

EFFECTS OF FORAGE COVER ON RUN-OFF AND SOIL LOSSES IN DIFFERENT PRODUCTIVE SYSTEMS IN CENTRAL ITALY.

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ABSTRACT

A trial has been carried out for four years, in a hilly area of Central Italy, on five covers concerning three different productive systems: traditional system based on the rotation of *Medicago sativa* and barley; low input system based on permanent association of grasses and legumes; annual self-reseeding legumes used as cover crop in vineyard. The pasture had the higher run-off but also the lower soil erosion thanks to the high number of plants per square metre which were able to hold the soil particles. The inerbment of the vineyard prevented greater soil erosion commonly known in cultivated grooves.

KEYWORDS

Fodder legumes, pastures, crop systems, vineyard, cover crops.

INTRODUCTION

In several Italian environments forage crops are more frequently utilized not only for production but also for protection, for landscape sight and to meet intensified concerns regarding environmental safeguards (King, 1990). Some research has been carried out about one of the major environmental problems concerning wide hilly surfaces of Central and Southern Italy, that is soil erosion in forage crops, vineyards and orchards, due to rainfall (Caporali and Campiglia, 1995). Research has shown the utility of reduction of energetic inputs in view of limiting erosion (Acutis et al., 1994), and the possibility of utilizing annual self reseeding legumes as cover crops because their vegetative rhythm is highly complimentary to that of the main crop (Piemontese et al., 1995). The aim of this work has been to compare soil losses in crops typical of systems of different intensity.

METHODS

The trial was conducted in a hilly area of Central Italy, located at 200 m a.s.l., with typical mediterranean climate characterized by 924 mm of annual rainfall and 13.9 °C of mean annual temperature. In plots idraulically isolated and with a 10% mean slope, the following five covers, representative of three systems common in the area were compared:

1. *Medicago sativa* cv. "Garisenda" sward, utilized only by cut and being part of a system based on rotation with barley after three years (system 1);
2. forage barley cv. "Plaisant", following the medic (system 1);
3. permanent pasture grazed by cattle, made of *Dactylis glomerata* L. cv. "Phyllox", *Festuca arundinacea* Shreb. cv. "Fawn", *Lolium perenne* L. cv. "Elka", *Lotus corniculatus* L. cv. "Leo", *Trifolium repens* L. cv. "Huia", *Trifolium pratense* L. cv. "Viola; part of a mono-cultural permanent system (system 2);
4. vineyard covered by annual self reseeding legumes (mixture at 50% with *Trifolium subterraneum* L. cv "Woogenellup" and *T. brachycalycinum* Katzn. & Morley cv. "Clare") grazed by sheep, part of a vineyard-pastoral system (system 3);
5. vineyard control area, drilled and uncovered soil (only spontaneous species).

Data collected were the followings: daily rainfall; soil cover (soil cover percentage and Leaf Area Index, monthly record); superficial run-off (mm of water flowing out the plot each day); soil losses by run-off (kg of soil eroded during each rain above 10 mm). In system

1 data were collected for three years in the medic and for one year in the barley.

RESULTS AND DISCUSSION

Rainfall. Annual rainfall in 1992 was 1164.8 mm, in 1993 was 717.6 mm, in 1994 was 777 and in 1995 was 875.8. The mean annual rainfall of the four years (883.8 mm) was slightly lower than normal.

Soil cover. In the three systems the percentage of soil cover was kept sufficiently high (Table 1); permanent pasture gave, in the average of the whole year, the best cover; subterranean clover gave a medium cover because of its annual cycle, but the sward kept the highest cover indexes during all the rainy periods. The trend of the L.A.I. was rather similar to the percentage of soil cover. The correlation soil cover vs. L.A.I. was the highest ($r=-0.85^{**}$).

Run-off. Concerning the different systems, the highest run-offs (table n. 1) were recorded in permanent pasture because of animal trampling and the lowest in vineyard; concerning single resources the maximum run-off was recorded from uncovered soil. The exceptional rainfall of October 30 in the year 1992 (243 mm) produced a maximum run-off of 70 mm from the uncovered soil in vineyard (corresponding to a maximum soil losses of 32 kg.ha⁻¹) and underlined the major sensibility of the medic sward and of the cover from native species; some summer stormy rains gave the maximum run-offs from the vineyard covered with subclover but caused a very small amount of soil losses because the ground was very compact and covered by residuals of dried vegetation.

Soil losses. Erosion was related to soil cover (-0.73^{**}) and to the L.A.I. (-0.60^{**}) but not to the run-off. Permanent pasture gave the lowest losses of soil (Table 1), the vineyard lost medium amounts. The strong erosion recorded during barley crop caused the system 1 to have the highest losses; the major erosion from the system medic-barley (in spite of the lowest run-off) was caused by the lowest density of plants in comparison to the permanent pasture and to the covered vineyard that were better able to retain the soil particles.

CONCLUSIONS

The traditional system based on the medic followed by barley showed to be more prone to erosion than the permanent pasture which can be substituted to the advantage of the environment. Using cover crops can halve the erosions in vineyards. The vineyard covered with annual self reseeding legumes halved soil erosion as compared to the bare soil and had also an efficient mulching behaviour during summer. Grazing was an efficient management for any cover.

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Table 1

Soil cover (%), Leaf Area Index, annual rainfall (mm), superficial run-off (mm), soil losses (kg.ha⁻¹). Means of the years of trial.

	Soil cover (%)	Leaf Area Index	Run-off (mm)	Soil Losses (kg.ha ⁻¹)	Max. run-off (mm)(1)	Max. soil losses (kg)(1)
<i>Medicago sativa</i>	79 ab	4.7 b	10.3 c	90.0 bc	65 ab	8 c
Barley	55 c	1.9 c	26.2 b	125.7 a	-	-
System 1 (medicago + barley)	73 abc	4.3 b	25.2 b	109.3 ab	54 b	20 b
System 2 (permanent pasture)	94 a	6.6 a	36.4 a	63.0 c	59 a	8 c
System 3 (Subclover+vineyard)	85 a	5.1 b	18.3 b	66.1 c	50 b	11 c
Uncovered vineyard soil	68 bc	2.3 c	37.8 a	119.0 ab	70 a	32 a

(1) rainfall of October 30th, 199