GRASS COVER IN VINEYARDS AS OVINE FEED

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Abstract - Grass cover is an important method to control weeds in vineyards. The sheep can be used to graze grass cover in vineyards since the eventual damage in grapevines can be controlled. This paper aims to to evaluate the effect of sheep grazing on the soil, and grass cover in vineyards and determine the adequacy of the natural grass of vineyards as feed to sheep.

Keywords - Vineyards, weed control, erosion control, grass covers,sheep grazing.

I. INTRODUCTION

Weed flora is part of agro-ecological systems and its functional role is essential [1,2]. Weeds provide environmental heterogeneity, supporting other essential life forms to crop-systems promoting ecological balance [2,3], harboring pest predators, parasitoids and pollinators, [4,5] reducing pesticide use, nutrients leaching [4] and protecting soil against erosion [1,4,6]. As vineyards are considered the most erosion-prone lands in the Mediterranean area [7,8,9,10] the presence of weeds can be seen as an advantage. However in vineyards weeds compete for nutrients, water and light [1,11,12] with grapevines and they are considered as a threat..

The methods more often used to managed weeds are mechanical andchemical [1,7,12], but both havesome disadvantagesassociated[1]. Mechanization increases soil erosion [1,13,14,15] and compaction which restricts root growth, nutrient, water and air movements [16]. Chemical methods contaminate animals, plants and the environment [1] and leads to high erosion rates [17]. Both methods result in bare soils.

Vineyards suffer high rates of erosion due to uncover soil [16], low rainfall rates [12,18,19], use of steep slopes, low level of organic matter and nutrient content in the soil [7].Therefore, is essentialthe use of alternative methods to control weedslike grass cover[20,21,22,23]. This method provide important benefits to the vineyards[2,24,25] such as prevention of soil erosion [24], increasing water, carbon and nitrogenretention[10]. Additionally, grass coverimprovenutrient cycling, enhance soil biological activity, enhance biological control and biodiversity. Bidddocu et al[15] verified that nutrient losses were lowest (except phosphorus) in the grassed vineyard when compared with tilled plots. Different mono- and pluri-specific plant covers showdifferent results [12,21,24]. Grapevine performance, with higher fruit quality, can be improved with careful vegetation cover selection and management [26]. Lopes et al. [27]verified that vineyards with grass cover present an increase of the grape quality in the third year.

The use of sheep to graze grass cover in the vineyards is reported in several studies [28,29].Sheep can contribute, not onlyto reduce biomassin vineyards [28,30,31]but also topromote soil health and farmer's income by reducing the costs with herbicide and mechanization [30].The sheep production also benefits with the use of the pasture area, despite these animals can cause damage in the grapevinesif they consume the young leaves and sprouts. Conditioned taste aversion is a method used to prevent crop damage by sheep grazing [32].

The aim of this study was to evaluate the effect of sheep grazing on the soil, and grass coverin vineyards and determine the adequacy of the natural grass of vineyards as feed to sheep.
To control grazing sheep postures in order to minimize the crop damage, anew mechanism placed on a collar for monitoring animal posture is being developedwithin SheepIT project,to identify threatening postures for the leaves and/or fruits.

II. EXPERIMENTAL DETAILS

2.1. Materials and Procedures

This research was conducted during 2018 growing season in a vineyard, located at the Agrarian Superior

School of the Polytechnic Institute of Viseu. This vineyard was inserted in the region of Dão, latitude 40° 38'17.33 "N, longitude 7 ° 54'57.07" W and altitude of 452 m, it is part of a parcel of a non-irrigated vineyard, installed in the year 2008, with "Touriga National". Its approximate area is 0.57 ha and includes about 4000 plants. The vines were conducted in a low-wire system, spaced 1.0 m within and 2.30 m between rows, unilateral Royat pruning with six fruiting units.The selection of the vineyard was made based on its size, geographical situation, climatic, and edaphic characteristics.

The experiment was carried out in an area that was divided into six experimental plots with about 300m^2. A randomized complete block design was used, with three replications and the following two treatments: (1) grazing (G)and (2) non-grazing control (NG) arranged in a scheme of subdivided parcels.Each one of the plots corresponded to an uppercase letter A, B, C, D, E and F (Figure 1).

