter-rows has proved over the time improving the stability of soil aggregation, mitigation of soil erosion by reducing runoff (Plesa et al., 1980).

MATERIALS AND METHODS

The climate of the area is represented by cold winter associated with snow, dry summer, average rainfall of 522 mm/year, and average annual temperature of 10.6°C and annual soil loss of 26 to /year/ha. It is based on the statistical data provided by Ploiesti Meteorological Station and Climatologically Atlas of Romania. The soil type is a clay textured chernozem.

The crop, parceling and modeling of the fields had been done as follows:

a) Sloping the vine rows on the general direction of the level curves according to the

exhibition requests, realizing bigger lengths of work and applying the agricultural and technical measures against erosion.
These plantations are done on fields having a slope up to 14%, the useful surface being of 85-95% , the plantation distance of 2.2/1.0 meters, this meaning a number of 4545 hubs on a hectare.
b) By flattening, cleaning and putting the roads on level curves, facing the rows on the line of the biggest slope and ensuring the mechanization conditions with the winch.
In this case the fields have a slope of over 25%, the useful surface being 85-90%, the plantation distance of 1.5-1.0 m, thus there are a number of 6666 hubs/hectare.
c) By flattening and cleaning the slope, putting the roads on the level curves, between which the plantation of the vine is done, on the curve level. In the first 2-3 years, through repeated works of the soil, on each interval a micro terrace is created.
In this situation the slope of the field is of 15-25%, the useful surface of 85-87%, the plantation distance of 2.8/0.8 m, thus there are a number of 4464 hubs/hectare.
d) By creating terraces and by vine plantation the useful breadth of the terrace platform is according to the field slope. In this case the field slope is of 15-25%, the useful surface of 58-64%, the plantation distance of 2.0/1.2 m, thus there are a number of 4167 hubs/hectare.
The plantation distances, the density of the hubs for a hectare and the used leading forms contain solutions which are presented in Table 1.

Table 1. Plantation distance, density of the vine and leading forms used in experiment

Crop system	Plantation distance	Nutrition surface/hub	Density of the hub vine/hectare	Distance report	Leading form
On the contour level without terraces	2.20 x1.0	2.20	4545	2.20	Bilateral string on the strain
Terraces	2.00 x 1.20	2.40	4167	1.66	Bilateral string on the strain
Micro terraces on the contour lines	2.80 x 0.80	2.24	4464	2.80	Unilateral string on the strain
Rows oriented on the slope line	1.50 x 1.00	1.50	6666	1.50	Unilateral string on the strain

The sustaining system specific to these forms of crop is the espalier with 2.20 m concrete poles using 5 rows of wire (Dejeu, 2004).
When there is a crop on level curves through micro terraces and when there is a crop by facing the rows on the slope line then the number of the espaliers used on a hectare is bigger with 30-40%.

RESULTS AND DISCUSSIONS

The way the field was used (Table 2) emphasizes the 30-40% losses from the terrace crop surface. For the other crop systems the field is 80-90% valued.
Soil erosion rate is influenced by the crop system and by the slope (Table 3).

Table 2 Land use according to the crop system

Field slope %	Crop system	The useful width of the platform in meters	Number of rows	Non productive field from the crop surface
0-14	On the contour level without terraces	60-100	25 - 45	5-15
15-25	Terraces	9.5-17.5	4 - 8	34-42
	Micro terraces on the contour lines	80-100	29-35	15-23
Over 25	Rows oriented on the slope line	40-60-80	-	10-15

Table 3 The average yearly soil erosion according to the crop system

Crop system	Width of the platform (m)	Inclination of the platform (%)	Soil erosion rate/year
On the contour level without terraces	60-100	0-14	3.11
Terraces	9.5-17.5	0-6	2.47
Micro terraces on the contour lines	80-100	12-20	22.87
Rows oriented on the slope line	40-80	Less than 25	28.83

The volume of eroded soil, due to the heavy torrential rains has values between 2,47 and 28,83 m^3/hectare/year being substantially reduced on the contour lines plantations with a field slope of up to 14% and on terraced plantations that have a field slope of 15-25%. (Motoc et al., 1975). For the vine plantations where the slope degree does not modify, there the erosion is 15% bigger (Mircea et al., 2007). For these crop systems, the erosion decreased with over 50% when the width of this lot is getting smaller due to improvement works, like: soil mulching, and non-cultivation through spraying with herbicides previously and afterwards (Magdalina, 1994).

The grape production for the Merlot type in the plantations with a slope of up to 14% is 9541kg/hectare, in comparison to 6499-8194 kg/hectare in plantations that have a slope bigger than 15% (Table 4).

Concerning the quality of the crop, this earned 20-30 grams of sugar/liter on plantations with micro terraces and on those mechanized with the help of the winch, to which the general slope of the field did not modify the latter, having a great percent of light.

The production costs are influenced by the slope and by production level. In over 255 slope plantations the values are 20 – 40% bigger than in 14% slope plantations.

Table 4. Grape production fr the Merlot type

Specification	Measurement Unit	Average on variants	Crop system			
			Withoutterraces on levelcurves	Terraces	On level curves through micro terraces	With the rows facing the slope line
Hub production	Kg %	1.891 100	2.447 131	2.164 104	1.611 96	1.273 67
Hectare production	Kg %	7817 100	9541 122	8194 105	6499 83	7036 90
Sugar	g/l %	209 100	189 90	201 96	220 105	228 109
Acidity	g/l	5.3	5.9	6.4	4.8	4.2
H_2SO_4	%	100	111	121	91	79

CONCLUSIONS

On fields situated on slopes bigger than 5%, agricultural systems and cultivation technologies must be applied specific for these types of fields which can ensure the production increase, the prevention and the stop of the soil erosion, the maintenance and increase the soil fertility. As the fields slope increases, the volume of the necessary works for the crop and preparation of the field for future plantations and exploitation is 36 – 130%.

The erosion process on bigger slope fields is diminished when special terrace works are done. In order to protect and prevent soil erosion, vine plantations with slopes up to 14%

are recommended with the rows facing the level curves and plantation on terraces with slopes up to 25%.

Micro terrace plantations on a slope up to 25% increase the value of the field. Establishing vine plantations on slopes bigger than 25% with the rows facing the slope line can be done in family farms.

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