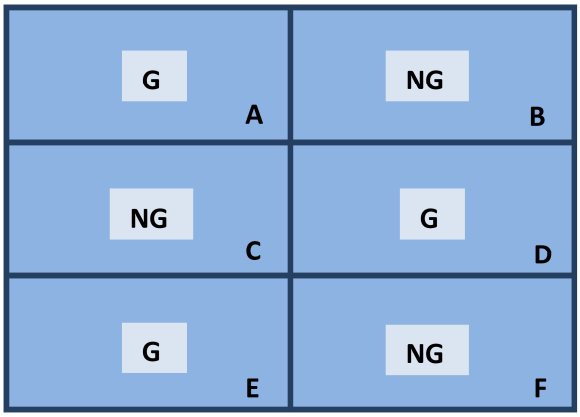


Figure 1: Experimental area

Each replicate (plot) had four rows of vines, each and all the measurements were made in the two central ones.
The soil management, vine-pest and disease control and other cultivation practices, including grapevine canopy management, were similar in all the treatments. Conventional soil tillage treatment included vegetation mowing in the first week of July.
Soil samples were collected with a depth probe at 0-60 cm depth. Composite soil samples were selected in each plot at randomlychosen sites, obtain in a zigzag walk [33]. From the mixture of the eight partial samples, three subsamples were removed, in each of the six plots of the test plot, making a total of 18 samples.

Soil samples were collectedbeforeand after grazing,in January andMay, todetermine the pH in water, organic matter content, micronutrient content, extractable phosphorus and potassium contents.
A group of 29 sheep was taken to graze in the study vineyard, from February to March7 days each month. The sheep were placed in each of the fields, being the equivalent of one day in each of them.
One month later, the grass samples were obtained with a square frame of 1.0m x 1.0m. The cutting was done to the ground level [34], with a pair of scissors. The evaluation of the forage production of each experimental unit was performed once, in six systematically defined sites, three in the inter-row and three in the row of vines. Given the characteristics of the portion of the vegetation cover in the study, allocated in vines, we chose to systematic sampling. According to Mannetje [35], the launching of quadrats and the selection of representative positions and samplings are hardly performed impartially. The random choice of sampling points became in the context of the vineyard, a process that was not very efficient in time, and it was decided to choose sampling sites at regular intervals.

The positions of the samples were chosen at regular intervals along parallel transects at equal distances, in each of the lines of each experimental unit, followed by a diagonal orientation. In each collection, 36 samples were obtained, making a total of 72 samples. The number of samples was defined according to the duration of the test.

The collected material was mixed, and from this mixture, a sub-sample containing about 10% of the total weight of the initial sample was taken, with a reference value of 200 grams and a minimum value of 100 grams. The subsamples were placed on a tray and weighed individually and accurately on a precision scale. The adequately identified trays were taken to a dehydration oven at a temperature of 60 ° C for 72 hours. After drying the subsamples were placed in the desiccator until cooling, and then again weighed to determinethe dry matter [34]. The percentage of moisture was obtained by the quotient of the initial weight and the value obtained from the subtraction to the initial weight (Pi) of the final weight (Pf) and multiplying that value by 100.
The grass nutrients composition was also determined, with a Fourier Transform Near Infrared spectrometer (FT-NIR), a methodology that provides quick and accurate results [36]. The thirty-six subsamples of the dry matter were milledbefore FT-NIR determination of total contents of moisture, protein, lipid, and ash.
Statistical data analysis was performed by analysisof variance and LSD testsin accordance withStatistica 5 procedures [37].

III. RESULTS AND DISCUSSION

3.1. Soil analyses

The soil analyses shows a significant difference for K2O (Table 1), with anincrease after the animal grazing. The content of Fe also has significant differences, but apparently the animal grazing not influence the content of Fe in the soil.

All other components of soil analyzed not have presented significant differences.

Table1: Soil chemical characteristics (means andstandard deviation)

N=18	Before grazing NG M±SD	Before grazing G M±SD	After grazing NG M±SD	After grazing G M±SD	P-Value
% Organic matter	0.45 ±0.049	0.48 ±0.005	0.45 ±0.004	0.44 ±0.026	NS
pH H2O	5.43 ±0.259	5.15 ±0.123	4.96 ±0.206	4.89 ±0.275	NS
P2O5 (mg/kg)	61.42 ±19.09	59.268 ±11.6	101.3 ±11.78	96.81 ±17.59	NS
K2O (mg/kg)	133.0a ±6.98	141.3ab ±3.39	179.6b ±25.9	228.3c ±28.7	P<0.05
B (mg/kg)	0.54 ±0.181	0.59 ±0.124	0.63 ±0.229	0.83 ±0.143	NS
Cu (mg/kg)	1.67 ±0.270	1.77 ±0.197	1.24 ±0.124	1.67 ±0.711	NS
Zn (mg/kg)	0.71 ±0.119	0.89 ±0.515	0.88 ±0.219	0.96 ±0.228	NS
Fe (mg/kg)	28.08a ±6.448	37.04b ±1.840	33.14c ±4.007	32.97abc ±6.174	P<0.05
Mn (mg/kg)	4.72 ±1.086	4.15 ±1.505	5.97 ±1.419	5.33 ±0.640	NS

Note. In each row different letter suffixes showsstatistically significantdifferences at P<0.05 by LSD test. G – grazing; NG-Non-grazing.

3.2.Grass cover yield and Dry Matter

Table 2 shows the grass cover yield and,we can observe that it is not statistically significant different (P<0.05) between the grazing and the non-grazing areas. In fact, although the grazing periods showeda lower average yield in the grazing area (2.53 t/ha) than in the non-grazing area (3.23 t/ha), the variability (SD) of the grass cover yield was very high.

The dry matter also did not differ significantly and showed high variability, namely in the grazing area (20.32 ±10.81) compared with the non-grazing area (17.57 ±3.91). This can be explained by the grazing behavior of the ewes, showing ahigh selective feed behavior and preferring some plants species rather others.

Table2: Grass cover yield and dry matter (DM)

Parameter N=18	Grazing M±SD	Non-grazing M±SD	P-Value
DM Yield t/ha	2.53±1.73	3.23±2.36	NS
% DM	20.32±10.81	17.57±3.91	NS

Note. M = mean; SD = standard deviation, NS Not significant(P>0.05).

The grass cover within the vineyard shows it can be suitable for sheep feeding. Thus it can easily complement the regular pastures.

The results obtained about the analysis of grass nutrients are presented in Table 3. It is observed that the protein and starch content are significantly different,withhigher protein and starchcontent after the animal grazing. This may be related to thesheep grazing, which increases the grass regeneration, mainly based onyounger plants. It is widely known that nutrient levels are affected by theplant phenological stage and in this case, higher protein and starch levels were found in younger grass grown after grazing. The nutrients from the grass cover in vineyards can feed the sheep, meeting the maintenance and lactationnutrient requirements in common productive breeds. Using this practice, we can reduce the weeds in vineyards and its associated costs. Also, it is more ecological and hasenvironmental benefits, reduces the carbon footprint and soil erosion,an important feature when vineyards are inhills or steep slopes, where land is particularly sensitive to erosion.

Table3:Grass nutrients composition

Parameter	Grazing (n=9) M±SD	Non-grazing (n=9) M±SD	P-Value
% Moisture	5.562±1.045	5.121±1.280	NS
% Lipid	3.977±0.866	3.582±0.852	NS
% Protein	15.58±3.351	13.36±2.762	P<0.05
% Crude	19.28±2.119	20.29±2.437	NS

Fiber			
% Ash	6.716±3.440	8.068±5.699	NS
% Starch	10.66±4.464	7.231±3.978	P<0.05
% NDF.	34.59±2.018	36.20±2.821	NS
% Lysine	2.124±0.260	2.108±0.302	NS
% Cystine	0.412±0.083	0.352±0.143	NS
% Methionine	0.534±0.117	0.536±0.097	NS
% Phosphorus	0.356±0.142	0.263±0.165	NS

Note. M = mean; SD = standard deviation, NS Not significant(P>0.05).

CONCLUSIONS

A soil without naturalplants has costs that can be economically high. They are also environmentally reductive because soil life is impoverished and because it increases soil erosion.

The coexistence of crops along with the weeds and the use of grazing animals, which does not impair the productivity of the long-term exploitation is an interesting solution.

The integration of agrarian production methods may be of capital importance. In the case of the vineyard, the natural grass cover combined with the use of sheep in no-till systems can result in better environmental services. Benefits such as erosion reduction, root colonization of surface horizons by crops, an increase of organic matter in relevant quantities due to sheep excretions, enhance biodiversity, and decreases soil compaction, may be other benefits that this win-win method of weed management with sheep can bring, benefiting the culture installed.

The presence of sheep has the potential to increase soil quality.

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